Fintech Related Machine Learning:

Experimental Investigation on the Effects of Data Variance Towards Difficulty of Learning for Deep Learning Models

Submitted in Partial Fulfilment of the Requirements

for the Degree of Bachelor of Computer Science

of Nanyang Technological University

by

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School of Computer Science and Engineering

2021

ABSTRACT

The application of Artificial Intelligence models in the domain of Financial technology, more commonly known as Fintech, has been widely studied by researchers throughout the years. With Deep Neural Networks gaining traction in the field of Artificial Intelligence, the use of Deep Neural Networks, or Deep Learning models, for Fintech applications has become more prevalent in recent years. One of the most widely studied application of Deep Learning models for Fintech, is the utilization of Deep Learning models for tasks surrounding the trading and investing of financial instruments such as Stocks or Forex. Some of these tasks include the prediction of next-day stock prices, stock portfolio management, valuation of assets, etc.

Although past research have tackled stock market prediction tasks using Deep Learning models, much of these research conducted, allow the Deep Learning models to learn by training on a large amount of training data, without full understanding of the underlying data that is used to train these models from a financial perspective. Past research also often do not take into consideration if the data used to train the Deep Learning models fully captured the various variations and economic trends present in stock data, which is necessary for the Deep Learning models to learn the stock market prediction task and enable them to generalize better and make more accurate predictions.

In addition, minimal work has been done to study how variations present in the training data used to train the Deep Learning models, affect the ability of the Deep Learning models to learn the stock market prediction task, as well as if the introduction of specific variations to the training data(based on knowledge of stock trends and factors affecting stock prices) used to train the Deep Learning models, will allow them to be able to better learn and make predictions on stocks with certain characteristics(bullish stocks, small-cap stocks etc.).

Therefore, there is a need to study how different variations introduced to the training data of the Deep Learning models affects the learning ability of the Deep Learning models for learning the task of stock market prediction, or in other words, how different variations introduced to the training data of the Deep Learning models affects the difficulty of learning of these models to learn the task of stock market prediction.

This paper proposes a novel study on the effects of introducing different variations to the training data used to train Deep Learning models(CNN and LSTM models), towards the ability of these models to learn the task of stock trading action prediction. The variations were introduced to the training data in a manner that allowed us to better understand how various variations present in the training data used for stock trading action prediction affect the ability of Deep Learning models to learn the task of stock trading action prediction. The variations introduced to the training data also took into consideration stock market specific factors likely to affect stock prices and movement.

From the results obtained from the study, we were able to better understand the effects of the introduction of certain types of data variation towards the ability of Deep Learning models to learn the task of stock trading action prediction. In addition, we also learnt which variations, when introduced to the training data used to train the Deep Leaning models, are beneficial towards helping Deep Learning models better overcome the difficulty of learning from the training data during training, to enable them to solve the task of stock trading action prediction. The results of the study will be of assistance towards future studies conducted on the use of Deep Learning models for stock market prediction tasks, by providing insights on how to improve the training of Deep Learning models for stock market prediction tasks with the use of training data introduced with variations beneficial towards helping the Deep Learning models better overcome the difficulty of learning from the training data during training.

ACKNOWLEDGEMENT

The author would like to express his gratitude and appreciation towards the following people for their mentorship and guidance which made the completion of the Final Year Project Possible.

Dr Althea Liang – First of all, the author would like to express his gratitude and thanks to his FYP Supervisor, for her meticulous guidance, mentorship, and encouragement throughout the whole duration of the Final Year Project. Her advices and suggestions towards the project made it successful and the completion of it possible.

Tai Fong Wan – Next, the author wishes to thank a fellow graduate who has provided guidance to the author, allowing him to better understand theory and concepts behind the previous work done by Dr Althea Liang and him, which allows for the continued study of the theory of the previous work for financial data related learning tasks in this Project.

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1. Introduction

1.1 Background

The application of Artificial Intelligence models in the domain of Financial technology, or more commonly known as Fintech, has been widely studied by researchers throughout the years. With Deep Neural Networks gaining traction in the field of Artificial Intelligence, the use of Deep Neural Networks, or Deep Learning models, for Fintech applications has become more prevalent in recent years. Deep Learning models have been used for Fintech applications such as Algorithmic Trading [1, 2], Financial Risk Assessment [3], as well as Cryptocurrency and blockchain studies[4].

One of the most widely studied application of Deep Learning models for Fintech, is the utilization of Deep Learning models for Fintech tasks surrounding the trading and investing of financial instruments such as Stocks or Forex. Some of these tasks include the prediction of next-day stock prices, stock portfolio management, valuation of assets, etc. For our Final Year Project, we will be focusing on the application of Deep Learning models for Stock Prediction tasks.

In the previous work done by Dr Althea Liang and Mr Tai Fong Wan [5], research was done to study the effects of variances of visual objects in images towards the ability of Deep Learning models to learn the task of object recognition. The results of the study suggests that variances of visual objects in images affects the amount of learning or information gained by the Deep Learning models significantly. Studies on the application of Deep Learning models for Fintech in the past, have not taken into consideration the effects of data variance of financial data towards the ability of Deep Learning models to learn these various Fintech tasks. Therefore, for our Final Year Project, we would also like to continue the study of this theory for financial data related learning tasks.

1.2 Literature Review of Past Research on Application of Deep Learning Models for Stock Prediction Tasks

There has been an extensive use of Deep Learning models such as LSTM (Long Short-Term Memory) RNN (Recurrent Neural Network) models, and CNN (Convolutional Neural Network) models for the purposes of stock market related applications in many past research. LSTM models have been used in past research for the purpose of predicting the next trading day stock price of stocks and CNN models have been used for the purpose of predicting the trading action (to buy, hold or sell the stock) to be performed on the stocks based on the input data given.

However, the methods in which Deep Learning models are developed for stock prediction tasks in past research, are usually impractical for real world applications. This is coupled with the fact that work done by past research, are not able to provide us with definitive answers as to how variations present in the training data used to train Deep Learning models affects their ability to learn the stock prediction tasks.

1.2.1 Past Research Using LSTM (Long Short-Term Memory) RNN models for Stock Prediction Tasks

LSTM models have been used in past research, mainly for regression tasks such as to predict stock prices for the next trading day, usually based on time-series input of stock indicators data from past **n** number of lookback days. While the results obtained by models in many past research papers seems promising, the predicted stock prices by the models do not aid stock traders in deciding what trading actions to perform on the stock. The predicted stock prices merely informs the stock trader the estimated stock price for the next trading day. In addition, the predicted stock prices are usually lagging behind the actual stock prices, which can be observed if the predicted and actual prices are plot on the same graph, as shown in Figure 1-1 below. The implications of this phenomenon is that when there is a change in the stock price direction (rising-to-falling or falling-to-rising), the predicted

prices will only reflect the change in stock direction a few trading days later, which make the predicted stock prices similar to the Moving Average prices of the stock. Therefore, the prediction models created are not practical for real world usage, as stock traders are not able to make use of the predicted stock prices to detect possible changes in the predicted stock's trends which is necessary for traders to make profitable trades. This renders the usage of LSTM models for the prediction of next trading day stock prices not very useful for stock trading Fintech applications.

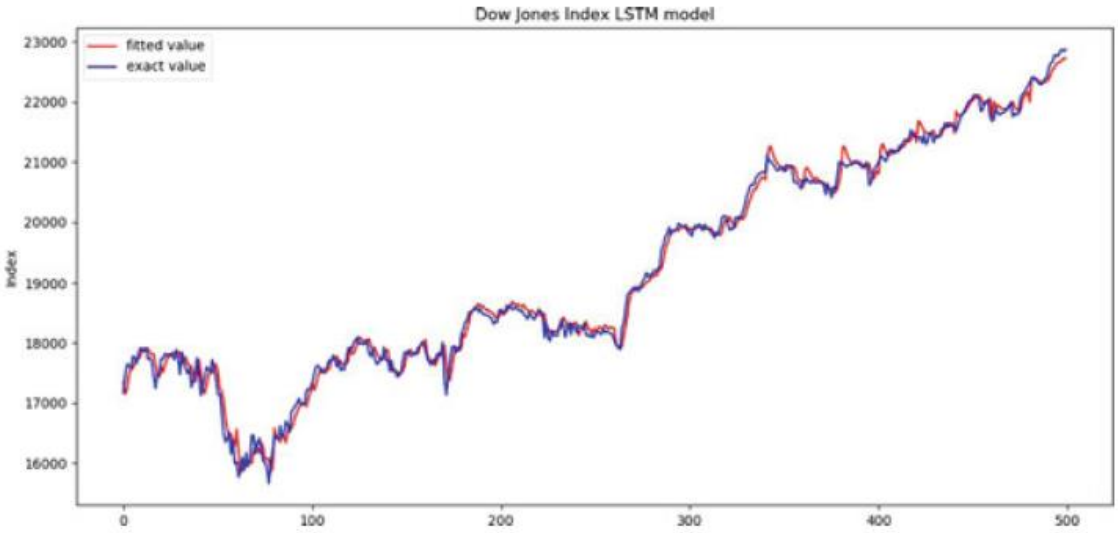


Figure 1-1 Plot showing predicted stock prices "lagging" actual stock prices, Source: Adapted from [6]

1.2.2 Past Research Using CNN (Convolutional Neural Network) models for Stock Prediction Tasks

For previous research involving the usage of CNN models, researchers utilized the models for stock prediction classification tasks, with the predicted labels usually being stock trading actions such as "Buy", "Hold", and "Sell", to signal a buy, hold, or sell trading action for the stock. In the research conducted by O. Sezer et.al [2], a 2D (two-dimensional) CNN model is used to determine the "Buy", "Hold", and "Sell" points in stock prices using 15 different technical indicators with different time intervals and parameter selections for each daily stock price time series to create images.

The technical indicators for each day, RSI, Williams %R, WMA, EMA, SMA, HMA, Triple EMA, CCI, CMO, MACD, PPO, ROC, CMFI, DMI, and PSI values for different intervals (6 to 20 days) are calculated and for each day a 15x15 image is generated by using 15 technical indicators and 15 different intervals of technical indicators.

From the results obtained by the research, we can observe that the precision and F1 score of the model is not very high for the "buy" and "sell" trade action labels (Table 1.2.2). This means that the model will not be very practical for use in a real-life trading scenario, as how stock trades generate profits is by making accurate "buy" and "sell" trades. However, with that being said, the model can still be profitable if the predicted "buy" points have stock prices of cost lesser than the predicted "sell" points.

Total Accuracy: 0.58			
	Hold	Buy	Sell
Recall	0.55	0.80	0.81
Precision	0.95	0.22	0.18
F1 Score	0.70	0.34	0.29

Table 1-1 Results Obtained from the Research Paper by O. Sezer et.al, Source: Adapted from [2]

A plausible reason for the CNN model not performing well for the prediction of "buy" and "sell" trade action labels can be due to the fact that the input data contains too many data dimensions/input features and not every data dimension is actually useful in helping the CNN model learn the prediction of stock trade action labels. In addition, the way the data image is created in the research, compresses each technical indicator with past 15 days lookback data points into one-dimensional data. Convolutional networks are inspired by biological processes in that the connectivity pattern between neurons resembles the organization of the human visual cortex, and it may be challenging for the CNN model to visualize the one-dimensional representations of the 15 technical indicators, thus making it hard to learn the patterns present in the technical indicators data to be able to learn them efficiently to make predictions on stock trading action labels.

1.2.3 Understanding of the Effects of Data Variance on Learning Ability of Deep Learning Models for Fintech-Related Tasks

As earlier stated, although past research have tackled stock market prediction tasks using Deep Learning models, many of these research allow the Deep Learning models to learn by training them on a large amount of training data, without full understanding the data that is used to train these models from a financial perspective. Past research often also do not take into consideration if the data used to train the Deep Learning models fully captured the various variations and economic trends present in stock data, which is necessary for the Deep Learning models to learn the stock market prediction task and enable them to generalize better and make more accurate predictions.

In general, the task of Stock Market Prediction has been studied as both a regression task where input data is used by the Deep Learning models to predict a continuous value such as stock price, as well as a classification task where input data is used to predict the class label of the data, such as, if the input data corresponds to a 'buy' class label which signals a stock buying action, or a 'sell' class label which signals a stock selling action. For both these tasks, the input data for the Deep learning models usually consists of the price of the stock, as well as various technical indicators data derived from the stock prices, which are then used in a time-series manner with a predetermined lookback period. Each Deep Learning model is then trained on the stock data of a particular stock and used to make predictions on that particular stock.

For each research, the stocks that are used to train the Deep Learning models, as well as the type of stock data to be used as input for the models, are selected and determined at the discretion of the researchers. Therefore, the stocks that are used to train the Deep Learning models, as well as the type of data that is used as input to the Deep Learning models vary from research to research, where one research may only make use of past trading days stock prices as input data, and others may use different combinations of stock technical indicators for their research.

Therefore, although these research are useful for providing evidence that Deep Learning models have the potential for stock market prediction tasks, they are not transferable to real world stock market applications. This is due to the fact that we are not able to determine if the Deep Learning models developed and trained in the papers performed well due to the type of financial data that is being used

to train the Deep Learning models, or due to the fact that the Deep Learning models were able to better make predictions for the particular stocks that was selected for use in the research. As a consequence, we cannot be certain that transferring the methods used in the research paper published to real world stock market applications will allow us to produce the same results.

In addition, from past research papers, we are not able to ascertain that the training data used to train the Deep Learning models allowed them to learn the stock market prediction task effectively, as well as how variations present in the training data used to train the Deep Learning models affects the ability of the Deep Learning models to learn the stock market prediction task.

In the experimental investigation done by Dr Althea Liang and Mr Tai Fong Wan [5], results suggests that variances of visual objects in images affects the amount of learning or information gained by the Deep Learning models significantly. Therefore, there is a possibility that the same observation applies for the use of Deep Learning models for Fintech tasks, where data variance present in financial data affects the ability of Deep Learning models to learn various Fintech tasks.

Therefore, there is a need to determine how different variations introduced to the training data of the Deep Learning models affects the learning ability of the Deep Learning models, or in other words, how different variations introduced to the training data of the Deep Learning models affects the difficulty of learning the stock market prediction task.

1.3 Final Year Project Objectives

The objective of this Final Year Project is to first survey past research carried out on the application of Deep Learning models for stock market prediction tasks and recreate some of the Deep Learning models used in past research in order to determine their performance for the purpose of stock trading actions predictions.

Next, the Final Year Project aims to conduct an experimental investigation to observe the effects of introducing different variations to the training data, which is used to train the Deep Learning models for the task of stock market prediction, on the difficulty of learning for these models. The variations introduced to the training data should help us better understand how these various variations affect the difficulty of learning for Deep Learning models for stock market prediction tasks. The variations introduced to the training data should also take into consideration stock market specific factors such as stock cycles, ripple effect caused by changes to the price of one stock on other stocks belonging to the same business sector, market momentum, Market Sentiments etc.

1.4 Scope

This project will focus mainly on the use of LSTM (Long Short-Term Memory) RNN, and CNN (Convolutional Neural Network) Deep Learning models for the purposes of stock trading actions predictions. Both Deep Learning models will be trained using the same set of stocks, which consists of stocks from different business sectors and different stock exchanges. Variations will then be introduced into the training data used to train the Deep Learning models; subsequently the trained models will then be evaluated against an evaluation dataset to measure the effect of the different data variations on the performance of the Deep Learning models.

1.5 Source of Data and Procedure of Project

For this project, the data required to conduct the various experiments are, the daily trading Volume of various stocks used for the experiments, Opening, Closing, High and Low stock prices of various stocks used for the experiments which are obtained from Yahoo Finance, as well as their various technical indicators data which are derived from the from the trading Volume, Opening, Closing, High and Low stock prices using the TA-Lib library in Python.

The project will be conducted in 3 phases. In the first phase, we will first survey past research carried out on the application of Deep Learning models for stock market prediction tasks and recreate some of the Deep Learning models used to determine their performance for the purpose of stock trading actions predictions. In the second phase, we will devise experiments for the purpose of understanding which stock technical indicator used in the input data of Deep Learning models is more important in helping overcome the difficulty of learning of the Deep Learning models for the task of stock trading action prediction. In the last phase of the project, we will conduct experiments to observe the effects of introducing different variations to the training data which is used to train the Deep Learning models for the task of stock market prediction on the difficulty of learning for these models.

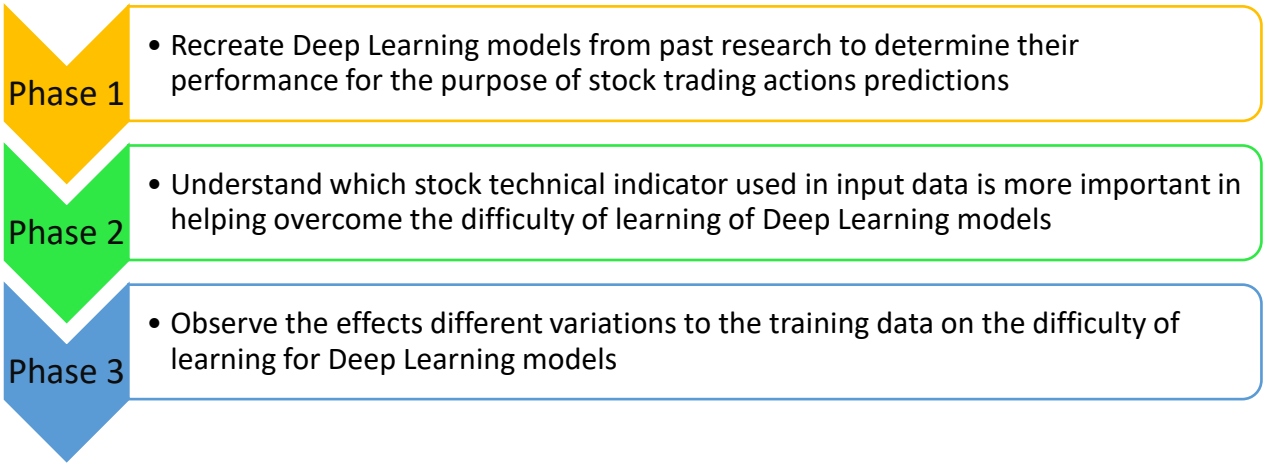


Figure 1-2 Procedure of Final Year Project

1.6 Organisation of Report

This report is organised into 5 Chapters. Chapter 1 is the introductory chapter of the report which provides the background, review of past research, as well as the purpose of the experimental investigation conducted for this Final Year Project. Chapter 2, 3, and 4 will detail the work done, the results obtained from the experiments conducted, as well as the observations and conclusions for each phase of the project. The final chapter, Chapter 5 will provide the reader with an overall summary and conclusion of the Final Year Project as well as improvements and investigations that can be done for future work.

The main focus of this Final Year Project is the experimental investigation on the effects of introducing different variations to the training data used to train Deep Learning models(CNN and LSTM models), towards the ability of these models to learn the task of stock trading action prediction. The results and observations made on this experimental investigation is detailed in Chapter 4 of this report. The experimental investigation detailed in Chapter 4 constitutes the main bulk of the work done for this Final Year Project.

2 Initial Experiments Using Past Research Methods

In the first phase of the project, in order to determine the performance of LSTM (Long Short-Term Memory) RNN, and CNN (Convolutional Neural Network) Deep Learning models for the task of stock trading actions prediction, experiments are conducted using LSTM and CNN models based on implementations from past research which utilized these models for forecasting of stock trading actions. This includes the way the data was prepared for the models, the parameters for the models, as well as the number of layers for the Deep Learning models.

2.1 CNN Deep Learning Method Used for Initial Experiments

For the CNN model used for our experiments, we adopted the two-dimensional CNN model that was used by Omer Berat Sezer et al. [2] in their research, which proposed the use of CNN model for algorithmic trading. For the implementation of this model, instead of using the conventional one-dimensional financial time series data used in most financial forecasting models, a two-dimensional image-like data representation is used, in order to be able to utilize the power of Convolutional Neural Network.

The two-dimensional data representation is obtained by using 15 different technical indicator and 15 different intervals used to calculate the technical indicators (6 to 20 days range). Also, the rows are ordered in such a way that similar indicators are clustered together to accomplish the locality requirements along the y-axis. As a result, 15x15 pixels sized images are generated and fed into the Convolutional Neural Network.

The data is prepared by first obtaining historical open, high, low, close stock prices and daily trade volume from Yahoo finance from year 2000 to 2019, and the various technical indicators are then derived from the data obtained from Yahoo finance by using the TA-lib Python library which has functions to derive the various technical indicators.

After obtaining the data required for the experiments, daily close prices are then manually marked as “Hold”, “Buy”, or “Sell” by determining the top and bottom points in a sliding window. Bottom points are labelled as “Buy”, top points are labelled as “Sell”, and the remaining points are labelled as “Hold”. The structure of the labelling process is given in the algorithm below, adopted from the research done by Omer Berat Sezer et al. [2].

```
procedure LABELLING()
    windowSize = 11 days
    while(counterRow < numberOfDaysInFile)
        counterRow++
        If (counterRow > windowSize)
            windowBeginIndex = counterRow − windowSize
            windowEndIndex = windowBeginIndex + windowSize − 1
            windowMiddleIndex = (windowBeginIndex + windowEndIndex)/2
            for (i = windowBeginIndex; i <= windowEndIndex; i++)
                number = closePriceList.get(i)
                if(number < min)
                  min = number
                  minIndex = closePriceList.indexOf(min)
                if(number > max)
                  max = number
                  maxIndex = closePriceList.indexOf(max)
            if(maxIndex == windowMiddleIndex)
                result = "SELL"
            elif(minIndex == windowMiddleIndex)
                result = "BUY"
            else
                result = "HOLD"
```

Figure 2-1 Algorithm to Label Data, Source: Adapted from [2]

The two-dimensional CNN model is then trained with the two-dimensional data arrays for 200 epochs, using the Adam optimizer, at a learning rate of 0.001, with a two-dimensional CNN model with the following parameters:

- **Layer 1**: Convolutional Layer (32 Filter, 3x3 kernel)
- **Layer 2**: Batch Normalization Layer
- **Layer 3**: Dropout Layer (0.25 dropout rate)
- **Layer 4**: Convolutional Layer (64 Filter, 3x3 kernel)
- **Layer 5**: Batch Normalization Layer
- **Layer 6**: MaxPooling Layer (2x2)
- **Layer 7**: Dropout Layer (0.25 dropout rate)
- **Layer 8**: Flatten Layer
- **Layer 9**: Dense Layer (128 neurons, activation='relu')
- **Layer 10**: Batch Normalization Layer
- **Layer 11**: Dropout Layer (0.5 dropout rate)
- **Layer 12**: Output Dense Layer (3 neurons, activation='softmax')

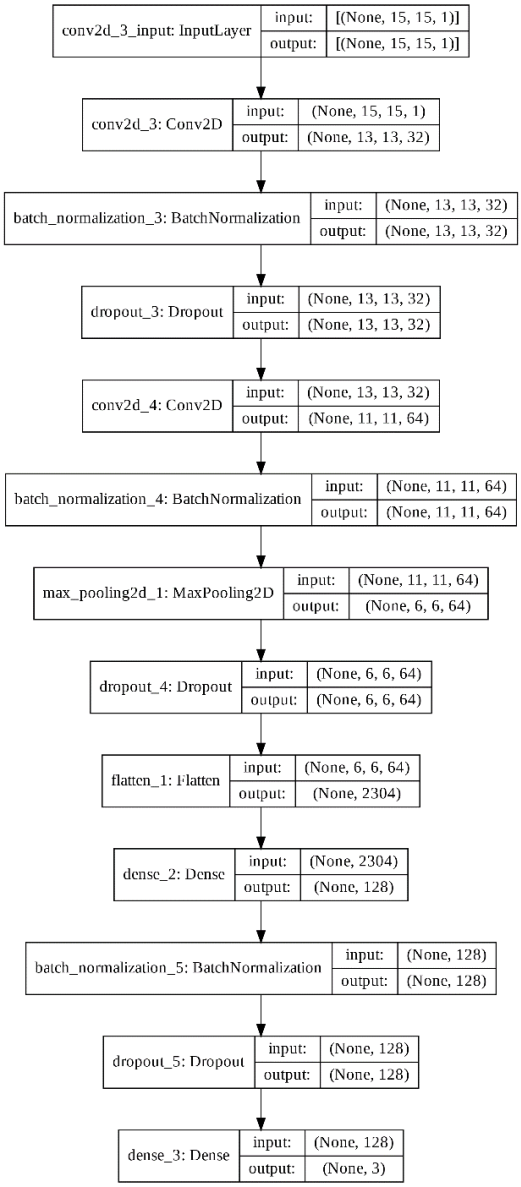


Figure 2-2 CNN Model Architecture

After the model is trained, the model is then evaluated against the stock data of the first 6 months of the year 2020 to determine the performance of the model.

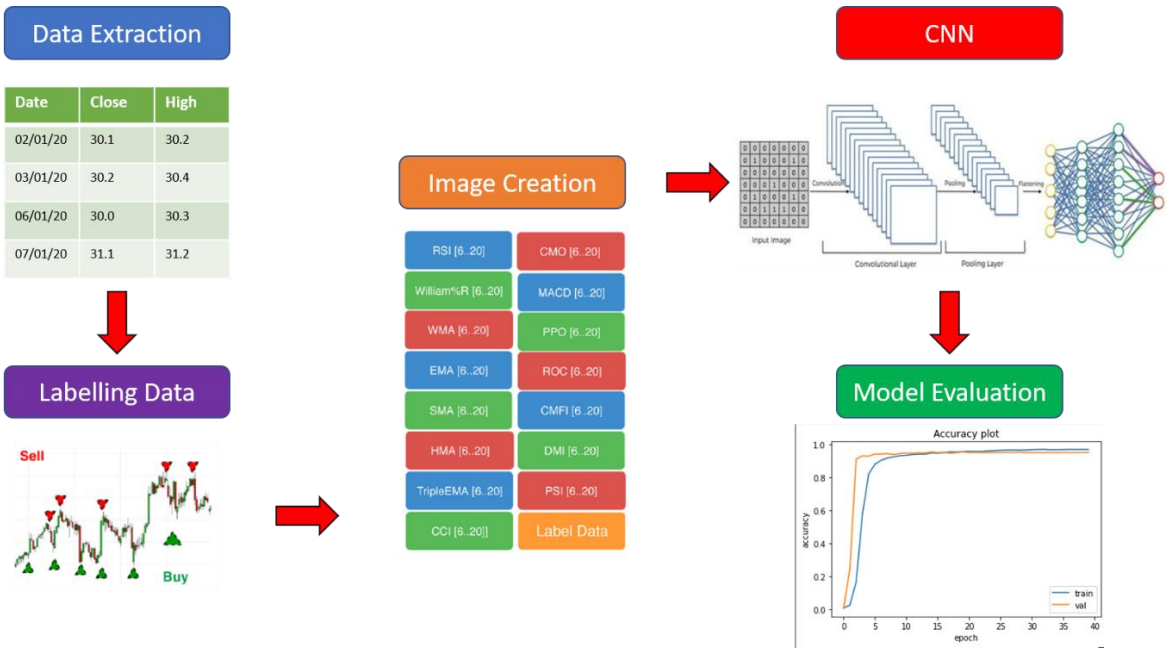


Figure 2-3 CNN Model Process

2.2 LSTM Deep Learning Method Used for Initial Experiments

LSTM networks have been used in many past research concerning stock market forecasting, as well as many other time-series related Machine Learning tasks and have proven to be highly effective in time series forecasting.

For our initial first phase experiments, the type of data fed to the LSTM model would be the same as the data that was fed into the two-dimensional CNN model, in order to ensure that the testing is fair. However, instead of having a 15x15 Two-Dimensional representation for the input data, the data are arranged into multiple time series arrays of 15 time-steps with 15 technical indicators' data for each time step. The LSTM model is then trained with the input arrays for 200 epochs, using the Adam optimizer, at a learning rate of 0.001, with an LSTM model with the following parameters:

- **Layer 1**: LSTM Layer (128 neurons, activation='tanh')
- **Layer 2**: Dropout Layer (0.2 dropout)
- **Layer 3**: Batch Normalization Layer
- **Layer 4**: LSTM Layer (128 neurons, activation='tanh')
- **Layer 5**: Dropout Layer (0.15 dropout)
- **Layer 6**: Batch Normalization Layer
- **Layer 7**: Dense Layer (32 neurons, activation='relu')
- **Layer 8**: Dropout Layer (0.2 dropout)
- **Layer 9**: Output Dense Layer (3 neurons, activation='softmax')

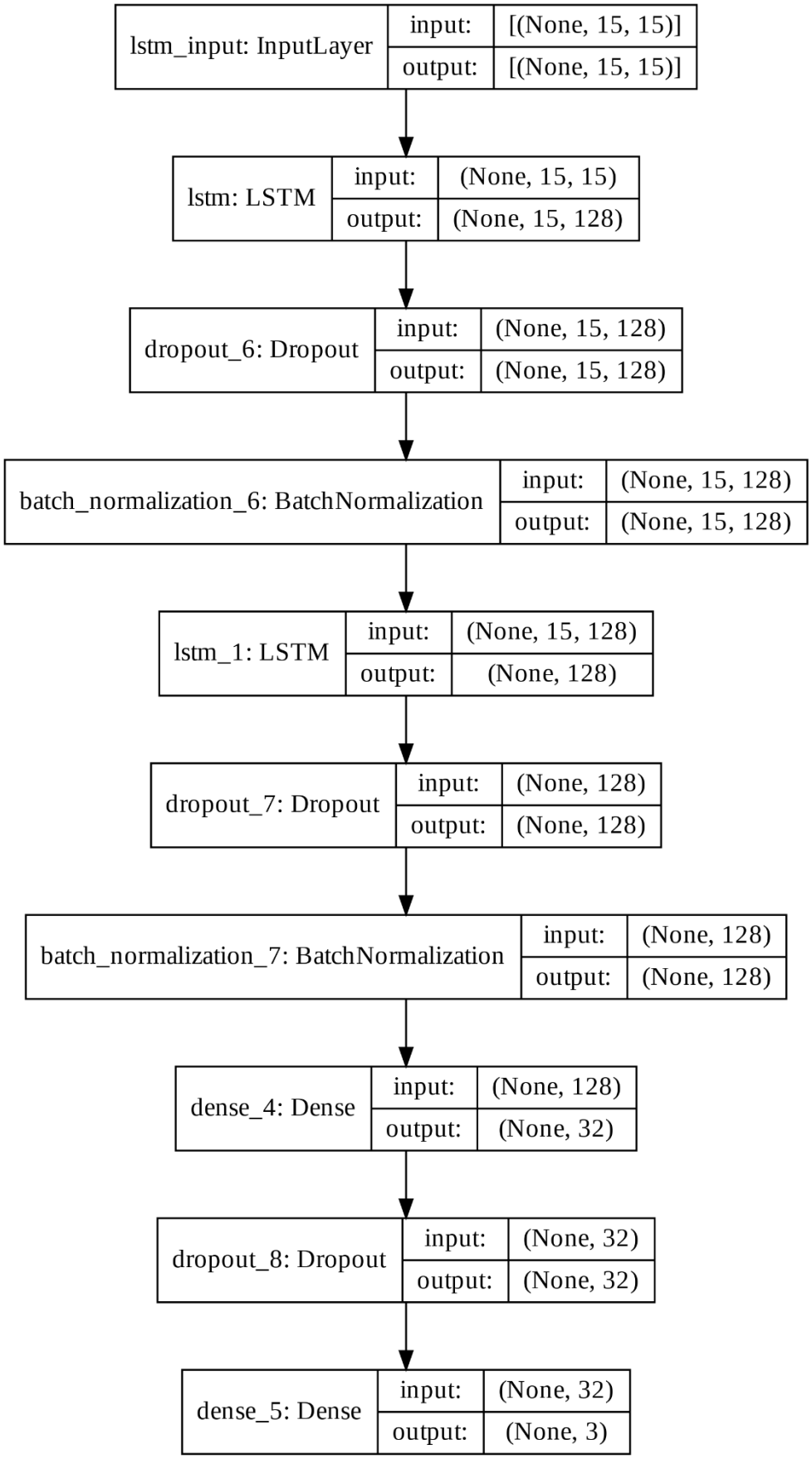


Figure 2-4 LSTM Model Architecture

After the model is trained, the model is then evaluated against the stock data of the first 6 months of the year 2020 to determine the performance of the model.

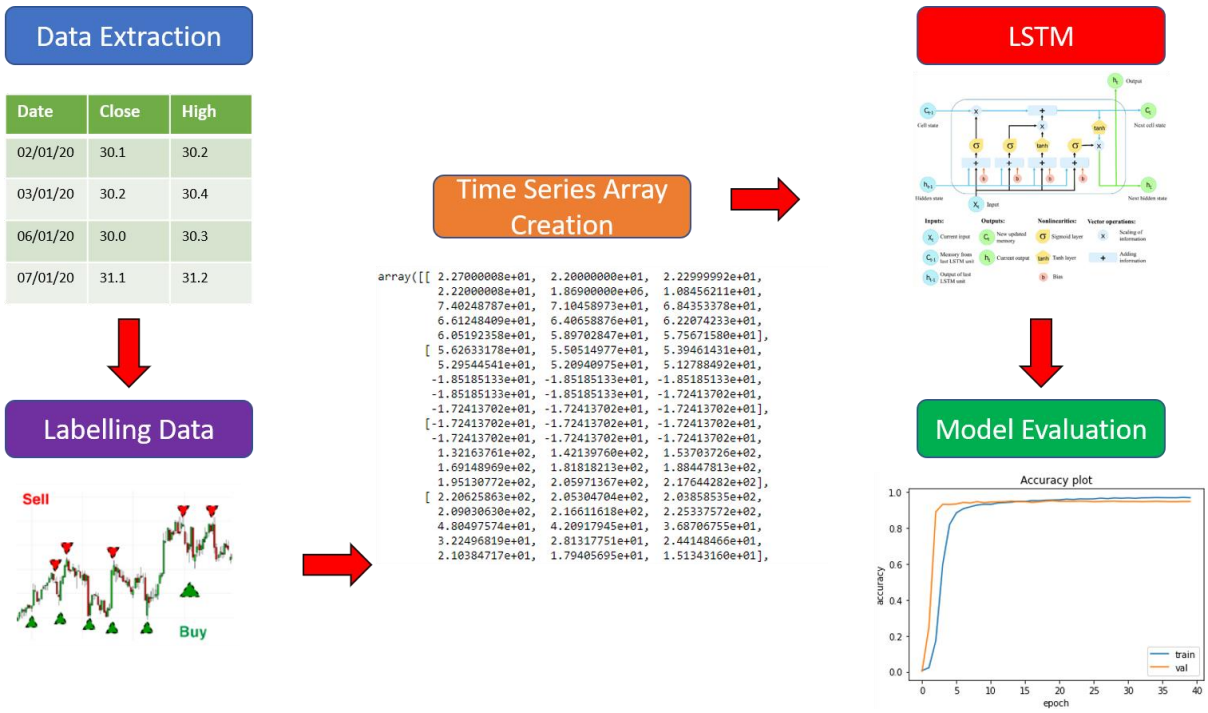


Figure 2-5 LSTM Model Process

2.3 Application of Deep Learning models to Various Stocks

The two Deep Learning models are trained on a variety of different stocks, to determine their efficacy in the prediction of stock trading actions for stocks in different stock markets and different business sectors. The stocks we selected are categorized into four categories, Singapore Bank Stocks, Singapore Medical Stocks, US Bank Stocks and US Medical Stocks. The test accuracy of these stocks are then recorded and analysed.

2.3.1 Models Results

<u>2D CNN Model</u>

America Bank Stocks:

Stock	Validation Loss	Validation Accuracy	Test Accuracy (First 6 months 2020 Stock Data)
Bank of America	0.62168	0.62751	0.69841
CitiBank	0.61727	0.63811	0.77778
JPMorgan	0.62877	0.65084	0.74603
Wells Fargo	0.50254	0.72325	0.76190

Table 2-1 CNN Model Accuracy on America Bank Stocks

Singapore Bank Stocks:

Stock	Validation Loss	Validation Accuracy	Test Accuracy (First 6 months 2020 Stock Data)
DBS Bank	0.67536	0.61151	0.62295
OCBC Bank	0.53624	0.67466	0.70491
UOB Bank	0.58449	0.67971	0.68852

Table 2-2 CNN Model Accuracy on Singapore Bank Stocks

Singapore Medical stocks:

Stock	Validation Loss	Validation Accuracy	Test Accuracy (First 6 months 2020 Stock Data)
Healthway Medical	0.54978	0.75496	0.73770
Raffles Medical	0.52434	0.71565	0.70491
Singapore Medical	0.56218	0.72033	0.70491
Alliance Health	0.18275	0.95455	0.96721

Table 2-3 CNN Model Accuracy on Singapore Medical Stocks

America Medical stocks:

Stock	Validation Loss	Validation Accuracy	Test Accuracy (First 6 months 2020 Stock Data)
Biogen Inc	0.59457	0.64924	0.65079
Alexion Pharma	0.61276	0.62912	0.61905
Vertex Pharma	0.48695	0.72566	0.82540

Table 2-4 CNN Model Accuracy on America Medical Stocks

<u>LSTM Model</u>

America Bank Stocks:

Stock	Validation Loss	Validation Accuracy	Test Accuracy (First 6 months 2020 Stock Data)
Bank of America	0.76658	0.60901	0.68254
CitiBank	0.93206	0.58809	0.71429
JPMorgan	1.01584	0.52776	0.74603
Wells Fargo	0.91447	0.59131	0.63492

Table 2-5 LSTM Model Accuracy on America Bank Stocks

Singapore Bank Stocks:

Stock	Validation Loss	Validation Accuracy	Test Accuracy (First 6 months 2020 Stock Data)
DBS Bank	0.81837	0.51719	0.70492
OCBC Bank	0.85762	0.60714	0.80328
UOB Bank	0.66079	0.84705	0.88525

Table 2-6 LSTM Model Accuracy on Singapore Bank Stocks

Singapore Medical stocks:

Stock	Validation Loss	Validation Accuracy	Test Accuracy (First 6 months 2020 Stock Data)
Healthway Medical	0.57295	0.81870	0.63492
Raffles Medical	1.00491	0.59585	0.65574
Singapore Medical	1.09847	0.64228	0.70492
Alliance Health	0.08530	1.00000	0. 96721

Table 2-7 LSTM Model Accuracy on Singapore Medical Stocks

America Medical stocks:

Stock	Validation Loss	Validation Accuracy	Test Accuracy (First 6 months 2020 Stock Data)
Biogen Inc	0.97424	0.58246	0.69841
Alexion Pharma	1.16025	0.56798	0.53968
Vertex Pharma	0.97693	0.56235	0.66666

Table 2-8 LSTM Model Accuracy on America Medical Stocks

Average Results of Both Deep Learning Models

Model	Average Validation Accuracy	Average Test Accuracy
CNN Model	0.696792857	0.729319286
LSTM Model	0.646940714	0.697812308

Table 2-9 Average Model Accuracy for CNN and LSTM Models

2.4 Conclusions and Findings for First Phase of Project

In general, the 2D CNN models in the first phase experiments performed better than the LSTM models, with the validation accuracy and test accuracy of the 2D CNN models when evaluated against the first 6 months of stock data in 2020 at 69.68% and 72.93% respectively, as compared to the validation and test accuracy of the LSTM models at 64.69% and 69.78% respectively.

Also, the validation accuracy, as well as test accuracy of 2D CNN models are much more stable across the various categories of stocks(Singapore Bank Stocks, Singapore Medical Stocks, US Bank Stocks and US Medical Stocks), with the intra-category accuracies very close to each other as well, when compared against the intra-category accuracies of the LSTM models. The initial experiments conducted in the first phase of the project allowed us to conclude that 2D CNN models' performance are more stable than that of the LSTM models for the task of stock trading action prediction, having satisfactory performance for most stocks across various stock markets and business sectors.

For the LSTM models, the validation accuracy, as well as test accuracy for the stocks are relatively more unstable as compared to that of the CNN models, with the models performing better for some stocks, but not as well for other stocks. Even within the same category of stocks, the validation accuracy, as well as test accuracy of intra-category stocks can vary significantly. This causes the results for the LSTM models to be inconclusive, as the performance of the LSTM models vary significantly from stock to stock for the task of stock trading action prediction.

From the first phase experiments, we can also conclude that Deep Learning models are more accurate when making stock market predictions on stocks from certain business sector's stocks and markets, as compared to others. For example, the 2D CNN models showed a higher prediction accuracy when predicting the stock trading actions of US bank stocks as compared to Singapore bank stocks but showed a higher accuracy when predicting Singapore medical stocks as compared to US medical stocks.

In summary, we can observe from the first phase experiments of the Final Year Project, that for the classification task of stock trading action prediction, 2D CNN models perform better as compared to LSTM models, with the 2D CNN models achieving higher average validation and test accuracies as compared to the LSTM models and having more stable results for most stocks across various stock markets and business sectors. In addition, we also observed that the business sector and stock market of the stock used for training the Deep Learning models, does have an impact on the prediction accuracy of the Deep Learning models.

3 Experiments on Importance of Various Technical Indicators in Helping Overcome the Difficulty of Learning for Deep Learning models

3.1 Objective of Second Phase of Project

For the initial experiments conducted in the first phase of the project, the task was to utilize various stock technical indicators data of the past 15 trading days of various stocks, as input data to train two kinds of Deep Learning models (LSTM and CNN models), in order to learn the task of stock trading actions prediction, where the output of the models will be a trading signal(buy, hold, or sell) for the stocks. Subsequently, we evaluated the models against test datasets after training them, to determine the performance of LSTM and CNN Deep Learning models for the task of stock trading actions prediction.

For the second phase of the Final Year project, we then devised experiments for the purpose of understanding the significance of each stock technical indicator, when used as input data for the initial experiments, towards the learning of the stock trading action prediction task by the Deep Learning models. In other words, which stock technical indicator used in the input data is more important in helping overcome the difficulty of learning of the Deep Learning models for the task of stock trading action prediction.

The primary objective of second phase experiments was to find out, for the task of stock trading action prediction, which stock technical indicators(data dimensions) are more important toward the learning of the stock trading action prediction task amongst all the input technical indicators. In other words, the significance of each particular stock technical indicator in terms of its impact towards the overcoming the difficulty of learning for Deep Learning models.

3.2 Second Phase Experiments Set Up

3.2.1 Creation of Input Data for CNN and LSTM Models

From the historical Closing, Lowest, Highest stock prices data for each trading day in the datasets we obtained from Yahoo Finance, we were able to derive various technical indicators using the TA-lib Python library, to be used as input data for the Deep Learning models for the stock trading action prediction task. The technical indicators that were derived can be classified into 2 main categories, technical indicators that are Moving Averages indicators, and technical indicators that are Momentum-related indicators. The technical indicators derived are as follows:

Moving Averages	Momentum Indicators
SMA (Simple Moving Average)	CCI (Commodity Channel Index)
EMA (Exponential Moving Average)	CMO (Chande Momentum Oscillator)
TEMA (Triple Exponential Moving Average)	DMI (Directional Movement Index)
KAMA (Kaufman's Adaptive Moving Average)	MOM (Momentum Indicator)
WMA (Weighted Moving Average)	ROC (Rate of Change)
	RSI (Relative Strength Index)
	Stochastic (Stochastic Oscillator)
	WILLR (Williams %R)

Table 3-1 Technical Indicators Used for Second Phase Experiments

With the data of the technical indicators derived, as well as the Closing Price data of the stocks, we are then able to create the input data arrays for the LSTM and CNN models.

For the CNN models and LSTM models, we will be using the same model architectures as the from the experiments conducted in the first phase of the project. Therefore, the input data for the CNN model will have a two-dimensional data representation, obtained by using the different technical indicators instances, with 15 different intervals used to calculate the technical indicators (6 to 20 days range), as well as the past 15 days Closing Price of the stocks to create a 15 x 15 data matrix. The input data for the LSTM model will be a times-series data array with 15 time-steps and 15 different technical indicators for each time step.

3.2.2 Training Datasets Variants Used to Train Deep Learning Models

In order to find out, for the task of stock trading action prediction, which stock technical indicators(data dimensions) are more important toward the learning of the stock trading action prediction task amongst all the input technical indicators, we created multiple variations of the training dataset to train the CNN and LSTM models, with the variations to the training dataset as follows:

1. Original training dataset with no variations (Control Dataset).
2. Training dataset with Closing Price columns data points all set to 0.
3. Training dataset with SMA columns data points all set to 0.
4. Training dataset with EMA columns data points all set to 0.
5. Training dataset with TEMA columns data points all set to 0.
6. Training dataset with KAMA columns data points all set to 0.
7. Training dataset with WMA columns data points all set to 0.
8. Training dataset with CCI columns data points all set to 0.
9. Training dataset with CMO columns data points all set to 0.

10. Training dataset with DMI columns data points all set to 0.
11. Training dataset with MOM columns data points all set to 0.
12. Training dataset with ROC columns data points all set to 0.
13. Training dataset with RSI columns data points all set to 0.
14. Training dataset with Stochastic columns data points all set to 0.
15. Training dataset with WILLR columns data points all set to 0.
16. Training dataset with Moving Average Indicators columns data points all set to 0.
17. Training dataset with Momentum-Related Indicators columns data points all set to 0.
18. Training dataset containing only Momentum-related Indicators (all other columns data points set to 0).

For each variant training dataset, the data columns are set to 0 to exclude the specific technical indicator(s) out from the training data. The reason for setting the data columns instead of removing them from the dataset is because the architecture of the CNN models used requires a square matrix representation as the input data, therefore we have to keep all 15 data columns, in order to keep the shape of the square matrix.

3.2.3 Procedure for Conducting the Experiments

Similar to the experiments conducted in the first phase of the project, the experiments in the second phase of the project will be performed on the CNN and LSTM Deep Learning models, with the same model architecture as defined in the first phase of the project.

Both the CNN and LSTM models will be trained using the all the training dataset variants defined in section 3.2.2, for 1000 epochs for each training dataset variant, using an Adam optimizer, at a learning rate of 1e-5. Next, the trained models are evaluated to determine the performance of the models.

Figure 3-1 Experiment Procedure for Second Phase Experiments

3.3 Quantifying the Significance of Each Indicator in Terms Impact of Difficulty in Learning

In order to quantify the significance of the various technical indicators in terms of its impact towards the difficulty in learning for the Deep Learning models, we trained the Deep Learning models using training dataset variants with technical indicator(s) left out, out for each model, for all the derived technical indicators. After which, we evaluated the trained models using the following metrics[1]:

- Final Epoch Validation Loss, Final Epoch Validation Accuracy
- Learning Rate for Model Accuracy (percent per epoch)
- Learning Rate for Model 10 Epochs Moving Average Accuracy (percent per epoch)
- Rate of Model Accuracy Learning Jitter
- Rate of Model Loss Learning Jitter

<u>Learning Rate for Model Accuracy</u>

We define the Learning Rate for Model Accuracy as the sum of the percentage increase of the current training epoch's validation accuracy from the previously highest obtained validation accuracy from previous epochs(if the current training epoch validation accuracy is higher than the previously highest obtained validation accuracy), for each training epoch and divide it by the total number of epochs the model is trained (1000 epochs for our experiments). Due to the fact that for most of the models, there is a drop of accuracy to the absolute minima for the first 20 epochs, we will take the accuracies for the last 980 training epochs.

$$\textbf{Learning Rate for Model Accuracy} = \frac{Sum\ (Percentage\ increase\ \text{of the current training epoch's validation accuracy from previous highest obtained validation accuracy})}{Total\ Number\ of\ Training\ Epochs}$$

<u>Learning Jitter</u>

During training, the Deep Learning models experience learning "jitters", which are minor fluctuations in accuracies of the models during training (as seen in the graph below)

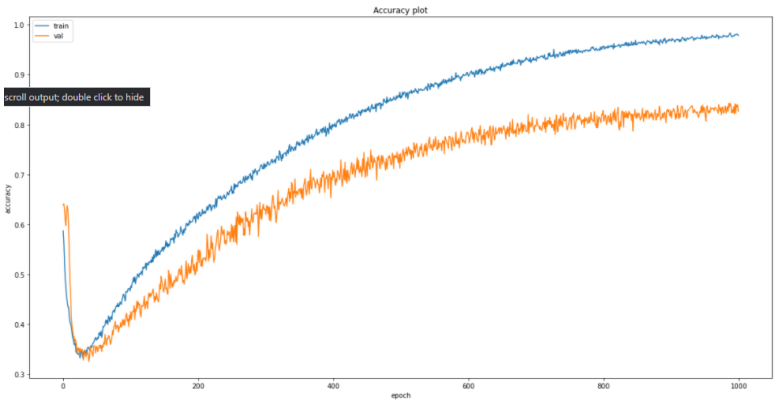


Figure 3-2 Accuracy Graph Plot Showing Jitter

[1] The results for Learning Rate for the Deep Learning models' 10 Epochs Moving Average Accuracy (percent per epoch) will be in Appendix 1

Therefore, we would like to observe if the removal of any technical indicators from the training dataset results in more learning 'jitter' during the training of the Deep Learning models, which can indicate difficulty of the Deep Learning models in the learning of the stock trading action prediction task, as the accuracy improvement of the model fluctuates during training. The rate of Learning Jitter (%) is defined by:

learning jitter = (count of minor accuracy drops / number of training epochs) * 100

This gives the rate which Learning Jitter occur during the training of the models, with a higher rate of Learning Jitter indicating more difficulty of the Deep Learning models during the learning of the training data and a lower rate of Learning Jitter indicating less difficulty of the Deep Learning models during the learning of the training data.

3.4 Results of Second Phase Experiments

3.4.1 Results of CNN Models

Validation Loss & Accuracies

Indicator Removed	Validation Loss	Validation Accuracy
Original Indicators	0.68315	0.82629
Remove Close Price	0.66293	0.84462
Remove CCI	0.61444	0.8255
Remove CMO	0.66106	0.83984
Remove DMI	0.65948	0.83028
Remove EMA	0.66496	0.84382
Remove KAMA	0.65456	0.83984
Remove Momentum	0.65603	0.82231
Remove ROC	0.66506	0.81673
Remove RSI	0.64864	0.83426
Remove SMA	0.66223	0.84303
Remove Stochastic	0.63624	0.82789
Remove TEMA	0.64236	0.83984
Remove WILLR	0.66014	0.80637
Remove WMA	0.66797	0.84382
Remove Moving Averages	0.61911	0.83586
Remove Momentum Indicators	0.76259	0.69323
Remove all except Momentum Indicators	0.59126	0.83506

Table 3-2 CNN Models Results for Validation Loss & Accuracies

For the CNN models that were trained, we observed that the validation accuracies of the models trained with training data with only a single technical indicator removed from the input data are similar to each other, with validation accuracies obtain around 80-84% . Therefore, we further experimented with removing all the technical indicators from one of the two main categories of

indicators, namely, technical indicators that are Moving Averages indicators, and technical indicators that are Momentum-related indicators from the training dataset, to train two additional models. From the experiments, we found that when we remove all the Momentum-related indicators from the training dataset, the validation accuracy of the model is significantly lower than that of the other models trained with other data variations, at 66.3% as compared to the 80% accuracies of other models. Also, the validation loss is also the highest amongst all the models trained, for the model with all the Momentum-related indicators removed from its training dataset.

Learning Rate for Model Accuracy

Indicator Removed	Accuracy Learning Rate (percent per epoch)	Accuracy Learning Rate (percent per epoch) with respect to final Accuracy	Rank
Original Indicators	0.08644	0.071424508	15
Remove Close Price	0.09283	0.078406075	7
Remove CCI	0.08922	0.07365111	14
Remove CMO	0.0907	0.076173488	12
Remove DMI	0.09863	0.081890516	3
Remove EMA	0.09413	0.079428777	4
Remove KAMA	0.09445	0.079322888	5
Remove Momentum	0.09112	0.074928887	13
Remove ROC	0.09395	0.076731784	10
Remove RSI	0.09133	0.076192966	11
Remove SMA	0.09286	0.078283766	9
Remove Stochastic	0.08256	0.068350598	16
Remove TEMA	0.09323	0.078298283	8
Remove WILLR	0.08345	0.067291577	17
Remove WMA	0.09304	0.078509013	6
Remove Moving Averages	0.10369	0.086670323	2
Remove Momentum Indicators	0.08816	0.061115157	18
Remove all except Momentum Indicators	0.10844	0.090553906	1

Table 3-3 CNN Models Results for Learning Rate

From the experiments, we also found that when we rank the models according to their Learning Rate for Model Accuracy, the bottom 3 ranked models were:

- The CNN model with Stochastic Indicator removed from training dataset
- The CNN model with WILLR Indicator removed from training dataset
- The CNN model with all Momentum-related indicators removed from training dataset

From the results we can observe that amongst all the technical indicators used as input data, the Momentum-related indicators are more significant towards helping the CNN models overcome the difficulty of learning for stock action prediction. Without the Momentum-related Indicators in the training dataset, the CNN model's Learning Rate for accuracy is reduced and the CNN model trained without Momentum-related indicators in the training dataset performed the worst amongst all the trained models. On the other hand, we can see that when we remove the Moving Average indicators from the training dataset, the Learning Rate for Model Accuracy is not negatively affected, in fact, the model with all Moving Average indicators removed from the training dataset, is the second best performing model out of all the models trained.

Learning Jitter

CNN				
Indicator Removed	Model accuracy learning jitter (%)	Accuracy average jitter percentage (%)	Model Loss learning jitter (%)	Loss average jitter percentage (%)
Original Indicators	47.095	1.86013	49.745	2.03609
Remove Close Price	46.687	1.8485	48.93	2.10857
Remove CCI	47.604	1.91349	47.91	2.22999
Remove CMO	46.687	1.75541	49.541	2.13506
Remove DMI	49.032	2.3145	51.172	2.62047
Remove EMA	48.318	1.8136	48.93	2.14377
Remove KAMA	48.114	1.89618	48.522	2.23319
Remove Momentum	47.91	1.67941	49.235	2.09511
Remove ROC	47.095	1.70121	48.522	2.06012
Remove RSI	47.401	1.9251	49.235	2.14012
Remove SMA	46.483	1.90861	49.439	2.13551
Remove Stochastic	47.299	2.18961	49.337	2.57798
Remove TEMA	47.91	1.84474	49.235	2.18792
Remove WILLR	46.993	2.28823	49.847	2.63884
Remove WMA	46.687	1.86858	49.541	2.10577
Remove Moving Averages	47.197	3.45909	48.726	4.08796
Remove Momentum Indicators	49.439	7.77625	49.439	7.31207
Remove all except mom Indicators	47.401	3.84709	49.235	4.4563

Table 3-4 CNN Models Results for Learning Jitter

From the table above, we can observe that the results obtained are not very conclusive for observing the effects of removing technical indicators towards the Learning Jitter of the CNN models during training, when comparing the Learning Jitter of models that have been trained on training datasets with only 1 indicator removed. However, when the CNN model is trained using the training dataset with all Momentum-related indicators removed, the model has the most Learning Jitter and the highest Average Jitter Percentage deviation amongst all the models trained, meaning that without Momentum-related Indicators in the training dataset, the accuracy improvement of the CNN models fluctuates more and that the fluctuations of the accuracies are larger than that of the models trained with training data of other variations.

Conclusion

From the experiments conducted in the second phase of the project, we can conclude that for CNN models, Momentum-Related indicators used in the training dataset have more significant impact towards overcoming of the difficulty of learning of the stock trading action prediction task for CNN models and that the presence of Moving Averages indicators, as well as Closing Prices data in the training data, are less impactful towards the learning of the stock trading action prediction task for CNN models. The CNN model that performed best in the experiments performed, in terms of the Learning Rate of Model Accuracy, is the model trained using only Momentum-related indicators. As for the Learning Jitter metric, we can observe that the results obtained from the experiments conducted were not very conclusive, with little deviation in the Learning Jitter of models trained with training data of different data variation.

3.4.2 Results of LSTM Models

Validation Loss & Accuracies

Indicator Removed	Validation Loss	Validation Accuracy
Original Indicators	1.4976	0.76358
Remove Close Price	1.52348	0.78035
Remove CCI	1.49656	0.76358
Remove CMO	1.51632	0.76997
Remove DMI	1.50752	0.7492
Remove EMA	1.54567	0.77396
Remove KAMA	1.60793	0.76438
Remove Momentum	1.5195	0.78195
Remove ROC	1.49869	0.78275
Remove RSI	1.50511	0.77316
Remove SMA	1.51581	0.78355
Remove Stochastic	1.46233	0.78355
Remove TEMA	1.54403	0.76757
Remove WILLR	1.51601	0.77077
Remove WMA	1.52499	0.77716
Remove Moving Averages	1.4855	0.77476
Remove Momentum Indicators	1.49728	0.76518
Remove all except Momentum Indicators	1.47925	0.76038

Table 3-5 LSTM Models Results for Validation Loss & Accuracies

For the LSTM models that were trained with the various training datasets of different variations, the variation in validation accuracies and validation losses of the models were not very conclusive for models trained with only a single technical indicator removed from the training dataset, with the validation accuracies and validation losses of the models not really differing that much from one another. Even when experiments were conducted with all the technical indicators from one of the two main categories of indicators, namely, technical indicators that are Moving Averages indicators, and technical indicators that are Momentum-related indicators, removed from the training dataset, to train two additional models, the results were fairly similar to those of the models with only one indicator removed. Most of the models have validation accuracies of around 74% - 78% and validation loss around 1.4 – 1.6.

Learning Rate for Model Accuracy

Indicator Removed	Accuracy Learning Rate (percent per epoch)	Accuracy Learning Rate (percent per epoch) with respect to final Accuracy	Rank
Original Indicators	0.10542	0.080496604	8
Remove Close Price	0.10358	0.080828653	6
Remove CCI	0.10097	0.077098673	14
Remove CMO	0.10042	0.077320387	13
Remove DMI	0.12103	0.090675676	1
Remove EMA	0.10554	0.081683738	5
Remove KAMA	0.09549	0.072990646	17
Remove Momentum	0.1006	0.07866417	12
Remove ROC	0.09541	0.074682178	16
Remove RSI	0.11036	0.085325938	4
Remove SMA	0.09615	0.075338333	15
Remove Stochastic	0.11061	0.086668466	2
Remove TEMA	0.09358	0.071829201	18
Remove WILLR	0.11135	0.08582524	3
Remove WMA	0.10176	0.079083802	10
Remove Moving Averages	0.10205	0.079064258	11
Remove Momentum Indicators	0.10557	0.080780053	7
Remove all except Momentum Indicators	0.10485	0.079725843	9

Table 3-6 LSTM Models Results for Learning Rate

We also found out from the experiments, that for LSTM models, the experiments results on the Learning Rate of Model Accuracy are not as conclusive as the results for the CNN models results. From the results obtained, we are not able to determine which technical indicator in the training data has a more significant impact towards the overcoming of the difficulty of learning of the stock trading action prediction task, or if Momentum-related indicators or Moving Average indicators have more significant impact towards the overcoming of the difficulty of learning of the stock trading action prediction task. From the results, there is no clear indication that Momentum-related indicators or Moving Average indicators have a more significant impact towards the overcoming of the difficulty of learning for LSTM models, with the model trained with Moving Average indicators removed from the training dataset, and the model trained with Momentum-related indicators removed from the training dataset, both having average performance amongst all the models trained, without having performance greatly affected with the absence of any of the 2 groups of technical indicators.

Learning Jitter

LSTM				
Indicator Removed	Model accuracy learning jitter (%)	Accuracy average jitter percentage (%)	Model Loss learning jitter (%)	Loss average jitter percentage (%)
Original Indicators	48.012	2.41765	49.541	1.9364
Remove Close Price	49.235	2.78206	49.134	2.30154
Remove CCI	48.828	2.37728	49.032	2.24329
Remove CMO	48.216	2.11975	48.828	1.89394
Remove DMI	48.726	3.12087	49.439	2.37727
Remove EMA	48.726	2.77536	50.866	2.3398
Remove KAMA	48.624	2.53129	50.968	2.14352
Remove Momentum	47.299	2.37622	49.439	1.89156
Remove ROC	47.503	2.53073	50.663	2.17271
Remove RSI	47.503	2.29227	48.522	2.12641
Remove SMA	49.541	2.92115	50.357	2.39904
Remove Stochastic	47.91	2.95169	49.643	2.44648
Remove TEMA	49.032	2.96871	51.682	2.38451
Remove WILLR	47.91	2.69361	47.706	2.42338
Remove WMA	48.828	2.8643	48.726	2.39212
Remove Moving Averages	49.541	2.02332	51.07	1.90937
Remove Momentum Indicators	47.401	2.41469	49.439	1.98942
Remove all except mom Indicators	48.42	2.3387	49.847	2.36579

Table 3-7 LSTM Models Results for Learning Jitter

The effects of removing technical indicators from the training dataset towards the Learning Jitter of the LSTM models during training are also not very conclusive, based on the results obtained from the experiments, similar to that of the CNN models. However, removing Moving Average related indicators did resulted in more Learning Jitter generally as compared to removing Momentum-related indicators from the training dataset for the LSTM models.

Conclusion

Therefore, based on the observations of the experiments results, the impact of the variance of technical indicators used in the training dataset towards the learning difficulty of Deep Learning Models in LSTM models was less conclusive, as compared to that of CNN models. From the experiments, we were unable to determine which technical indicators, when used in the training dataset used to train the LSTM models, are more significant towards overcoming the difficulty of learning for LSTM models. In addition, the LSTM model with the best Learning Rate for Model Accuracy is the model trained with the training dataset with all the technical indicators included.

3.5 Overall Conclusions for Experiments Conducted in Second Phase of Project

From the results of the experiments conducted for the second phase of the Final Year Project, we were able to observe that the impact of the absence or presence of certain technical indicators used in the training dataset for the Deep Learning models toward the learning difficulty of these models, is more apparent in CNN models as compared to LSTM models.

Also, from the results, we were able to conclude that for CNN models, the presence of Momentum-Related indicators in the training data, such as RSI (Relative Strength Index) and WILLR (Williams %R) indicators etc., have a more significant impact towards the overcoming of the difficulty of learning of the stock trading action prediction task for CNN models, as compared to the presence of Moving Averages indicators and Closing Prices data.

Lastly, from the results of experiments conducted on both the CNN and LSTM models, we were able to observe that the use of Learning Jitter as a metric to determine the impact of the removal of technical indicators from the training data towards the learning difficulty of Deep Learning Models was not very useful, and we were not able to obtain much insight from the Learning Jitter evaluation metric of the Deep Learning models. The existence of Learning Jitter could be due to other factors when training the Deep Learning models, but it is not strongly co-related to the presence or absence of various technical indicators in the training dataset used to train the models.

4 Experiments on the Effects of Data Variance on the Difficulty of Learning for Deep Learning models

4.1 Objectives of Experimental Investigation Conducted for Third Phase of Project

As earlier stated, although past research have tackled a myriad of Fintech related tasks using Deep Learning models, many of these research solve these Fintech tasks by letting the Deep Learning models learn from a large amount of training data, without fully understanding the underlying data that is used to train these models from a financial perspective. Most research also do not take into consideration if the data that is used to train the models fully captured the various variations and economic trends necessary for the Deep Learning models to learn the Fintech tasks and to be able to generalize better and make more accurate predictions.

One such Fintech task that has been widely studied, is the task of stock market prediction. From the work done in past research papers, we were not able to determine if the training data that was used in the research to train the Deep Learning models actually allowed them to learn the stock market prediction task effectively, or if the training data used for those research captured the various variations and economic trends present in stocks.

Moreover, minimal work has been done to study how variations present in the training data used to train the Deep Learning models, affect the ability of the these models to learn the stock market prediction task, as well as if the introduction of specific variations to the training data(based on domain knowledge of stock trends and factors affecting stock prices) used to train the Deep Learning models, will allow them to be able to better learn and make predictions on stocks with certain characteristics(bullish stocks, small-cap stocks etc.).

Therefore, there is a need to determine how different variations introduced to the training data of the Deep Learning models affects the learning ability of the Deep Learning models, or in other words, how different variations introduced to the training data of the Deep Learning models affects the difficulty of learning of these models when learning the task of stock market prediction.

From the experiments conducted in the second phase of the project, we were able to observe that variations made to the training data used to train the Deep Learning models(CNN and LSTM models), does affect the performance of the models, as well as their ability to overcome the difficulty of learning during training. Therefore, in the third phase of the project, we proceeded to conduct further experiments on the impact of data variance introduced to the training data, towards the learning difficulty of Deep Learning Models for the task of stock trading action prediction.

From the experiments conducted in the second phase of the project, specifically with regards to the impact of the removal of stock technical indicators from the training data towards the difficulty of learning for Deep Learning models, we have conclude that the impact towards the learning difficulty is more apparent in CNN models as compared to LSTM models. We have also concluded that for CNN models, Momentum-Related indicators have a more significant impact towards overcoming of the difficulty of learning for the task of stock trading action, as compared to Moving Averages indicators and Closing Prices data.

However, although the experiments conducted in the second phase of the project enabled us to better understand the impact of the absence or presence of various technical indicators from the training data, towards the learning ability of Deep Learning models, the experiments did not take into consideration if the data that is used to train the models fully captured the various variations and economic trends necessary for the Deep Learning models to learn the task of stock trading action prediction, in order to be able to generalize better and make more accurate predictions. Also, the variations introduced to the experiments were from only one aspect, which is the variation of the technical indicators used as input data to the models.

Therefore, for the third phase of the Final Year Project, we conducted an experimental investigation on the effects of introducing different variations to the training data used to train Deep Learning models(CNN and LSTM models), towards the ability of these models to learn the task of stock trading action prediction. The variations introduced to the training data, should be carried out in a way that will allow us to better understand how various variations present in the training data, used for stock trading action prediction, affect the ability of Deep Learning models to learn the task of stock trading action prediction. The variations introduced to the training data should also take into consideration stock market specific factors likely to affect stock prices and movement(stock market cycles, ripple effect of changes in stock price for stocks belonging to the same business sector etc.).

4.2 Experimental Set Up for Experiments on Impact of Data Variance Towards the Learning Difficulty of Deep Learning Models for the Task of Stock Trading Action Prediction

4.2.1 Deep Learning Models Used

For the experiments conducted on the impact of data variance towards the difficulty of learning for Deep Learning models for the task of stock trading action prediction, the two types of Deep Learning models used are, the 2D (two-dimensional) CNN, as well as LSTM models.

The reason for conducting the experiments on both 2D (two-dimensional) CNN, and LSTM models is to ensure the consistency and continuity of the work done in the previously carried out experiments for the Final Year Project. In addition, another reason for utilizing these two particular Deep Learning architectures for the task of stock trading action prediction, is due to the fact that these two architectures have been widely used in past research on stock trading action prediction and have shown potential in solving this task.

However, for the experiments conducted in the third phase of the project, we adjusted some of the parameters of the CNN and LSTM models to fit the need of the experiments to be conducted in this phase of the project, as well as to slightly increase the performance of the models.

For the two-dimensional CNN model, the model now has the following parameters:

- **Layer 1**: Convolutional Layer (16 Filter, 3x3 kernel)
- **Layer 2**: MaxPooling Layer (2x2)
- **Layer 4**: Convolutional Layer (32 Filter, 3x3 kernel)
- **Layer 2**: MaxPooling Layer (2x2)
- **Layer 8**: Flatten Layer
- **Layer 9**: Dense Layer (64 neurons, activation='relu')
- **Layer 11**: Dropout Layer (0.25 dropout rate)
- **Layer 9**: Dense Layer (32 neurons, activation='relu')
- **Layer 11**: Dropout Layer (0.25 dropout rate)
- **Layer 12**: Output Dense Layer (3 neurons, activation='softmax')

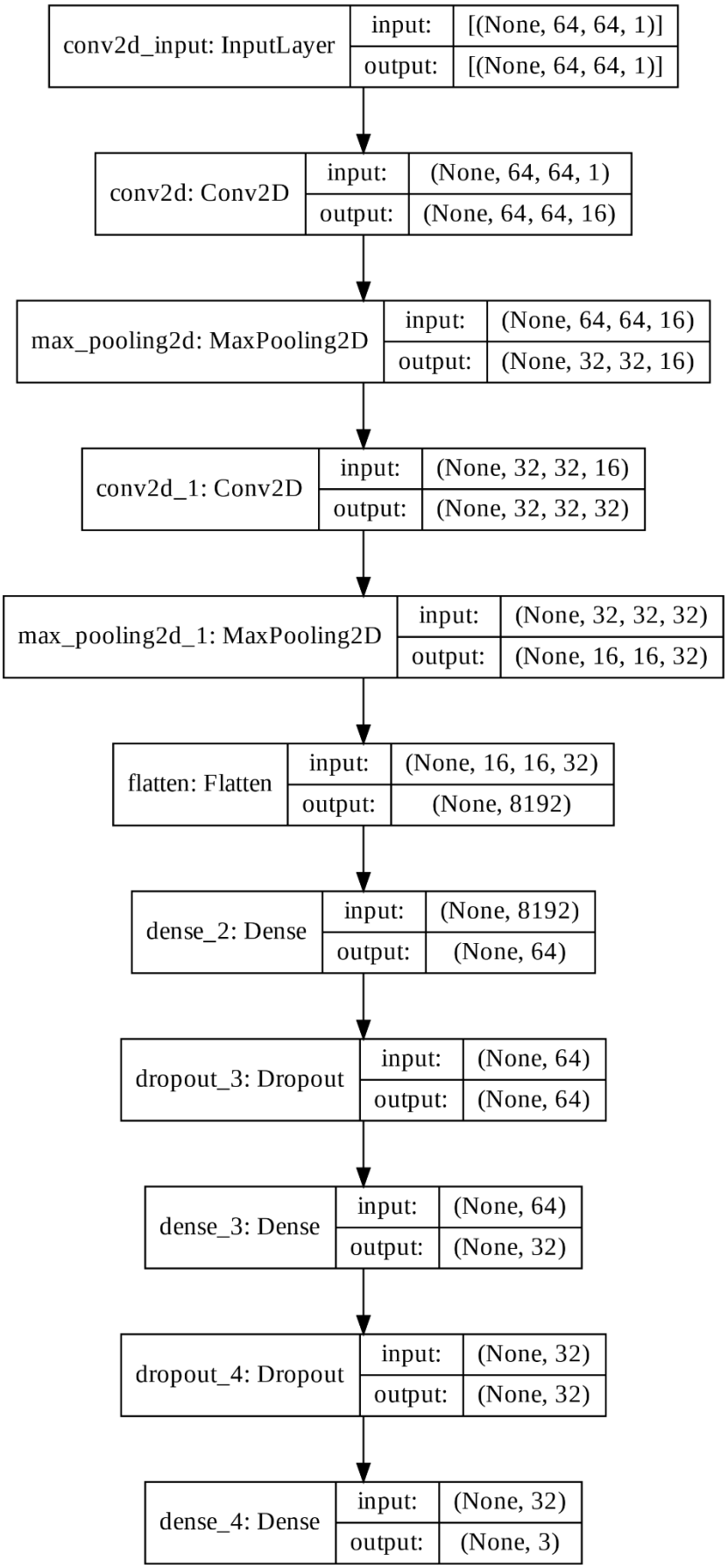


Figure 4-1 CNN Model Architecture

For the LSTM model, the model now has the following parameters:

- **Layer 1**: LSTM Layer (100 neurons, activation='relu')
- **Layer 3**: Batch Normalization Layer
- **Layer 4**: LSTM Layer (100 neurons, activation='relu')
- **Layer 6**: Batch Normalization Layer
- **Layer 7**: Dense Layer (75 neurons, activation='relu')
- **Layer 8**: Dense Layer (50 neurons, activation='relu')
- **Layer 9**: Output Dense Layer (3 neurons, activation='softmax')

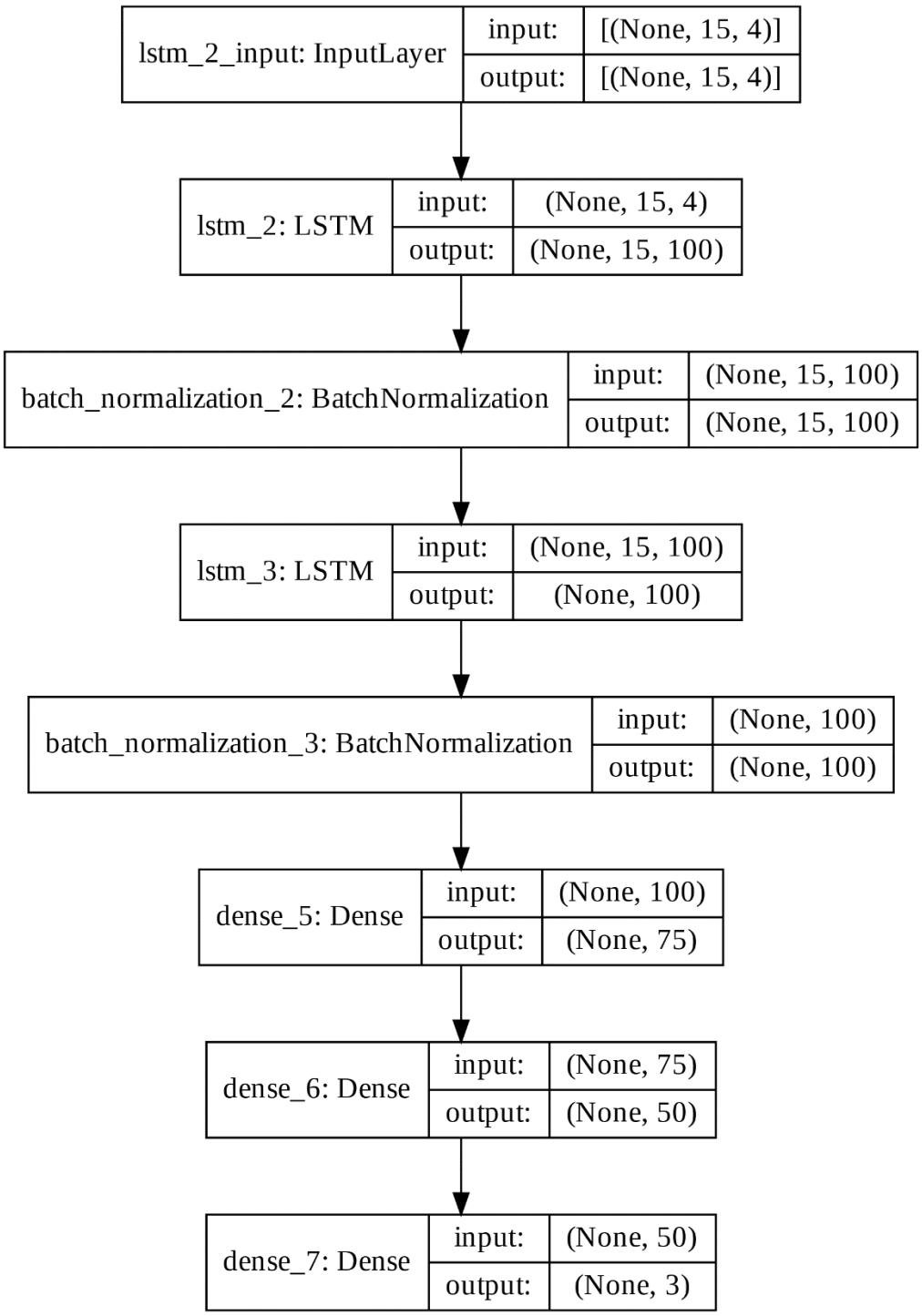


Figure 4-2 LSTM Model Architecture

For the experiments conducted for the third phase of the project, all models were trained for 200 epochs, using the Adam optimizer, at a learning rate of 1e-4.

4.2.2 Variations to be Introduced to Training Data for Experimental Investigation

As earlier stated, the objective of the experiments conducted in the third phase of the Final Year Project is to introduce different variations to the training data used to train Deep Learning models for the task of stock market prediction, in order to determine the effects of variations present in the training data on the difficulty of learning for these models.

The variations introduced should help us better understand how these variations affect the ability of Deep Learning models to learn the task of stock trading action prediction. In addition, the variations introduced to the training data should also take into consideration stock market specific characteristics that may be present in stock data, such as stock market cycles, or the ripple effect of one company's stock price on the stock prices of other companies belonging to the same business sector.

With these considerations in mind, we came up with 6 specific sets of variations to introduce to the training data used to train the Deep Learning models for the task of stock market prediction, in order to determine the effects of these variations in the training data on the difficulty of learning for these models. We would also like to investigate if introducing specific variations to the training data used to train the Deep Learning models, allows them to be able to better learn and make predictions on stocks with certain characteristics(bullish stocks, small-cap stocks etc.).

Variation 1 - Varying the Method Input Data is Presented to Deep Neural Networks

For our experiments, the first variation that we have introduced to the Deep Neural Networks, is the variation of the form in which the training data presented to them. In another words, we varied the dimensionality and presentation of the training data to the two Deep Learning models, in order to observe if the two Deep Learning models are able to better overcome the difficulty of learning the task of stock trading action prediction for one form of data input, when compared to another.

As previously stated, LSTM models are proficient at solving time-series related prediction tasks and CNN models are apt at processing spatial information and are proficient at solving image related prediction tasks. However, with that being said, there has been research done in the past where LSTM models have been used for at solving image related prediction tasks[7], and CNN models have been utilized in solving time-series related prediction tasks[8].

For the task of stock trading action prediction, instead of using 15 different stock technical indicators like the experiments conducted previously in the first and second phase of the project, we will only be using 4 technical stock indicators, from the past 15 days as the input data to predict the stock trading action to be performed for the current trading day. The reason for doing so is because the 4 technical indicators selected for use, are sufficient enough for tracking the different characteristics of stock data, with the WILLR(Williams Percent Range) indicator tracking the stock's momentum, Closing Price indicator tracking the changes in Closing Prices of the stock, EMA(Exponential Moving Average) indicator tracking the moving average of the Stock, and OBV(On-Balance Volume) indicator tracking the volume changes of the Stock.

Having established the stock technical indicators to be used as the training data, we then established the two methods of presenting the information of the training data to the two Deep Learning models.

The first method of presenting the training data information to the two Deep Learning models is to present the training data of the 4 technical indicators as an image of graph plots, of the past 15 trading days, where each graph corresponds to a particular technical indicator, to the Deep Learning models. The images will then be converted into numpy arrays and fed to the models, just like how images are

usually fed for image classification to Deep Learning models. The second method is to present the training data of the 4 technical indicators with a lookback period of the past 15 trading days, as a time-series array where the array will have a shape of 15x4, of 15 time-steps and 4 technical indicators for each time-step.

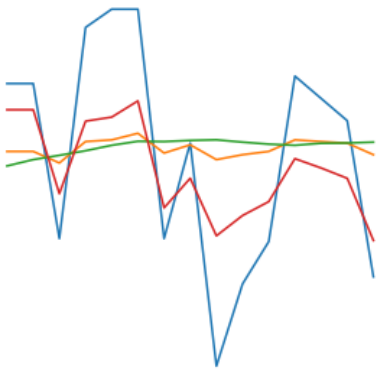
Method 1	Method 2
 **Image of technical indicators graphs** ⬇ array([[225.9045, 225.9045, 225.9045, ..., 225.9045, 225.9045, 225.9045], [225.9045, 225.9045, 225.9045, ..., 225.9045, 225.9045, 225.9045], [225.9045, 225.9045, 225.9045, ..., 225.9045, 225.9045, 225.9045], ..., [225.9045, 225.9045, 225.9045, ..., 225.9045, 225.9045, 225.9045], [225.9045, 225.9045, 225.9045, ..., 225.9045, 225.9045, 225.9045], [225.9045, 225.9045, 225.9045, ..., 225.9045, 225.9045, 225.9045]]) **Numpy Array Of Image**	array([[[0.81481487, 0.60958366, 0.74959619, 0.64575649], [0.81481487, 0.62529459, 0.74959619, 0.64575649], [0.42857117, 0.63600658, 0.54050985, 0.61705617], [0.95454526, 0.64743269, 0.72105651, 0.67035667], [1. , 0.66100121, 0.7311434 , 0.67445673], [1. , 0.67099906, 0.7714852 , 0.69085688], [0.42857156, 0.67028493, 0.50518066, 0.64165643], [0.66666697, 0.67314146, 0.57895141, 0.66215664], [0.11111158, 0.67456973, 0.43556846, 0.62525628], [0.31578974, 0.66885667, 0.48611108, 0.63755637], [0.42105332, 0.66385775, 0.52069047, 0.64575649], [0.8333328 , 0.66100122, 0.62766235, 0.67445673], [0.77777707, 0.66600014, 0.60449031, 0.67035667], [0.7222224 , 0.66671428, 0.57875002, 0.66625669], [0.33333333, 0.66885667, 0.42397181, 0.63755637]]]) **Time-series array of technical indicators**

Table 4-1 Methods of Presenting Training Data to Deep Learning Models

The reason behind varying the way information from the input data is presented to the two Deep Learning model is to help deepen our understanding of how the way information from the training data is presented to the Deep Learning models affects the ability of the models to learn the training data.

The hypothesis behind this variation experiment is that LSTM and CNN models emulates different cognitive functions of the human brain, and the way information from the training data is presented to the two Deep Learning models may affect the difficulty of the models in the learning of the stock trading action prediction task. For example, as CNN models emulate the visual cortex of the human brain, training data presented in the form of Method 1 may be akin to a human trader looking at graphs of technical indicators for past trading days, and input data presented in the form of Method 2 may be akin to a human trader looking at a spreadsheet of the technical indicators for past trading days, and that these two methods of presenting the input data to the CNN model may stimulate the model differently just like how different images may provide different visual stimulation to the visual cortex.

Variation 2 - Varying the Duration of the Input Data Presented to Deep Neural Networks

The second variation that we have introduced to the training data, is the variation of the number of past trading days to be used as the lookback period for the training data of the 4 technical indicators, used to train the Deep Learning models. In the first variation experiment using the **Variation 1** variations, the input data consisted of data points from the past 15 trading days, looked back from the day we are making the stock trading action prediction on, for the 4 technical indicators. Therefore, the lookback period of 15 past trading days will act as the control for our **Variation 2** experiments. We will then vary the number of past trading days to be used as the lookback period for the 4 technical

indicators for use as input data. The number of days used as lookback period for this set of experiments are, 5, 10, 15, 20, and 25 days.

Also, from the experiments conducted using the **Variation 1** variations, we were able to determine for each Deep Learning architecture (LSTM and 2D CNN architecture), the method of presenting training data to the models that will best allow them to overcome the difficulty of learning the data during training. Therefore, for the **Variation 2** experiments, when we were training the models, the method in which the training data was presented to the two different Deep Learning architectures, was the better of the two methods of presenting training data determined from the **Variation 1** experiments, for each of the two different Deep Learning architectures. This was to ensure that the way information is presented from the training data to the two different Deep Learning architectures will be the optimal for each of them, to ensure that the difficulty in learning of the stock trading action prediction task in the **Variation 2** experiments is only affected by the variation of the number of the past trading days to be used as the lookback period for the 4 technical indicators to be used as input data.

The reason behind introducing this variation to the training data is to determine whether it is more difficult for the two Deep Learning models to learn and generalize the task of stock trading action prediction with more trading days' worth of lookback data, or with less trading days' worth of lookback data.

The hypothesis behind introducing this variation to the training data used to train the Deep Learning models is that the number of days used as the lookback period for the time series data, may affect the Deep Learning models' ability to identify the cycle and the trend of the stock, for it to accurately make stock trading action predictions. Having too little number of days used as the lookback period may cause the cycles and the trends of the stock to not be captured by the training sample, and too many number of days used as the lookback period may result in the Deep Learning models to be less sensitive to the cycles and the trends of the stock, as more than one cycle might be captured in the data. The figures below give an example of how the stock data will look like for different number of days used as lookback.

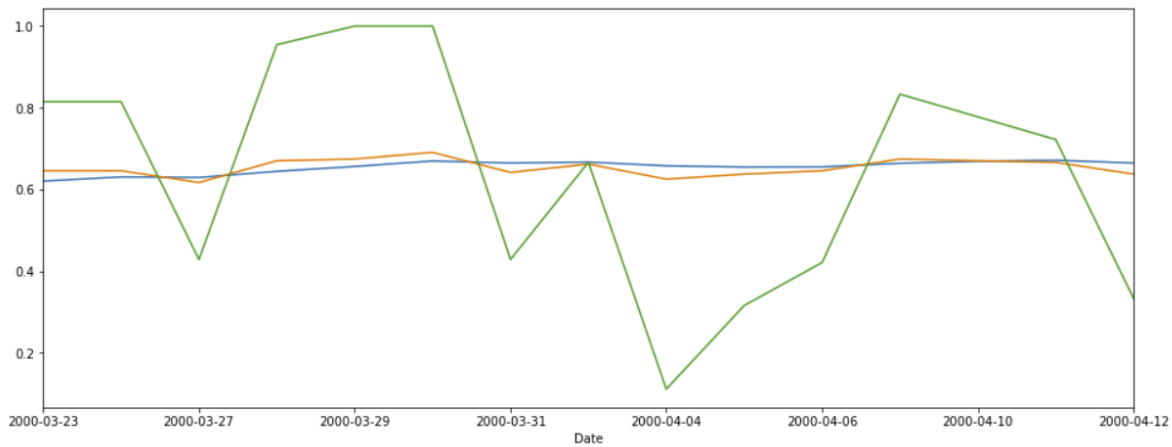


Figure 4-3 EMA, Closing Price and WILLR data using 15 days Lookback Period

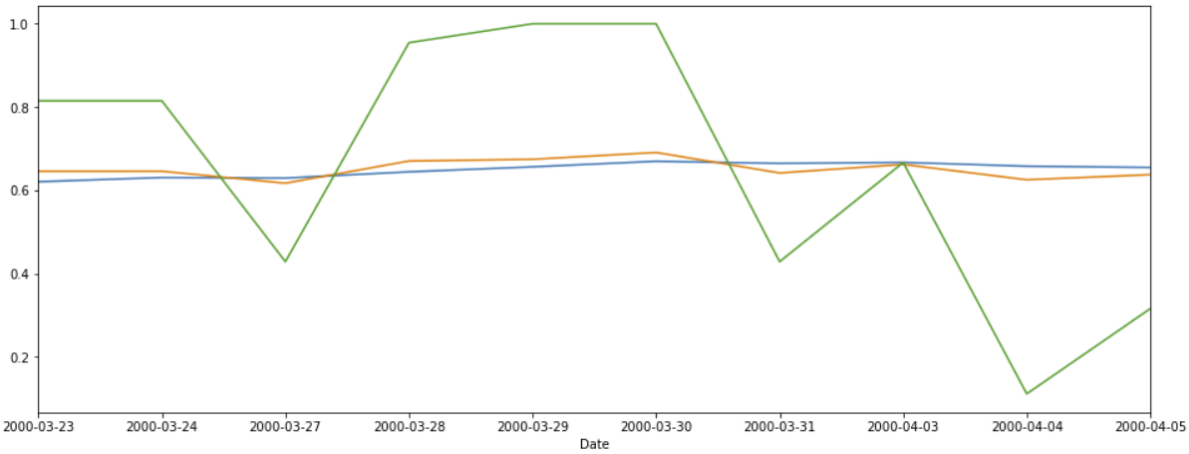


Figure 4-4 EMA, Closing Price and WILLR data using 10 days Lookback Period

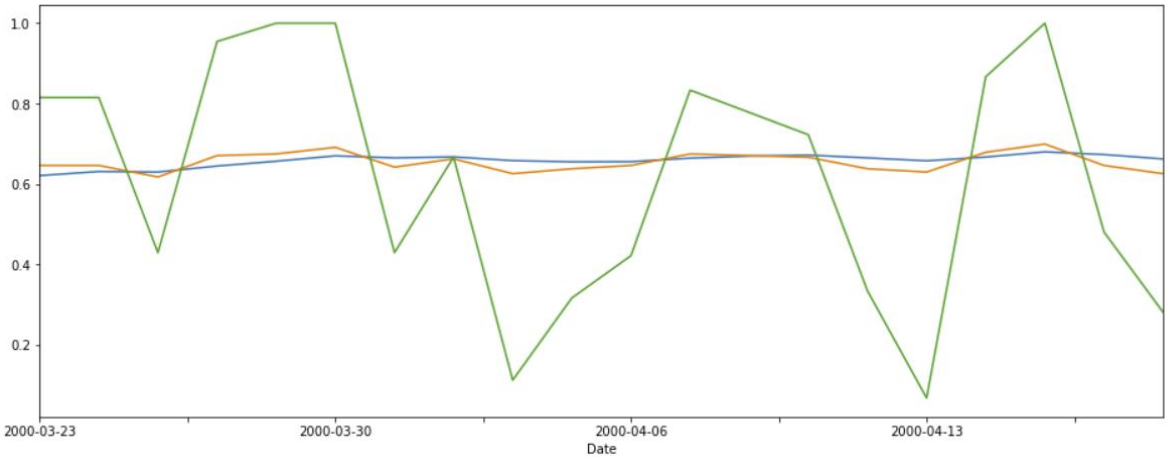


Figure 4-5 EMA, Closing Price and WILLR data using 20 days Lookback Period

The experiments conducted using **Variation 2** on the training data, will hopefully deepen our understanding of how the number of time-steps, or lookback period, for time-series data, affects the ability of Deep Learning models to identify stock trading cycles in the input data sequences and make accurate stock trading action predictions from them.

<u>Variation 3 - Varying the Ratio of Training Data Samples for Each Class</u>

The third variation that we have introduced to the training data used to train the Deep Learning models, is the variation of the ratio of the number of training data samples to be used for each class label of the stock trading action prediction task. For the task of the stock trading action prediction, the output labels are stock trading action labels which represent different trading actions to be performed, for a style of trading that attempts to capture short- to medium-term gains in a stock over a period of a few days to several weeks, known as Swing Trading. Due to the fact that in Swing Trading, stock positions are often held for a range of a few days to several weeks, there will be more “hold” stock trading actions as compared to “buy” and “sell” stock trading actions, in order to maximize the difference in the price the stock is bought at, and the price the stock is sold at, to ensure the most profit gained from the stock trades. Therefore, when we label the training data to be used for the experiments conducted for our Final Year Project, there will be more training samples for “hold” class labels in the training data as compared to “buy” and “sell” class labels, in other words the training data consists of imbalanced classes.

For the various experiments conducted for the Final Year Project, we utilized 20 years of daily stock trading data, to be used as the training input data for our Deep Learning models. The training data's Classes Ratio is as follows:

```
Total: 5020

Sell: 224 (4.46% of total)

Buy: 209 (4.16% of total)

Hold: 4587 (91.37% of total)
```

Figure 4-6 Breakdown of the Number of Training Data Rows for Each Class

From the figure above, we can observe that the data consisted of mainly training samples for the "hold" class label. For the experiments that we have conducted earlier in the second phase of the project, with this given training data's classes ratio, we were able to achieve a decent validation accuracies between 76% to 84% after training the models. However, of the correctly predicted labels, most of them came from the "hold" class, meaning that the trained Deep Learning models are capable of predicting "hold" class labels with high accuracy rates, but not the case for "buy" and "sell" class labels, even when we utilized class weights in the previous experiments conducted, to allow the models to take into account the skewed distribution of the classes, when training the models.

```
number of predictions: 1004
actual predicted buys: 6
actual buys but predicted sell: 0
actual buys but predicted hold: 37
actual sells but predicted buy: 0
actual predicted sells: 5
actual sells but predicted hold: 46
actual holds but predicted buy: 67
actual holds but predicted sell: 68
actual predicted holds: 775
Percentage buys correct: 13.953488372093023%
Percentage sells correct: 9.803921568627452%
Percentage holds correct: 85.16483516483517%
actual buys: 43
actual sells: 51
actual holds: 910
```

Figure 4-7 The Percentage of Correct Predictions for Each of the Classes

However, although the models are not able to predict the "buy" and "sell" labels with great accuracy, the predicted "buy" and "sell" points for the Stock are generally correct, meaning that the predicted "buy" points occur when the stock prices are low and the predicted "sell" points occur when the stock prices are high.

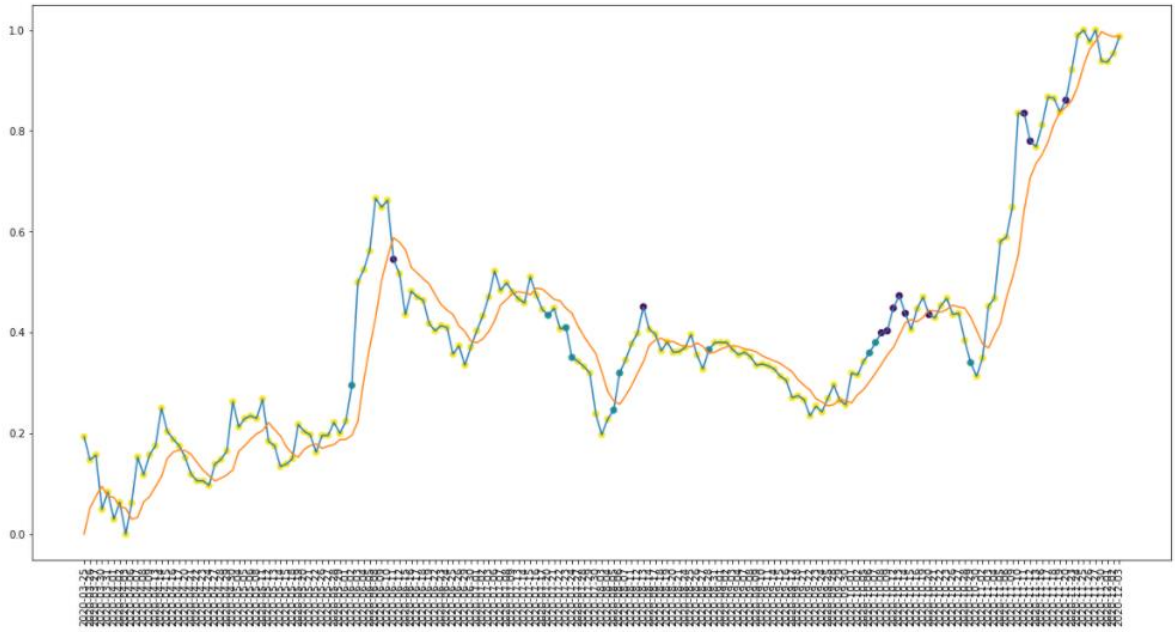


Figure 4-8 Line Graph showing the Closing Prices for a Stock with Coloured Points along it Showing the Predicted Class Labels

As seen from the figure above, the blue-coloured line graph plotting the stock prices, the yellow points are the predicted "hold" labels, the purple points are the predicted "sell" labels, and the blue points are the predicted "buy" labels. We can observe that the blue points occur when the stock prices are low and "sell" points occur when the prices are generally high. We can also observe that majority of the predicted points are "hold" labels, with very little predicted "buy" and "sell" class labels.

Therefore, for the third variation introduced to the training data used to train the Deep Learning models, we would like to observe, and explore if changes to the ratio of the amount of training data samples for each of the class labels in the training dataset, affects the difficulty in learning of the stock trading action prediction task for our Deep Learning models.

For the experiments on **Variation 3**, we will study the effect of 7 different ratio of amount of training data for each class label on the difficulty in learning of the stock trading action prediction task for our Deep Learning models. The 7 different variation ratios are:

- An equal ratio of training data samples for each class label
- A ratio of training data that contains 25 percent more training samples for the "buy" class labels, as compared to the 2 other classes
- A ratio of training data that contains 50 percent more training samples for the "buy" class labels, as compared to the 2 other classes
- A ratio of training data that contains 25 percent more training samples for the "sell" class labels, as compared to the 2 other classes

- A ratio of training data that contains 50 percent more training samples for the “sell” class labels, as compared to the 2 other classes
- A ratio of training data that contains 25 percent more training samples for the “hold” class labels, as compared to the 2 other classes
- A ratio of training data that contains 50 percent more training samples for the “hold” class labels, as compared to the 2 other classes

The reason behind introducing this variation to the training data used to train the Deep Learning models for the task of stock trading action prediction, is due to the occurrences from previous experiments in the first and second phase of the project, we were able to observe that the Deep Learning models are able to predict the “hold” class labels, for the task of stock trading action prediction, with high accuracy due to the fact that the training data consist mainly of data samples from the “hold” class.

Therefore, with that observation, we hypothesize that we should be able to achieve higher prediction accuracies for the other classes if we were to increase the ratio of their data in the training dataset. We also will have a training dataset containing an equal ratio of data for each of the classes which should hypothetically produce trained Deep Learning models that are able to predict each class with the same level of accuracy for each class.

<u>Variation 4 - Varying the Phases of Stock Cycle used for the Training Dataset</u>

In the stock market, stocks can be classified into 2 broad categories, namely, cyclical stocks and non-cyclical stocks. Cyclical stocks and their underlying companies have a direct relationship to the economy, while non-cyclical stocks repeatedly outperform the market even when economic growth slows. Usually, companies of cyclical stocks sell goods and services that many buy when the economy is doing well but cut during downturns, and non-cyclical companies sell goods household non-durable goods like soap and toothpaste which are still essential during downturns.

Therefore, for cyclic stocks, if one is able to recognize the stock cycles, he will be able to make profitable trades without falling victim to the changing phases of the stock. Typically, a cyclic stock will have a stock cycle consisting of 4 phases, Accumulation phase, Mark-Up phase, Distribution phase, and Mark-Down phase.

Figure 4-9 Figure Showing Different Stock Cycle Phases

In the previous experiments that we have conducted, the training data for each stock used to train the models, consisted of stock data from the past 20 years of trading days. Meaning the training datasets most probably contain a number of stock cycles within them. Therefore, since the Deep Learning models were trained with training datasets that most probably contains a number of stock cycles within them, we were not able to fully understand if the presence of stock cycles within training data affects the difficulty of learning of Deep Learning models when learning the training data for the task of stock trading action prediction. Also, we do not know that if we were to only use data from a certain phase of a stock cycle to build a training dataset to train the Deep Learning models, will they perform better when tested on making predictions on stock trading action, for a test dataset built using data only from the same phase of a stock cycle.

Therefore, for experiments to be conducted using **Variation 4**, we would like to introduce variations to the training dataset, so that we are able capture the effect of stock cycles on the difficulty of learning of Deep Learning models, for the task of stock trading action prediction. The variations suggested are as follows:

- The training dataset will only consist of data samples from one of the four phases of the stock cycle (meaning for this variation, there will be 4 unique training datasets where one set will consist of stock trading data only from the accumulation phase, one set will consist of stock trading data only from the Mark-Up phase etc.)
- The training dataset will only consist of data from the "bullish" part of the stock cycle (training datasets will only contain data from Accumulation, Mark-Up phases of the stock cycle)
- The training dataset will only consist of data from the "bearish" part of the stock cycle (training datasets will only contain data from Distribution, Mark-Down phase of the stock cycle)
- The training dataset will consist of data from one full stock cycle

We will then test each of the various trained models, trained using the different training dataset variants, on test datasets built using the same variations introduced in the training datasets, as well as test datasets built with the other variations. This will allow us to observe if a model trained with a training dataset built using stock data from only one particular stock cycle phase is able to achieve high prediction accuracies for making predictions on the test dataset built using stock data only from the same stock cycle phase, as well as how well will the model perform when making predictions on test datasets built with data from other phases of the stock cycle. This will allow us to then conclude if phases present within the stock cycle affect the difficulty of learning of Deep Learning models for the task stock trading action prediction.

Variation 5 – Introducing Supporting Price Data from another Stock from Same Business Sector

In stock markets, stock trends of stocks in the same business sector usually "follow" each other. In other words, usually the stock price trend of one stock in a particular business sector will follow the stock price trend of stocks from the same sector.

Therefore, the next variation we introduced to the training data used to train the Deep Learning models for the task of stock trading action prediction, is the inclusion of the stock price data of

another stock from the same business sector to the training dataset, in addition to the data of the original four technical indicators of the particular stock being used to train the Deep Learning models, when training the Deep Learning models on a particular stock's data. For this set of variation experiments, we will first use only the data of the original four stock technical indicators, from stocks that are not the market leaders of that business sectors, to build the control training datasets to train the Deep Learning models. After which, we will produce another set of training datasets where in addition to the data of the original four stock technical indicators of the stocks used for the control training datasets, we include the stock prices data of the market leader of that business sector, for each training dataset. These two sets of training datasets will then be used to train the Deep Learning models.

The reason behind introducing this variation, to the training dataset used to train the Deep Learning models, is to observe if the inclusion of stock price data of the market leader stock in the same business sector, to the training data of the stock we are using to train the Deep Learning models, will aid the Deep Learning models in terms of the difficulty of learning the task of stock trading action prediction. The hypothesis behind the introduction of **Variation 5** is that, usually, when the stock price of the market leader of a particular business sector changes in a certain direction, the sentiments of investors towards the other stocks in the same business sector will change accordingly, which will then affect the stock prices of other stocks in the same business sector, therefore, in theory, the introduction of stock price data of the stock of the market leader of a particular business sector to the training data of the Deep Learning models will allow them to better learn the trend of the stock used for training the models, which will help overcome the difficulty of learning.

Variation 6 – Varying the Category of Market Capitalization of Stocks Used to Train the Deep Learning Models

The next variation that we have introduced to the training data used to train the Deep Learning models, is the variation of the category of Market Capitalization of the stocks to be used to train the Deep Learning models.

Market capitalization refers to the total dollar market value of a company's outstanding shares of stock. Commonly referred to as "market cap," it is calculated by multiplying the total number of a company's outstanding shares by the current market price of one share. Large-cap, or big-cap, companies typically have a market capitalization of $10 billion or more. These large companies have usually been around for a long time, and they are major players in well-established industries. Mid-cap companies generally have a market capitalization of between $2 billion and $10 billion. Mid-cap companies are established companies that operate in an industry expected to experience rapid growth. Companies that have a market capitalization of between $300 million to $2 billion are generally classified as small-cap companies. These small companies could be young in age and/or they could serve niche markets and new industries. These companies are considered higher risk investments due to their age, the markets they serve, and their size. Smaller companies with fewer resources are more sensitive to economic slowdowns. As a result, small-cap share prices tend to be more volatile and less liquid than more mature and larger companies.

Therefore, for the experiments conducted on the **Variation 6** variation, we used the stock data of stocks from each of the 3 different Market Capitalization categories, for different business sectors and used them to train different Deep Learning models, where each model will learn from the training data from a stock of a particular market cap and business sector.

With the trained models, we can then obtain the test performance of these models, when tested against the test datasets, and from there, we can observe if the type of Market Capitalization of the underlying stocks used for the building the training datasets used to train the Deep Learning models, affect their

performance in stock trading action prediction, or in other words their ability to learning the stock trading action prediction task.

The hypothesis behind the introduction of this variation, to the training data used to train the Deep Learning model, is that since the trend of stock prices for companies of different Market Capitalization behave differently, based on the domain knowledge of stock markets, the stock trends of stocks from different Market Capitalization are different, and Deep Learning models trained with stock data of different Market Capitalization may be able to identify stock trends differently, which may affect their ability to make stock trading action predictions. For example, small-cap share prices tend to be more volatile and less liquid which causes the stock trends to have more fluctuations, and large-cap share prices tend to be more stable which causes the stock trends to have less fluctuations, and Deep Learning models trained using the stock data of small-cap stocks may be more sensitive to stock trends, whereas Deep Learning models trained using the stock data of large-cap stocks may be less sensitive to stock trends which may affect the difficulty of learning for the Deep Learning models for the task of stock trading action prediction.

4.2.3 Metrics to Measure Performance of the Deep Learning Models

In order to assess how well the Deep Learning Models are able to learn the task of stock trading action prediction, from the training data used to trained them for the various variation experiments conducted in the third phase of the project, we will need a suitable evaluation metrics to quantify the performance of the Deep Learning Models.

From the experiments conducted in the second phase of the project, we were able to observe from the results obtained for the experiments, that we cannot rely purely on the prediction accuracy or loss of the models, for the measuring the difficulty of learning for the Deep Learning Models for the task of stock trading action prediction. This is due to the fact that in the previous experiments conducted in the second phase of the project, most of the correctly predicted labels for the test dataset is of the “hold” class label, with poor accuracies obtained for the “buy” and “sell” class labels.

In addition, it will not be fair to judge the performance of the models only by how accurately they are able to predict the “buy” and “sell” labels, as the “buy” and “sell” labels(created using the algorithm shown in Figure 2-1) for both the training and test datasets are usually at the exact peaks and though in the stock prices. Judging the models on based on their prediction accuracy for the prediction of “buy” and “sell” labels, will be the equivalent of judging the models’ ability to exactly predict and pinpoint the exact peaks and though points for the stock prices, a task in which even the best human Stock Traders will find it extremely difficult to do so. This is due to nature of stock prices, whereby although from the various stock technical indicators and the patterns of the stock prices, one is able to roughly predict the trend of stocks, it is often difficult to pinpoint the exact points in which stock prices change direction.

In past research papers, the test accuracies or the test loss of the Deep Learning models are often used to quantify the performance of the Deep Learning Models, which may not be the most ideal evaluation metrics for quantifying the performance of Deep Learning models, especially for classification tasks with unbalanced classes, as high overall test accuracies of the models can be obtained by having models that is biased at predicting the class with the highest ratio of training data, and consequently, Deep Learning models in past research that are not able to obtain very high test accuracies may not be necessarily bad at stock prediction tasks, as although they may not be able to identify the exact points where the stock prices peaks and troughs, they may be able to generally identify the high points and low points of the stock.

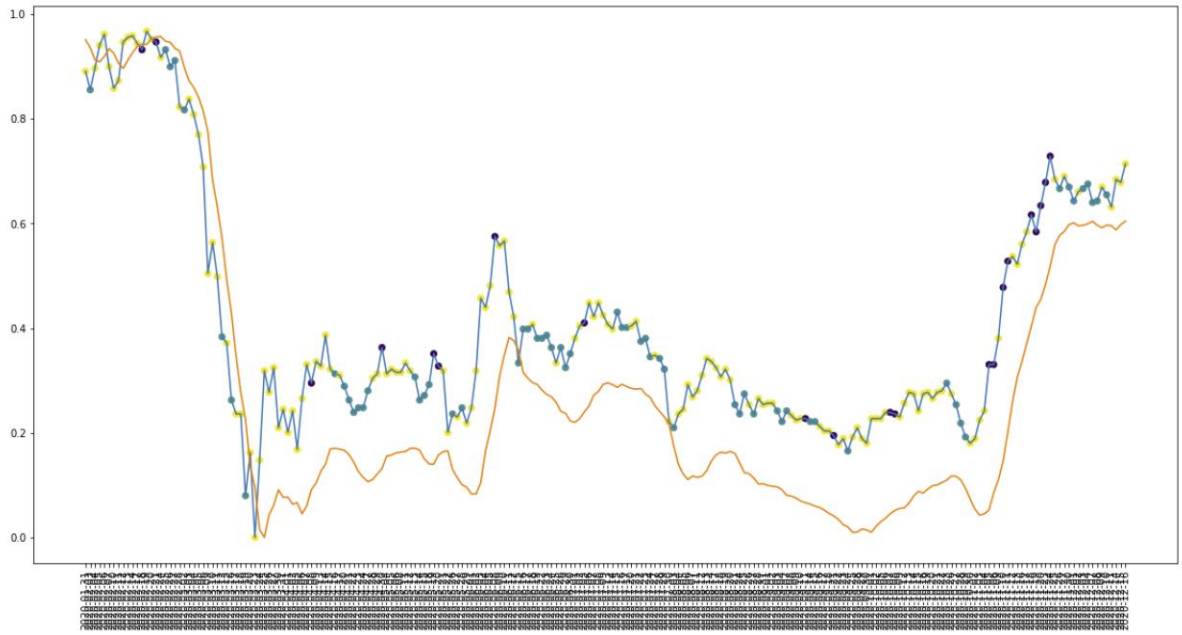


Figure 4-10 Plot of Predicted Labels and Stock Prices

For example, in our experiments conducted in the second phase of the project, when one of the trained Deep Learning models is evaluated against the test dataset, the model is only able to obtain a test accuracy of 60.36%. We can see from the figure above (Figure 4-11) that generally, the model is able to learn the high and low points of the stock, with the blue coloured dots representing a "buy" stock trading action, which are generally located at the low points of the graph, and the purple coloured dots representing a "sell" stock trading action which are generally located at the high points of the graph, despite having only a test accuracy of 60.36%.

Therefore, for the experiments conducted for the third phase of the project, instead of judging the performance of the Deep Learning models by how accurately the Deep Learning models are able to predict the labels of the test dataset, where the "sell" and "buy" labels are the exact peaks and troughs of a 15 day trading period, we use a measurement to see how well the predicted "sell" and "buy" labels are able to identify local maxima and minima points in the stock prices, with some tolerance for error, and how well "hold" labels are able to identify the neutral points in the stock prices.

<u>Metrics to Evaluate How Well Predicted Labels are Able to Identify Local Maxima and Minima Points in the Stock Prices</u>

The following algorithm was used experiments conducted for the third phase of the project, to measure how well the predicted "sell" and "buy" labels by the Deep Learning models are able to identify local maxima and minima points in the stock prices, with some tolerance for error, and how well "hold" labels are able to identify the neutral points in the stock prices:

Correct_minima *= 0*

Correct_maxima *= 0*

Correct_hold *= 0*

For each predicted label:

*If label == "**buy**":*

Find the stock price of past 4 days from label date, stock price of forward 4 days from label date and stock price on label date

If stock price on label date is lowest, 2nd lowest or 3rd lowest or 4th lowest among the 9 prices:

***Correct_minima** += 1*

*If label == "**sell**":*

Find the stock price of past 4 days from label date, stock price of forward 4 days from label date and stock price on label date

If stock price on label date is highest, 2nd highest or 3rd highest or 4th highest among the 9 prices:

***Correct_maxima** += 1*

*If label == "**hold**":*

Find the stock price of past 4 days from label date, stock price of forward 4 days from label date and stock price on label date

If stock price on label date is NOT highest AND NOT lowest among the 9 prices among the 9 prices:

***Correct_hold** += 1*

*Accuracy of buy = **Correct_minima** / number of buy labels*

*Accuracy of sell = **Correct_maxima** / number of sell labels*

*Accuracy of hold = **Correct_hold** / number of hold labels*

Metric to Evaluate Profitability of Labels Predicted by Deep Learning Models

Another metric that can be used to determine how well the Deep Learning models have learnt the training data, or in another words how well the models have generalized to the data, for the task of stock trading action prediction, is a metric that is able to measure how well the Deep Learning Models are able to make profits by making stock trades using the stock trading actions predicted. The reason behind using this method of measurement is that a Deep Learning model that was able to better learn from the training data for the task of stock trading actions prediction, will be better able to predict high price points to "sell" the stock and low price points to "buy" the stock, which will in turn allow the model to be able to make profits from the stock trading actions predicted. Also, since the ultimate goal of research on the use of Deep Learning models for stock prediction tasks is to eventually use them for real world stock trading, this method of judging the performance of Deep Learning models is more practical, as we are able to determine how profitable the predictions made by the trained Deep Learning models are, when we use the stock trading actions predicted by them to make trades on the test dataset.

In order to measure how well the Deep Learning Models are able to make profits from the stock trading actions predicted, we designed an algorithm to perform trades with the buy points and the sell points predicted by the models on the test dataset. If the price of the "sell" point is higher than that of the "buy" point by more than the trading cost incurred (trading fees at a rate of 0.55% of the traded sum, for 2 trades performed, buy, and sell performed), the model will have made a profit. Although a number of research in the past have used profitability as a measure of the performance of the Deep Learning Models for stock market prediction tasks, the algorithms used to calculate the profitability of

the models often do not take into account the trading fees incurred when a stock trade is being made. Therefore, for our Final Year Project, we designed an algorithm that perform trades with the buy points and the sell points predicted by the models on the test dataset, with the trading fees incurred each time a trade is being made taken into account. We will use a fairly common trading commission rate, at 0.275% of the traded sum for each trade performed in our algorithm.

In order to ensure that the profitability of the trades performed by the Deep Learning models' predictions are not affected by the different prices of the different stocks used in the experiments, when traded using the same fixed starting capital, all the prices of stocks in the test datasets are normalized to between $0.01(we cannot trade at $0 so a minimum price of $0.01 is used) and $1 before the trading algorithm is applied to the predicted stock trading actions. The algorithm will start with 100 dollars to trade and we will determine the profit gained in percentage after performing the predicted trading actions over the trading period of the test set. During a stock trade, if the same label comes consecutively, only the first label is activated and the corresponding transaction is performed. Repeating labels are ignored until the label changes.

Algorithm:

```
Initial_capital = 100
Stocks_capital = 0
Previously_bought = False
For trading day in test period:
{       If label is "buy":
                If Initial_capital Not Equal 0 and Previously_bought Equal False:
                        Stocks_capital = Initial_capital * 0.99725 (due to trade commission of 0.275%);
                        Initial_capital = 0;
                        Previously_bought = True;
        If label is "sell":
                If Stocks_capital Not Equal 0 and Previously_bought Equal True:
                        Initial_capital = Stocks_capital * 0.99725 (due to trade commission of 0.275%);
                        Stocks_capital = 0;
                        Previously_bought = False;
}
If Stocks_capital Not Equal 0:    //if there are stocks that are not sold at the end of the trading period
        Initial_capital = Stocks_capital * 0.99725 (due to trade commission of 0.275%);
Profit = ((Initial_capital- 100 )/ 100) * 100
```

By finding the profit margin made by the Deep Learning models when performing stock trades using the predicted stock trading actions, we will be able to determine how well the models have actually learnt and generalized from the training data, for the task of stock trading action prediction. Therefore, using the profit margin, we will be able to rank the models based on the profit margin and from there

determine if the difficulty of learning for the Deep Learning Models is affected by the variations introduced in the experiments. If the variations introduced to the training data resulted in more difficulty in learning for the Deep Learning Models, the profit margin of the test set predictions will be lower and vice versa, if the variations introduced to the training data resulted in less difficulty in learning for the Deep Learning Models.

4.2.4 Evaluation of the Deep Learning Models During Training

As mentioned, the objective of the experiments conducted for the third phase of the Final Year Project is to conduct an experimental investigation on the effects of introducing different variations to the training data used to train Deep Learning models(CNN and LSTM models), towards the ability of these models to learn the task of stock trading action prediction.

In order to do that, we cannot solely evaluate the Deep Learning models using the test datasets at the end of training them after 200 epochs, as that will only tell us how the final performance of the Deep Learning models is affected after training them using the training datasets with the various variations introduced. By only evaluating the Deep Learning models only at the end of training them for 200 epochs, we will not be able to observe how well the Deep Learning models have learnt during the 200 epochs or training. For example, if a model evaluated at the end of 200 epochs of training has a prediction accuracy of 60 percent for correctly predicting “buy” labels at low price points, we do not know if the model obtained the accuracy of 60 percent after learning from the training data with each epoch, or if the model has a prediction accuracy of 60 percent for correctly predicting “buy” labels at low price points throughout the 200 epochs when trained on the training data(meaning to say that the model did not learn to predict “buy” labels at low price points and the accuracy of predicting “buy” labels at low price points remained stagnant throughout the 200 epochs of training).

Therefore, there is a need to evaluate the Deep Learning models while they are being trained, in order to observe the effects of the variations introduced to the training data on the learning of these models. Therefore, for the experiments conducted in the third phase of the project, we will evaluate the Deep Learning models on the test datasets after every 20 epochs, up until they are trained for 200 epochs. This is done by running the training of each Deep Learning model using a while loop, where at every iteration of the loop, the model is trained for 20 epochs and then evaluated against the test dataset, until 200 epochs is reached, as shown in the code snippet below.

```
while epochs < 200:

    print('\n\n')
    print("RUNNING EPOCHS {} - {}".format(epochs,epochs+20))
    print('\n\n')

    logger = []

    # Train model
    histories['epochs{}-{}'.format(epochs,epochs+20)] = model.fit(
        train_x, train_y,
        batch_size=BATCH_SIZE,
        epochs=20,
        validation_data=(validation_x, validation_y),
        shuffle=True,
        class_weight=d_class_weights
    )

    score = model.evaluate(validation_x, validation_y, verbose=0)
    print('Validation loss:', score[0])
    print('Validation accuracy:', score[1])

    print('\n')
    print('Non-Recession Test')
    print('\n')

    X = nr_test_data['{}_X'.format('C6L.SI')]
    y = nr_test_data['{}_y'.format('C6L.SI')]

    score = model.evaluate(X, y)
    print('Test loss:', score[0])
    print('Test accuracy:', score[1])
    print('\n')
    logger.append(score[1])

    predictions = model.predict(X)
    predictions = [np.argmax(y, axis=None, out=None) for y in predictions]
    actual = [np.argmax(i, axis=None, out=None) for i in y]
```

Figure 4-11 While Loop Used to Train and Evaluate Models

By evaluating the Deep Learning Models after every 20 epochs of training, we provide stopping points along the training of the models, which allows us to record the learning of the Deep Learning Models with each passing epoch. Utilizing this method, we will be able to observe if the performance metrics of the models increase, decrease, or remain stagnant with each epoch of training.

Also, in order to track the learning of the Deep Learning models during training, we also recorded the Learning Rates of the accuracy of correctly predicting "buy" and "sell" labels, the accuracy of predicting "buy" labels at low price points, as well as the accuracy of predicting "sell" labels at high price points. We calculate Learning Rate of the various accuracy metrics as the sum of the percentage increase of the current 20 training epochs' accuracy from the previous 20 training epochs' accuracy, for each 20 epochs stopping point and divide it by the total number of stopping points for the training of the model.

$$\textbf{Learning Rate for Accuracy Metrics} = \frac{Sum\ (\text{Current 20 training epochs' accuracy} - \text{previous 20 training epochs' accuracy})}{Total\ Number\ of\ Training\ CheckPoints}$$

4.3 Results and Observations for Experiments on Impact of Data Variance Towards the Learning Difficulty of Deep Learning Models for the Task of Stock Trading Action Prediction

In this section, we will present the results obtained by the experiments conducted in the third phase of the project, on the effects of data variance in training data used to train Deep Learning models, towards the difficulty of learning of these models for the task of stock trading action prediction, for the set of variations, **Variation 1** to **Variation 6**, defined in section 4.2.2 of this report.

4.3.1 Results of Deep Learning Models Trained using Training Datasets Introduced with Variation 1 variations

For this set of experiments conducted, we varied the dimensionality and presentation of the training data to the two Deep Learning models, in order to observe if the two Deep Learning models are able to better overcome the difficulty of learning the task of stock trading action prediction for one form of data input, when compared to another.

We trained the Deep Learning models on a set of stocks, consisting of stocks from both the cyclic stocks category, as well as the non-cyclic stocks category. For each category of stocks, there is one small market capitalization stock. The stocks that were used are:

Cyclic Stocks	Non-Cyclic Stocks
Singapore Airlines Limited	Kweichow Moutai Co., Ltd.
Oversea-Chinese Banking Corporation Limited	Midea Group Co., Ltd.
CNOOC Limited	Walmart Inc.
JPMorgan Chase & Co.	Fresh Del Monte Produce Inc. (small market capitalization)
American Axle & Manufacturing Holdings, Inc. (small market capitalization)	

Table 4-2 Stocks Used for Training Deep Learning Models for Variation 1 Experiments

For the 2D CNN models used for the experiments, the input data is presented to them using 2 different methods. For the first method, a 64 x 64 image of graphs plots is used, where each line graph corresponds to a particular stock technical indicator past 15 trading days data. For the second method,

the 4 stock technical indicators data, from the past 15 trading days are arranged into a time-series vector, padded to a 64 x 64 array, so that we will be able to utilize the CNN model architecture with the same hyperparameters for both the training data representations.

Figure 4-12 Input Data Using Image Representation Method

```
array([[1.        , 1.        , 1.        , ..., 0.        , 0.        ,
        0.        ],
       [0.75999985, 0.92783951, 0.78504654, ..., 0.        , 0.        ,
        0.        ],
       [0.64000015, 0.8402295 , 0.80601767, ..., 0.        , 0.        ,
        0.        ],
       ...,
       [0.        , 0.        , 0.        , ..., 0.        , 0.        ,
        0.        ],
       [0.        , 0.        , 0.        , ..., 0.        , 0.        ,
        0.        ],
       [0.        , 0.        , 0.        , ..., 0.        , 0.        ,
        0.        ]])
```

Figure 4-13 Input Data Using Time-Series Representation Method For CNN Models

For the LSTM models used for the experiments, the input data is presented to them using 2 different methods. For the first method, a 64 x 64 image of graphs plots is used, where each line graph corresponds to a particular stock technical indicator past 15 trading days data, same as that of the CNN models. For the second method, the 4 stock technical indicators data , from the past 15 trading days, is presented as a time-series array with a shape of 15 x 4.

```
array([[1.        , 1.        , 1.        , 1.        ],
       [0.75999985, 0.92783951, 0.78504654, 0.79689969],
       [0.64000015, 0.8402295 , 0.80601767, 0.70426669],
       [0.48000031, 0.73069638, 0.17089513, 0.49966137],
       [0.51999969, 0.64686477, 0.23230939, 0.62728573],
       [0.6       , 0.59363121, 0.35514026, 0.70140718],
       [0.71999969, 0.57513856, 0.56213184, 0.83332079],
       [0.51999969, 0.51523893, 0.24368262, 0.71510272],
       [0.48000031, 0.45570436, 0.20037465, 0.64782903],
       [0.55999985, 0.42302965, 0.33794397, 0.70140718],
       [0.35999985, 0.35112982, 0.06280271, 0.54255399],
       [0.4       , 0.29914193, 0.1967527 , 0.57822259],
       [0.15999985, 0.20204974, 0.        , 0.41944465],
       [0.08000031, 0.1021941 , 0.11630365, 0.18639476],
       [0.        , 0.        , 0.05751282, 0.        ]])
```

Figure 4-14 Input Data Using Time-Series Representation Method For LSTM Models

Once all the Deep Learning models are trained on the various training datasets, we then test their performances on two one-year periods of the year 2019, and the year 2020. The reason behind doing so is due to the fact that in 2020, a global recession happened due to the Covid-19 pandemic, and in 2019, the financial market were relatively stable, therefore, by testing the performance of the models on test datasets created using 2019 stocks data and test datasets created using 2020 stocks data, we will be able to gauge the performance of the models for both recession and non-recession periods.

4.3.1.1 Results of CNN Models

Image Representation Input Method									
Singapore Airlines Model	Non-Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.055045873	5.833333333	5.102040816	0	48.33333333	41.2371134	0	-73.93014221	-64.15459983
Epochs 40	0.064220183	7.216494845	5.785123967	0	50.51546392	43.33333333	0	-61.24076148	-64.15459983
Epochs 60	0.064220183	7.142857143	5.970149254	0	51.19047619	42.10526316	0	-74.97353755	-64.15459983
Epochs 80	0.165137619	6.024096386	5.714285714	83.33333333	49.39759036	42.85714286	68.96551724	-77.95189645	-64.15459983
Epochs 100	0.261467904	7.142857143	6.25	88.46153846	50	43.75	76.47058824	-79.32598994	-64.15459983
Epochs 120	0.353211015	8.928571429	5.681818182	90.54054054	55.35714286	43.18181818	78.08219178	-57.47837541	-64.15459983
Epochs 140	0.532110095	5.555555556	6.666666667	90.16393443	55.55555556	45	76.03305785	-87.90775474	-64.15459983
Epochs 160	0.596330285	5.882352941	6.52173913	90.57971014	50	50	77.37226277	-73.27748682	-64.15459983
Epochs 180	0.729357779	13.33333333	8.333333333	92.21556886	60	47.22222222	79.51807229	-45.35218564	-64.15459983
Epochs 200	0.793577969	0	10.34482759	91.89189189	100	44.82758621	78.80434783	-28.6844617	-64.15459983

Table 4-3 Example Results of Experiment for CNN Model Trained Using Singapore Airlines Stock Data, Using Image Representation Input

Image Representation Input Method									
Singapore Airlines Model	Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.060465116	5.34351145	7.142857143	0	44.27480916	53.01204819	0	-58.97742103	-78.23835547
Epochs 40	0.065116279	5.691056911	7.608695652	0	43.08943089	51.64835165	0	-91.2971408	-78.23835547
Epochs 60	0.079069771	5.172413793	8.333333333	100	44.82758621	54.73684211	100	-92.80849398	-78.23835547
Epochs 80	0.153488368	4.62962963	8.43373494	87.5	43.51851852	54.87804878	83.33333333	-95.71360002	-78.23835547
Epochs 100	0.269767433	5.617977528	9.090909091	93.87755102	47.19101124	55.26315789	87.75510204	-96.13166563	-78.23835547
Epochs 120	0.400000006	6.578947368	11.29032258	96.1038961	44.73684211	55.73770492	90.90909091	-93.9474729	-78.23835547
Epochs 140	0.553488374	5.660377358	11.36363636	94.06779661	43.39622642	52.27272727	88.88888889	-92.89231748	-78.23835547
Epochs 160	0.651162803	7.142857143	14.70588235	94.96402878	50	52.94117647	90.57971014	-50.05954345	-78.23835547
Epochs 180	0.767441869	5	17.39130435	93.02325581	65	52.17391304	86.5497076	-39.92720915	-78.23835547
Epochs 200	0.818604648	0	20	92.97297297	80	60	86.41304348	-19.35051027	-78.23835547

Table 4-4 Example Results of Experiment for CNN Model Trained Using Singapore Airlines Stock Data, Using Image Representation Input

The tables above shows an example of the results obtained for the experiments conducted for the **Variation 1** experiments. The above results are the results of the CNN model trained using the stock data of Singapore Airlines, which was then tested on the test dataset from the Non-Recession period of 2019, as well as test dataset from the Recession period of 2020, using the image representation method of presenting data to the CNN model. The results of the CNN models trained using the stock data of the rest of the stocks listed in Table 4-2 are also presented in a similar fashion as the example tables above[2]. For each of the CNN model trained, the test accuracy of the model, the percentage of

[2] The detailed results of CNN experiments conducted for the **Variation 1** set are included in Appendix 2

correctly predicted “buy”, “sell”, and “hold” labels, the percentage of “buy” labels predicted at low price points, the percentage of “sell” labels predicted at high price points, the percentage of “hold” labels predicted at neutral price points, the percentage of profits gained by the model are recorded at every 20 epochs. The last column of the tables shows the percentage of profits gained, if one were to buy the stock at the start of the test period and sell it at the end of the test period, also known as the buy and hold profit, it is used to compare the profits obtained by actively trading during the test period using the predicted labels of the model, against the profits obtained by the buy and hold strategy.

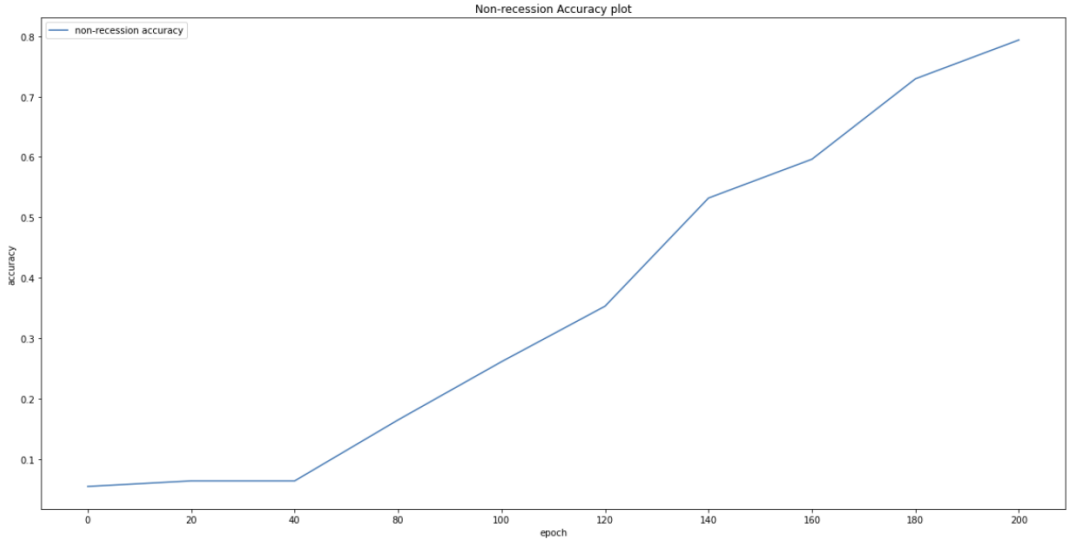


Figure 4-15 Test Accuracy Plot for CNN Model Trained Using Singapore Airlines Stock Data, Using Image Representation Input, for Non-Recession Test Period

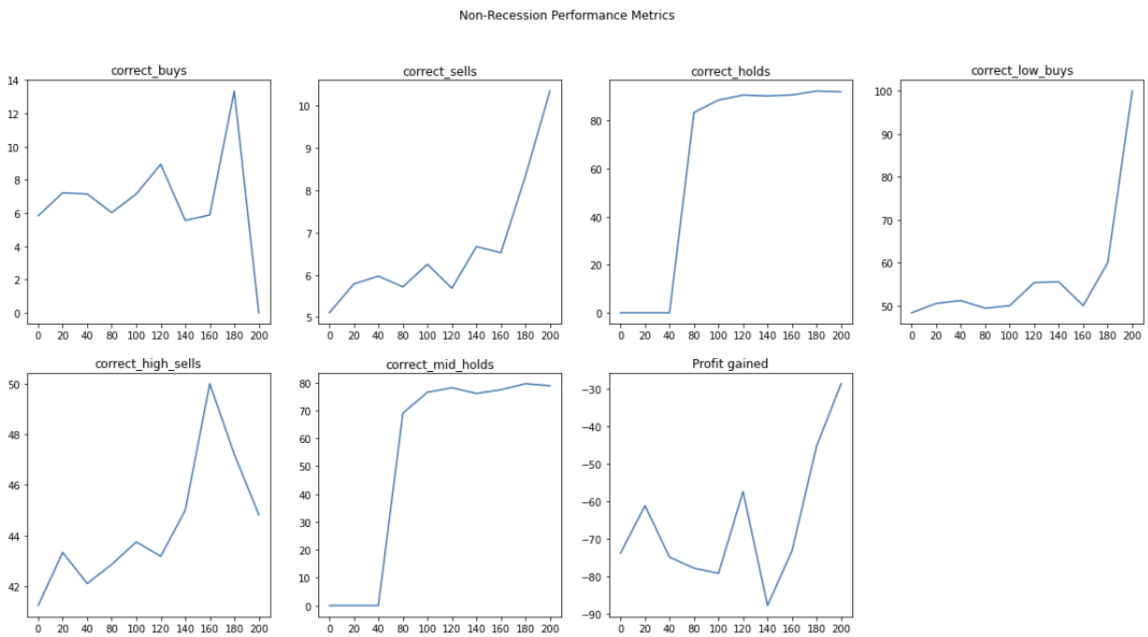


Figure 4-16 Accuracy Plots for Various Metrics for CNN Model Trained Using Singapore Airlines Stock Data, Using Image Representation Input, for Non-Recession Test Period

In addition to presenting the results obtained for the experiments conducted for the **Variation 1** experiments in tabular format, we also plotted out the results of the various metrics against number of

epochs trained, for all of the trained CNN models[3], which can be seen in the example graphs above, which are plotted based on the results of the CNN model trained using the stock data of Singapore Airlines, tested on the test dataset from the Non-Recession period of 2019. This is to allow us to better visualize the results and observe if the performance metrics of the models increase, decrease, or remain stagnant with each epoch of training.

In the example above, from Figure 4-16, we can observe why the prediction accuracy of correctly predicted "buy" and "sell" labels is not a good gauge of the performance of the trained Deep Learning models. From the first graph plot in Figure 4-16, we are able to observe that the prediction accuracy of correctly predicted "buy" labels, when compared to the actual ground truth labels increases and then drops to 0% at epoch 200, meaning that the number of correctly predicted "buy" labels is 0 after the model was trained for 200 epochs, and one would assume that the model was not able to learn the "buy" points for stock trading well. However, when we look at the fourth graph of Figure 4-16 which plots the percentage accuracy of "buy" labels predicted at low price points, we can observe that the accuracy increases to 100% at the end of 200 epochs of training, which means that the model is able to accurately predict "buy" labels at low price points of the stock, even if they are not the exact throughs of the stock prices. This tells us that although for the CNN model trained using the stock data of Singapore Airlines tested on the test dataset from the Non-Recession period of 2019 is not able to predict the "buy" labels at the exact lowest points for the test period, it is able to accurately predict "buy" labels at low price points of the stock, which tells us that the model learnt the prediction of the "buy" labels well after it was trained on the training data with image representation.

Also, from Figure 4-18, we can observe that the profitability of the CNN model fluctuates randomly with each epoch, this can be observed from the profitability graphs of the other trained CNN models as well, therefore we can conclude that profitability is not a good metric to use, to observe the difficulty of learning of Deep Learning models as the models are being trained.

Singapore Airlines Model				
	Increase in Percentage of correct buys	Increase in Percentage of correct sells	Increase in Percentage of correct low buys	Increase in Percentage of correct high sells
Epochs 20				
Epochs 40	1.383161512	0.683083151	2.18213059	2.09621993
Epochs 60	-0.073637702	0.185025287	0.67501227	-1.22807017
Epochs 80	-1.118760757	-0.25586354	-1.79288583	0.7518797
Epochs 100	1.118760757	0.535714286	0.60240964	0.89285714
Epochs 120	1.785714286	-0.568181818	5.35714286	-0.56818182
Epochs 140	-3.373015873	0.984848485	0.1984127	1.81818182
Epochs 160	0.326797385	-0.144927537	-5.55555556	5
Epochs 180	7.450980389	1.811594203	10	-2.77777778
Epochs 200	-13.33333333	2.011494257	40	-2.39463601
Average for 200 Epochs	-0.648148148	0.582531864	5.740740741	0.398941423

Table 4-5 Example Results of Experiment for CNN Model Trained Using Singapore Airlines Stock Data, Using Image Representation Input

Also, because we wanted to find out how much the models learn as it is being trained throughout the 200 epochs, we also recorded for each model, the increase in percentage accuracy of the percentage of correctly predicted "buy" labels , the percentage of correctly predicted "sell" labels, the percentage of "buy" labels predicted at low price points, the percentage of "sell" labels predicted at high price

[3] The detailed graph plots for the CNN experiments conducted for the **Variation 1** set are included in Appendix 3

points, from the current 20 epochs trained, to the previous 20 epochs trained. Then, at the end of the 200 epochs of training, we find the average of the sum of all the increase in percentage accuracy recorded, to give us the learning rate of each metric.

4.3.1.1.1 Summary Results of CNN Models

	Non-Recession Test Dataset				Recession Test Dataset			
	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells
Image Representation Average	0.213113695	0.222064603	1.357722725	0.844510073	0.293225153	1.01353028	1.223645121	1.66506325
Time Series Representation Average	0.037125277	0.155053167	0.514284324	0.474192359	0.197130415	0.220139213	0.598198378	0.435656666

Table 4-6 Summary Results of CNN Models Trained Using Variation 1 Training Datasets

Using all the results obtained for the CNN Models trained on both Image Representation and Time-Series Representation of training data, for each of the stocks detailed in Table 4-2, we then find the average learning rates of the accuracy of correctly predicted “buy” labels , the accuracy of correctly predicted “sell” labels, the accuracy of “buy” labels predicted at low price points, the accuracy of “sell” labels predicted at high price points, for both the CNN models trained with training data using Image Representation and Time-Series Representation, for results on both Non-Recession and Recession test datasets.

From the summary results in Table 4-6, we can observe that for the average learning rates for the accuracy of correctly predicted “buy” labels , the accuracy of correctly predicted “sell” labels, the accuracy of “buy” labels predicted at low price points, the accuracy of “sell” labels predicted at high price points, the CNN models trained using training data presented in the form of image representation learnt better as compared to CNN models trained using training data presented in the form of time-series representation.

This observation allows us to conclude that CNN models trained using training data presented in the form of image representation, are able to overcome the difficulty of learning better than that of CNN models trained using training data presented in the form of time-series representation, for the task of stock trading action prediction. This proves our hypothesis that CNN models, which emulates the visual cortex of the human brain, are able to overcome the difficulty of learning better when trained with data in the form of images, as compared to when trained with data in the form of time-series arrays, for the task of stock trading action prediction.

4.3.1.2 Results of LSTM Models

For the experiments conducted for the **Variation 1** experiments using the LSTM models, the results[4] for each of the LSTM models trained on the stocks listed in Table 4-2, for both variations of image representation and time-series representation of the training data, are also presented in a similar fashion as the example tables, Table 4-3 and Table 4-4, for CNN models results.

<u>Graph Plots for LSTM Model Trained Using Singapore Airlines Stock Data, Using Image Representation Input, for Non-Recession Test Period</u>

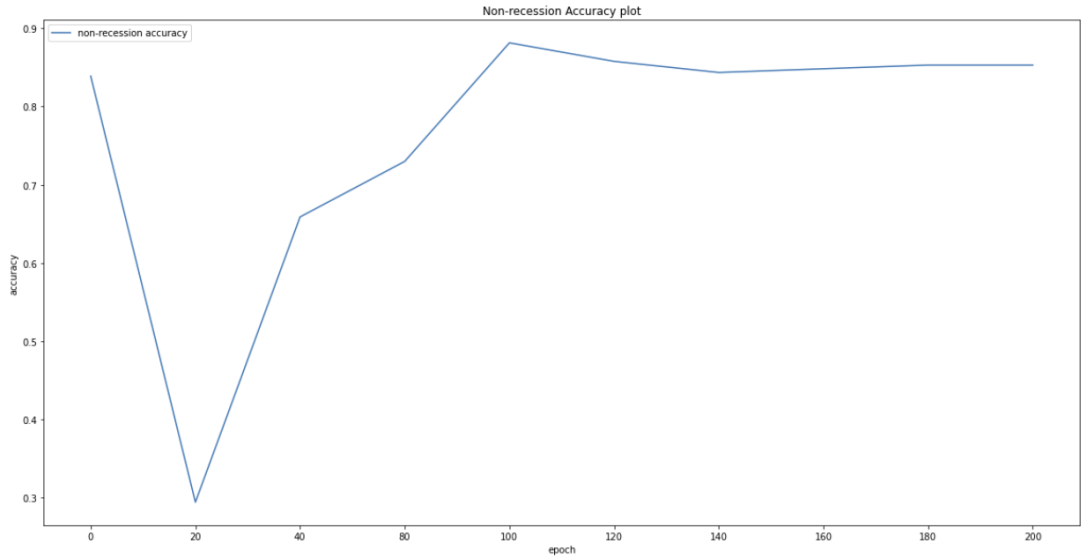


Figure 4-17 Test Accuracy Plot for LSTM Model Trained Using CNOOC Limited Stock Data, Using Image Representation Input, for Non-Recession Test Period

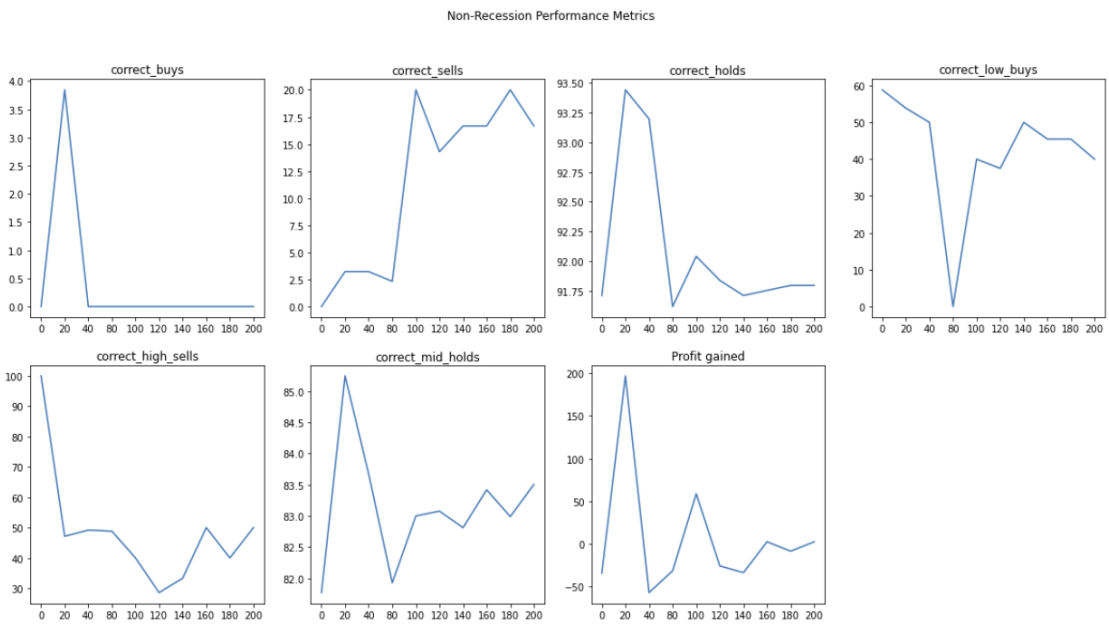


Figure 4-18 Accuracy Plots for Various Metrics for LSTM Model Trained Using CNOOC Limited Stock Data, Using Image Representation Input, for Non-Recession Test Period

[4] The detailed results of LSTM experiments conducted for the **Variation 1** set are included in Appendix 4

Graph Plots for LSTM Model Trained Using Singapore Airlines Stock Data, Using Time-Series Input, for Non-Recession Test Period

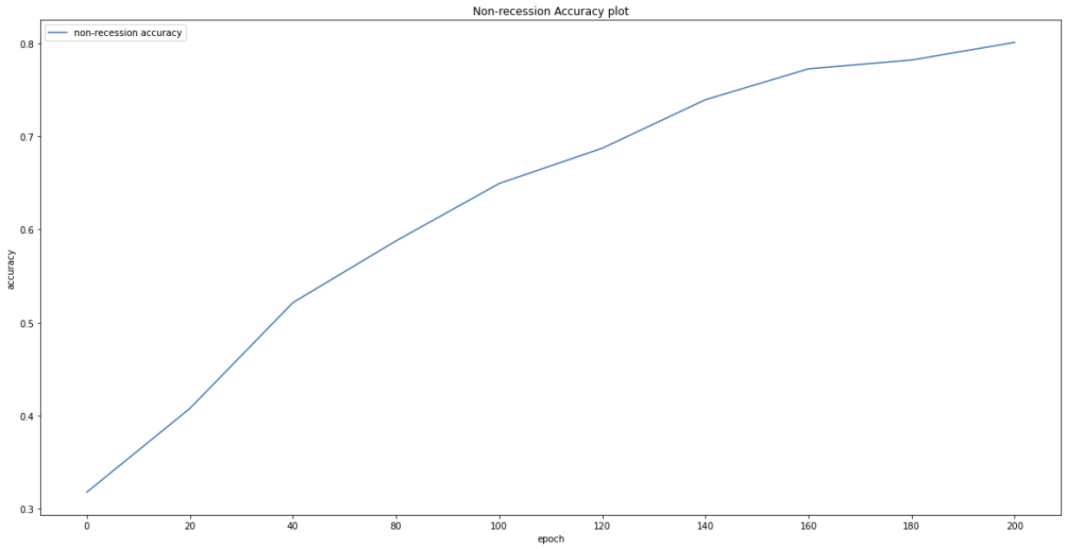


Figure 4-19 Test Accuracy Plot for LSTM Model Trained Using CNOOC Limited Stock Data, Using Time-Series Representation Input, for Non-Recession Test Period

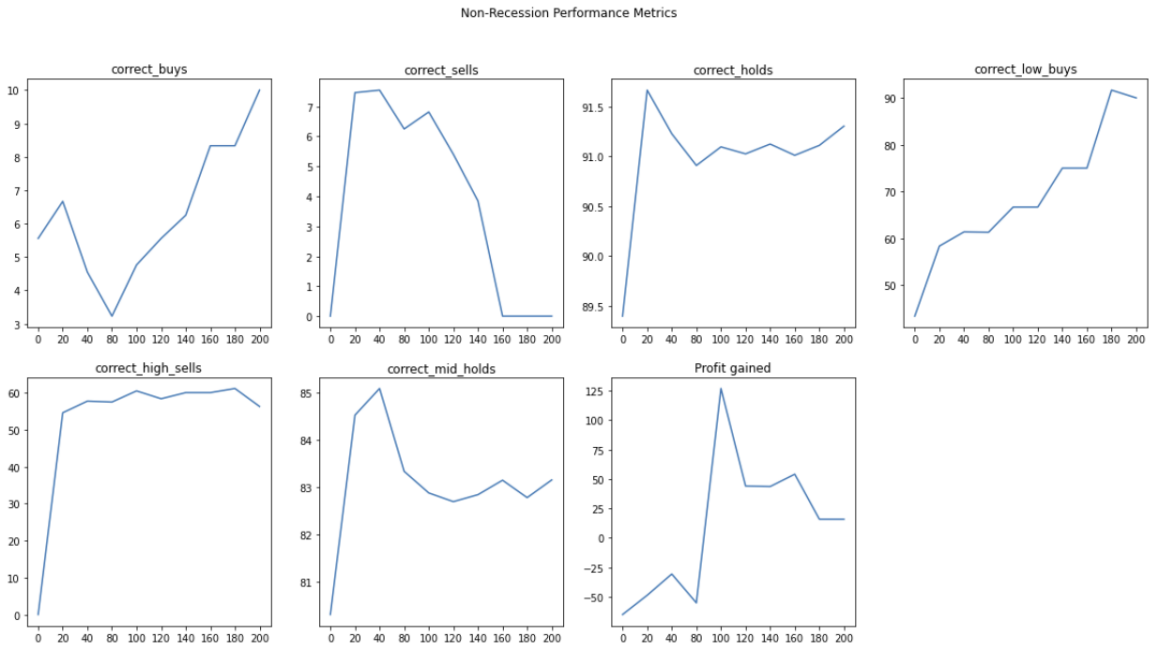


Figure 4-20 Accuracy Plots for Various Metrics for LSTM Model Trained Using CNOOC Limited Stock Data, Using Time-Series Representation Input, for Non-Recession Test Period

In order to illustrate the difference in the difficulty of learning for the task of stock trading action prediction, for LSTM models trained with training data using image representation and LSTM models trained with training data using time-series representation, we provided the example graph plots of the results of the LSTM model trained with the stock data of CNOOC Limited using image representation, as well as graph plots of the results of the LSTM model trained with the stock data of CNOOC Limited using time-series representation, in the figures above.

From Figure 4-17, we can observe that the test accuracy of the LSTM model trained with the stock data of CNOOC Limited, using image representation, is relatively volatile during the first 100 epochs of training, dipping drastically between epochs 1 to 20 of training, before rising rapidly to about 88% accuracy, before stagnating for the next 100 epochs of training. On the other hand, from Figure 4-19, the test accuracy of the LSTM model trained with the stock data of CNOOC Limited, using time-series representation, seems more stable, increasing steadily from the first epoch of training all the way till the last epoch of training, to around 80% accuracy. From these two figures, we are able to conclude that, the LSTM model trained with the stock data of CNOOC Limited using image representation, overfitted on the training data very quickly without really learning from the training data, with test accuracy stagnating just after the first 100 epochs of training, while the LSTM model trained with the stock data of CNOOC Limited using time-series representation is able to learn from the training data very well, throughout the 200 epochs of training without overfitting.

Next, from Figure 4-18, we can also observe that for the LSTM model trained with the stock data of CNOOC Limited, using image representation, the accuracy of "buy" labels predicted at low price points, as well as the accuracy of "sell" labels predicted at high price points do not increase steadily with each training epoch. The figure shows the accuracy of "sell" labels predicted at high price points dropping rapidly to around 30% accuracy for the first 120 epochs of training and having random fluctuations for the last 80 epochs between 40% to 50% accuracy, and the accuracy of "buy" labels predicted at low price points dropping to 0% accuracy for the first 80 epochs of training before stagnating between 40% to 50% accuracy for the last 120 epochs. This is in contrast to the results of the LSTM model trained with the stock data of CNOOC Limited, using time-series representation, shown in Figure 4-20, where the accuracy of "sell" labels predicted at high price points rapidly increases to around 60% accuracy for the first 20 epochs of training before steadily staying at 60% accuracy for the last 180 epochs, and the accuracy of "buy" labels predicted at low price points steadily increasing from the first epoch to the last epoch of training, to around 90% accuracy. The observations made from the 2 figures, allowed us to conclude that the LSTM model trained with the stock data of CNOOC Limited using image representation, was not able to effectively learn to predict "buy" labels at low price points and "sell" labels at high price points as the model is being trained, while the LSTM model trained with the stock data of CNOOC Limited using time-series representation was able to learn to predict "buy" labels at low price points and "sell" labels at high price points effectively, as the model is being trained. This consequently allowed us to conclude that the LSTM model trained with the stock data of CNOOC Limited using time-series representation was able to overcome the difficulty of learning better than the LSTM model trained with the stock data of CNOOC Limited using image representation, for the task of stock trading action prediction. The observations made for the graph plots of the LSTM models trained using the stock data of CNOOC Limited, for both training data representation variants, can be similarly observed for LSTM models trained using the stock data of the other stocks[5] listed in Table 4-2.

[5] The detailed graph plots for the LSTM experiments conducted for the **Variation 1** set are included in Appendix 5

4.3.1.2.1 Summary Results of LSTM Models

	Non-Recession Test Dataset				Recession Test Dataset			
	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells
Image Representation Average	0.350318105	0.336235049	-0.510172566	1.576070052	0.601087892	-0.33625731	1.216816573	0.914264829
Time Series Representation Average	-0.078944558	0.365722282	0.618670273	2.130779975	0.057708372	0.576039117	0.967880043	0.996569365

Table 4-7 Summary Results of LSTM Models Trained Using Variation 1 Training Datasets

Using all the results obtained for the LSTM Models trained on training data using both Image Representation and Time-Series Representation, for each of the stocks detailed in Table 4-2, we then find the average learning rates of the accuracy of correctly predicted "buy" labels , the accuracy of correctly predicted "sell" labels, the accuracy of "buy" labels predicted at low price points, the accuracy of "sell" labels predicted at high price points, for both the LSTM models trained with training data using Image Representation and Time-Series Representation, for results on both Non-Recession and Recession test datasets.

From the summary results in Table 4-7, we can observe that as compared to the summary results obtained for the experiments conducted using CNN models, the results of LSTM Models trained on training data using one form of data representation, is not distinctly better than that of the other. However, if we were to use measure the performance of the LSTM Models solely using the average learning rate of the accuracy of "buy" labels predicted at low price points, the accuracy of "sell" labels predicted at high price points, which are the more accurate metrics for evaluating the performance of the models in terms predicting low price points to buy stocks and high price points to sell stocks for trading, we are able to observe that the average learning rates of LSTM Models trained on training data using Time-Series Representation, are better than that of the LSTM Models trained on training data using Image Representation, with the exception of the learning rate of the accuracy of "buy" labels predicted at low price points for the recession test dataset, where the learning rate of the accuracy of "buy" labels predicted at low price points of LSTM Models trained on training data using Time-Series Representation is slightly lower than that of the LSTM Models trained on training data using Image Representation.

This observation allows us to conclude that LSTM models trained using training data presented in the form of time-series representation, are able to overcome the difficulty of learning better than that of LSTM models trained using training data presented in the form of image representation, for the task of stock trading action prediction. This proves our hypothesis that LSTM models, which emulates the Long Short-Term Memory of the human brain, are able to overcome the difficulty of learning better when trained with sequential data in the form of time-series arrays, as compared to when trained with data in the form of image representation, for the task of stock trading action prediction.

4.3.1.3 Conclusions of Experiments Conducted Using Variation 1 variations

From the results obtained by the experiments conducted to investigate effects of varying the dimensionality and presentation of the training data to the Deep Learning models, on their ability to overcome the difficulty of learning the task of stock trading action prediction, we were able to draw conclusions for the hypotheses made when designing this set of experiments.

Based on the results that were obtained for the experiments conducted on the CNN Deep Learning models, we were able to conclude that CNN models trained using training data presented in the form of image representation, are able to overcome the difficulty of learning better than that of CNN models trained using training data presented in the form of time-series representation, for the task of stock trading action prediction. This proves our hypothesis that CNN models, which emulates the visual cortex of the human brain, are able to overcome the difficulty of learning better when trained with data in the form of images, as compared to when trained with data in the form of time-series arrays, for the task of stock trading action prediction.

Next, from the results that were obtained for the experiments conducted on the LSTM Deep Learning models, we were able to conclude that LSTM models trained using training data presented in the form of time-series representation, are able to overcome the difficulty of learning better than that of LSTM models trained using training data presented in the form of image representation, for the task of stock trading action prediction. This proves our hypothesis that LSTM models, which emulates the Long Short-Term Memory of the human brain, are able to overcome the difficulty of learning better when trained with sequential data in the form of time-series arrays, as compared to when trained with data in the form of image representation, for the task of stock trading action prediction.

With the conclusions drawn from the experiments conducted based on the **Variation 1** variations, we are able to determine the best method of data representation to be used for both CNN and LSTM Deep Learning models when training them for the task of stock trading action prediction. This knowledge is useful towards the training of Deep Learning models for the task of stock trading action prediction, as there is now conclusive evidence to prove that for both the CNN and LSTM Deep Learning models, there is a method of data representation that is better able to help them overcome the difficulty of learning when training them for the task of stock trading action prediction.

In addition, we also observed from the results obtained that the profit gained metric of the Deep Learning models fluctuates randomly with each epoch, therefore we can conclude that profitability is not a good metric to use, when observing the difficulty of learning of Deep Learning models as the models are being trained. A possible explanation for the random fluctuations of percentage of profit gained by the Deep Learning models as they are being trained can be due to the fact that the number of predicted “buy” and “sell” labels changes as the models learn from the training data, causing the profitability of the model to change with each epoch of training. Moreover, while the model is being trained to optimize the prediction of buy” labels at low price points, and “sell” labels at high price points, there is no way of ensuring that the profitability of the model is optimized as the model is being trained, as the training data does not enclose information regarding profitability. As a result, while the model learns to optimize the prediction of buy” labels at low price points, and “sell” labels at high price points, the difference of price in the “buy” points and “sell” points may not be maximize, thus the profitability of the models may also be not optimized after learning the training data.

4.3.2 Results of Deep Learning Models Trained using Training Datasets Introduced with Variation 2 variations

For this set of experiments conducted, we varied the number of past trading days to be used as the lookback period for the training data of the 4 technical indicators used to train the Deep Learning models. The number of days used as lookback period for this set of experiments are, 5, 10, 15, 20, and 25 days. These experiments were conducted in order to investigate how the number of time-steps, or

lookback period, for time-series data, affects the ability of Deep Learning models to identify stock trading cycles in the input data sequences and make accurate stock trading action predictions from them.

We trained the Deep Learning models on a set of stocks, consisting of stocks from both the cyclic stocks category, as well as the non-cyclic stocks category. For each category of stocks, there is one small market capitalization stock. The stocks that were used are:

Cyclic Stocks	Non-Cyclic Stocks
Singapore Airlines Limited	Kweichow Moutai Co., Ltd.
Oversea-Chinese Banking Corporation Limited	Midea Group Co., Ltd.
CNOOC Limited	Walmart Inc.
JPMorgan Chase & Co.	Fresh Del Monte Produce Inc. (small market capitalization)
American Axle & Manufacturing Holdings, Inc. (small market capitalization)	

Table 4-8 Stocks Used for Training Deep Learning Models for Variation 2 Experiments

For the 2D CNN models used for the experiments, the input data is presented to them using the image representation method, with training samples are represented by a 64 x 64 image of graphs plots, where each line graph corresponds to a particular stock technical indicator's past **n** trading days data. For the LSTM models used for the experiments, the input data is presented to them using the time-series representation method, where the 4 stock technical indicators data , from the past **n** trading days, is presented as a time-series array with a shape of **n** x 4. For this set of experiments, this is done for 5, 10, 15, 20, and 25 lookback trading days to observe the effects of varying the number of past trading days to be used as the lookback period for the training data, for the **Variation 2** variation set.

Once all the Deep Learning models are trained on the various training datasets, we then test their performances on two one-year periods of the year 2019, and the year 2020, similar to the experiments conducted for **Variation 1**. The reason behind doing so is due to the fact that in 2020, a global recession happened due to the Covid-19 pandemic, and in 2019, the financial market were relatively stable, therefore, by testing the performance of the models on test datasets created using 2019 stocks data and test datasets created using 2020 stocks data, we will be able to gauge the performance of the models for both recession and non-recession periods.

4.3.2.1 Results of CNN Models

CNN 5 Days Models									
Singapore Airlines Model	Non-Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.068807341	6.081081081	8.571428571	0	49.65986395	48.57142857	0	-92.41020507	-64.15459983
Epochs 40	0.096330278	8.411214953	8.333333333	100	54.71698113	48.14814815	100	-84.69858009	-64.15459983
Epochs 60	0.155963302	9.87654321	7.56302521	94.44444444	56.25	47.89915966	77.77777778	-56.35461829	-64.15459983
Epochs 80	0.174311921	9.195402299	7.476635514	91.66666667	55.81395349	45.79439252	75	-64.98657066	-64.15459983
Epochs 100	0.211009175	8.823529412	9.195402299	100	54.45544554	50.57471264	82.75862069	57.27793154	-64.15459983
Epochs 120	0.266055048	6.666666667	8.602150538	90	56.75675676	49.46236559	78	-54.58514404	-64.15459983
Epochs 140	0.37155962	7.792207792	11.26760563	95.71428571	57.89473684	49.29577465	82.85714286	261.6345306	-64.15459983
Epochs 160	0.472477078	10	12.30769231	95.69892473	59.3220339	49.23076923	83.87096774	393.5747111	-64.15459983
Epochs 180	0.568807364	5.555555556	13.33333333	93.44262295	61.11111111	48.33333333	76.03305785	-31.96883286	-64.15459983
Epochs 200	0.665137589	6.25	12.72727273	93.19727891	56.25	47.27272727	78.08219178	-81.71830784	-64.15459983

Table 4-9 Example Results of Experiment for CNN Model Trained Using Singapore Airlines Stock Data, Using 5 Trading Days Lookback Period

CNN 5 Days Models									
Singapore Airlines Model	Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.065116279	5	10.90909091	0	40.625	59.25925926	0	-93.41539595	-78.23835547
Epochs 40	0.079069771	4.918032787	9.89010989	100	45.90163934	58.88888889	100	-93.45213086	-78.23835547
Epochs 60	0.14418605	6.25	8.737864078	100	47.91666667	56.8627451	93.75	-93.47760779	-78.23835547
Epochs 80	0.19069767	6.315789474	8.695652174	96.42857143	48.42105263	52.74725275	89.28571429	-90.52772501	-78.23835547
Epochs 100	0.200000003	5.454545455	10.52631579	100	49.09090909	54.66666667	82.75862069	-88.01599758	-78.23835547
Epochs 120	0.28372094	5.952380952	9.87654321	96	47.61904762	53.75	88	-86.43551829	-78.23835547
Epochs 140	0.311627895	5.555555556	8.196721311	89.0625	46.66666667	51.66666667	79.6875	-90.92630418	-78.23835547
Epochs 160	0.432558149	5.555555556	9.803921569	91.30434783	44.44444444	52	82.60869565	-95.7859554	-78.23835547
Epochs 180	0.520930231	7.547169811	8.163265306	92.03539823	45.28301887	54.16666667	84.07079646	-93.15470429	-78.23835547
Epochs 200	0.627906978	5.555555556	10.25641026	92.14285714	36.11111111	55.26315789	83.57142857	-94.00414561	-78.23835547

Table 4-10 Example Results of Experiment for CNN Model Trained Using Singapore Airlines Stock Data, Using 5 Trading Days Lookback Period

The tables above shows an example of the results obtained for the experiments conducted for the **Variation 2** experiments. The above results are the results of the CNN model trained using the stock data of Singapore Airlines, which was then tested on the test dataset from the Non-Recession period of 2019, as well as test dataset from the Recession period of 2020, using a lookback period of 5 trading days for each training sample. The results of the CNN models trained using the stock data of the rest of the stocks listed in Table 4-8 are also presented in a similar fashion as the example tables above[6]. For each of the CNN model trained, the test accuracy of the model, the percentage of correctly predicted "buy", "sell", and "hold" labels, the percentage of "buy" labels predicted at low price points, the percentage of "sell" labels predicted at high price points, the percentage of "hold" labels predicted at neutral price points, the percentage of profits gained by the model are recorded at every 20 epochs. The last column of the tables shows the percentage of profits gained if one were to buy the stock at the start of the test period and sell it at the end of the test period, also known as the buy and hold profit, it is used to compare the profits obtained by actively trading during the test period using the predicted labels of the model, against the profits obtained by the buy and hold strategy.

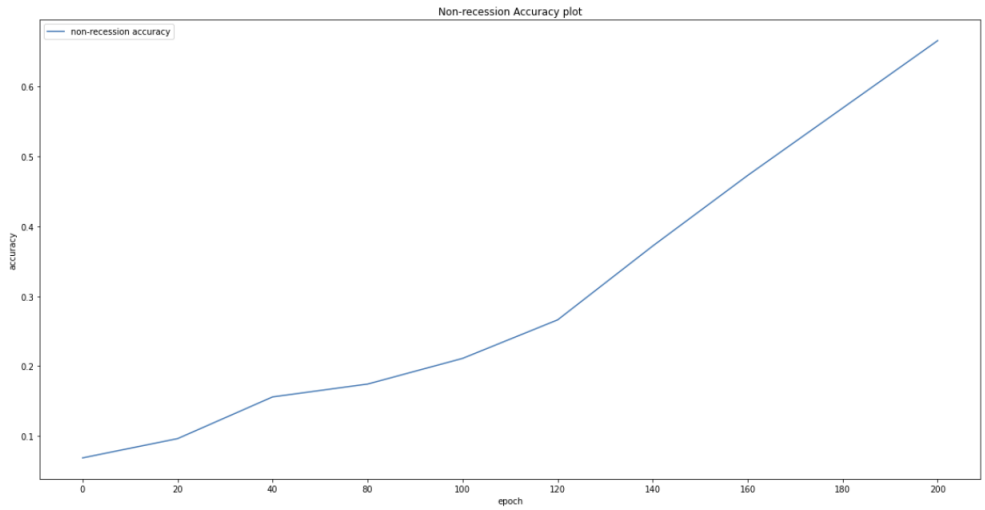


Figure 4-21 Test Accuracy Plot for CNN Model Trained Using Singapore Airlines Stock Data, Using 5 Trading Days Lookback Period, for Non-Recession Test Period

[6] The detailed results of CNN experiments conducted for the **Variation 2** set are included in Appendix 6

Figure 4-22 Accuracy Plots for Various Metrics for CNN Model Trained Using Singapore Airlines Stock Data, Using 5 Trading Days Lookback Period, for Non-Recession Test Period

In addition to presenting the results obtained for the experiments conducted for the **Variation 2** experiments in tabular format, we also plotted out the results of the various metrics against number of epochs trained, for all of the trained CNN models[7], which can be seen in the example graphs above, which are plotted based on the results of the CNN model trained using the stock data of Singapore Airlines and tested on the test dataset from the Non-Recession period of 2019. This is to allow us to better visualize the results and observe if the performance metrics of the models increase, decrease, or remain stagnant with each epoch of training.

Singapore Airlines Model				
	Increase in Percentage of correct buys	Increase in Percentage of correct sells	Increase in Percentage of correct low buys	Increase in Percentage of correct low sells
Epochs 20				
Epochs 40	2.330133872	-0.238095238	5.05711718	-0.42328042
Epochs 60	1.465328257	-0.770308123	1.53301887	-0.24898849
Epochs 80	-0.681140911	-0.086389696	-0.43604651	-2.10476714
Epochs 100	-0.371872887	1.718766785	-1.35850795	4.78032012
Epochs 120	-2.156862745	-0.593251761	2.30131122	-1.11234705
Epochs 140	1.125541125	2.665455092	1.13798008	-0.16659094
Epochs 160	2.207792208	1.04008668	1.42729706	-0.06500542
Epochs 180	-4.444444444	1.02564102	1.78907721	-0.8974359
Epochs 200	0.694444444	-0.6060606	-4.86111111	-1.06060606
Average for 200 Epochs	0.018768769	0.461760462	0.732237339	-0.144300144

Table 4-11 Example Results of Experiment for CNN Model Trained Using Singapore Airlines Stock Data, Using 5 Trading Days Lookback Period

[7] The detailed graph plots for the CNN experiments conducted for the **Variation 2** set are included in the supplemented Excel Workbook - Variation 2 Experiment results

Similar to the experiments conducted for **Variation 1**, because we wanted to find out how much the models learn as it is being trained throughout the 200 epochs, we also recorded for each model, the increase in percentage accuracy of the percentage of correctly predicted "buy" labels , the percentage of correctly predicted "sell" labels, the percentage of "buy" labels predicted at low price points, the percentage of "sell" labels predicted at high price points, from the current 20 epochs trained, to the previous 20 epochs trained. Then, at the end of the 200 epochs of training, we find the average of the sum of all the increase in percentage accuracy recorded, to give us the learning rate of each metric.

4.3.2.1.1 Summary Results of CNN Models

	Non-Recession Test Dataset				Recession Test Dataset			
	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells
5 Lookback Days Average	0.231771447	0.005086243	0.135981561	-0.398638799	0.333200511	0.414501358	0.486421721	0.097052236
10 Lookback Days Average	0.182007267	0.294733471	0.504325516	1.609260396	0.273438841	-0.172717693	1.023740878	1.147278625
15 Lookback Days Average	0.213113695	0.222064603	1.357722725	0.844510073	0.293225153	1.01353028	1.223645121	1.66506325
20 Lookback Days Average	0.481076145	0.476730531	0.527404069	2.455127968	0.604595473	0.464589998	1.922945765	3.049254666
25 Lookback Days Average	0.126745202	0.504821932	2.079691728	-0.080838383	0.08881871	0.373623107	2.390865264	-0.604616277

Table 4-12 Summary Results of CNN Models Trained Using Variation 2 Training Datasets

Using all the results obtained for the CNN Models trained on training data using 5, 10, 15, 20, and 25 lookback trading days, for each of the stocks detailed in Table 4-8, we then find the average learning rates of the accuracy of correctly predicted "buy" labels , the accuracy of correctly predicted "sell" labels, the accuracy of "buy" labels predicted at low price points, the accuracy of "sell" labels predicted at high price points, for all the CNN models trained, for results on both Non-Recession and Recession test datasets.

From the summary results in Table 4-12, we can observe that in terms of general performance of the models in predicting "buy" label at low price points and "sell" labels at high price points, the average learning rates for the accuracy of "buy" labels predicted at low price points and the accuracy of "sell" labels predicted at high price points for CNN models trained on training data using 20 lookback trading days for each training sample, is on average, across both Non-Recession and Recession test datasets, the best amongst all the CNN models trained with training data using different lookback trading days variants. Although for some of the result columns, the best result does not belong to the CNN models trained on training data using 20 lookback trading days, the models with the best results for those columns do not perform well on the whole, with poor results obtained for the other result columns in the table.

The observations made from the summary results allowed us to conclude that CNN models trained on training data using 20 lookback trading days, are able to overcome the difficulty of learning better than that of CNN models trained on training data using other number of lookback trading days, for the task of stock trading action prediction. This proves our hypothesis that the number of days used as the lookback period for training samples fed to Deep Learning models, does affect their ability to identify the cycle and the trend of the stock, for it to accurately make stock trading action predictions, and for the case of CNN models, 20 lookback trading days is the most optimal for them to identify the cycle and the trend of the stock and accurately make stock trading action predictions.

4.3.2.2 Results of LSTM Models

For the experiments conducted on the **Variation 2** variation set using LSTM models, the results[8] for each of the LSTM models trained on the stocks listed in Table 4-8, for each lookback trading days variant(l5, 10, 15, 20, and 25 lookback trading days) applied to the training samples, are also presented in a similar fashion as the example tables, Table 4-9, and Table 4-10, for the CNN models results.

In addition to presenting the results obtained for the experiments conducted for the **Variation 2** experiments in tabular format, we also plotted out the results of the various metrics against number of epochs trained, for all of the trained LSTM models[9].

4.3.2.2.1 Summary Results of LSTM Models

	Non-Recession Test Dataset				Recession Test Dataset			
	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells
5 Lookback Days Average	0.531865563	0.260102099	2.032433167	0.741459898	0.345974326	0.261895796	1.515268721	1.236265399
10 Lookback Days Average	0.259054658	0.187152737	0.740346147	1.693676	-0.022073093	-0.173097894	0.528813242	0.931502435
15 Lookback Days Average	-0.078944558	0.365722282	0.618670273	2.130779975	0.057708372	0.576039117	0.967880043	0.996569365
20 Lookback Days Average	0.070037141	0.368691754	-0.069105458	1.344869353	0.254198852	0.174592967	0.368609158	0.205178946
25 Lookback Days Average	0.231247566	-0.027330572	1.489181938	1.155780313	0.268595276	0.084179748	0.889275202	0.745606358

Table 4-13 Summary Results of LSTM Models Trained Using Variation 2 Training Datasets

Using all the results obtained for the LSTM Models trained on training data using 5, 10, 15, 20, and 25 lookback trading days, for each of the stocks detailed in Table 4-8, we then find the average learning rates of the accuracy of correctly predicted “buy” labels , the accuracy of correctly predicted “sell” labels, the accuracy of “buy” labels predicted at low price points, the accuracy of “sell” labels predicted at high price points, for all the LSTM models trained, for results on both Non-Recession and Recession test datasets.

From the summary results in Table 4-13, we can observe that in terms of the general performance of the models in predicting “buy” label at low price points and “sell” labels at high price points, the average learning rates for the accuracy of “buy” labels predicted at low price points and the accuracy of “sell” labels predicted at high price points for LSTM models trained on training data using 5 lookback trading days for each training sample, is on average across both Non-Recession and Recession test datasets, the best amongst all the LSTM models trained with training data using the various lookback trading days variants.

The observations made from the summary results allowed us to conclude that LSTM models trained on training data using 5 lookback trading days, are able to overcome the difficulty of learning better than that of LSTM models trained on training data using other number of lookback trading days, for the task of stock trading action prediction. This helps proves our hypothesis that the number of days used as the lookback period for training samples fed to Deep Learning models, does affect their ability to identify the cycle and the trend of the stock, for it to accurately make stock trading action

[8] The detailed results of LSTM experiments conducted for the **Variation 2** set are included in Appendix 7

[9] The detailed graph plots for the LSTM experiments conducted for the **Variation 2** set are included in the supplemented Excel Workbook - Variation 2 Experiment results

predictions, and for the case of LSTM models, 5 lookback trading days is the most optimal for them to identify the cycle and the trend of the stock and accurately make stock trading action predictions.

4.3.2.3 Conclusions of Experiments Conducted Using Variation 2 variations

From the results obtained by the experiments conducted to investigate effects of varying the number of past trading days to be used as the lookback period for the training samples used to train the Deep Learning models, on their ability to overcome the difficulty of learning the task of stock trading action prediction, we were able to draw conclusions for the hypotheses made when designing this set of experiments.

Based on the results that were obtained for the experiments conducted on the CNN Deep Learning models, we were able to conclude that CNN models trained on training data using 20 lookback trading days, are able to overcome the difficulty of learning better than that of CNN models trained on training data using other number of lookback trading days, for the task of stock trading action prediction.

Next, from the results that were obtained for the experiments conducted on the LSTM Deep Learning models, we were able to conclude that that LSTM models trained on training data using 5 lookback trading days, are able to overcome the difficulty of learning better than that of LSTM models trained on training data using other number of lookback trading days, for the task of stock trading action prediction.

From the conclusions drawn from the experiments conducted on both the CNN and LSTM Deep Learning models, we are able to prove that the number of days used as the lookback period for training samples fed to Deep Learning models, does affect their ability to identify the cycle and the trend of the stock, for them to accurately make stock trading action predictions. Not only that, but we were also able to observe that the optimal number of trading days used as the lookback period for CNN and LSTM models are different. This can be due to the fact that the training samples are presented to the CNN models in the form of images, which requires a larger lookback period for the models to identify stock trends and patterns to accurately make predictions for stock trading actions. On the other hand, the training samples are presented to the LSTM models in the form of time-series arrays, where a larger lookback period will result in the models having to learn a longer sequential data which may increase the difficulty of learning for the models, and a shorter lookback period is more ideal for LSTM models to learn the time-series sequence of stock data to accurately make predictions for stock trading actions.

Therefore, using the conclusions drawn from the **Variation 2** experiments, we can more effectively train the CNN and LSTM Deep Learning models for the task of stock trading action prediction, by providing the models with training samples applied with the optimal number of trading days used as the lookback period. This will allow the models to more effectively overcome the difficulty of learning the task of stock trading action prediction, and thus improve the performance of the models.

4.3.3 Results of Deep Learning Models Trained using Training Datasets Introduced with Variation 3 variations

For this set of experiments conducted, we varied the ratio of the number of training samples within the training dataset for each class(“buy” class, “sell” class, “hold class), in order to observe if the ratio of the number of training samples for each class in the training dataset, affects the difficulty in learning of the task of stock trading action prediction for Deep Learning models.

We trained the Deep Learning models on a set of stocks, consisting of stocks from both the cyclic stocks category, as well as the non-cyclic stocks category. For each category of stocks, there is one small market capitalization stock. The stocks that were used are:

Cyclic Stocks	Non-Cyclic Stocks
Singapore Airlines Limited	Kweichow Moutai Co., Ltd.
Oversea-Chinese Banking Corporation Limited	Midea Group Co., Ltd.
CNOOC Limited	Walmart Inc.
JPMorgan Chase & Co.	Fresh Del Monte Produce Inc. (small market capitalization)
American Axle & Manufacturing Holdings, Inc. (small market capitalization)	

Table 4-14 Stocks Used for Training Deep Learning Models for Variation 3 Experiments

For the 2D CNN models used for the experiments, the input data is presented to them using the image representation method, with training samples are represented by a 64 x 64 image of graphs plots, where each line graph corresponds to a particular stock technical indicator past 15 trading days data. For the LSTM models used for the experiments, the input data is presented to them using the time-series representation method, where the 4 stock technical indicators data , from the past 15 trading days, is presented as a time-series array with a shape of 15 x 4.

Once all the Deep Learning models are trained on the various training datasets, we then test their performances on two one-year periods of the year 2019, and the year 2020, similar to the experiments conducted for **Variation 1** and **Variation 2**. The reason behind doing so is due to the fact that in 2020, a global recession happened due to the Covid-19 pandemic, and in 2019, the financial market were relatively stable, therefore, by testing the performance of the models on test datasets created using 2019 stocks data and test datasets created using 2020 stocks data, we will be able to gauge the performance of the models for both recession and non-recession periods.

```
Total: 5020

Sell: 224 (4.46% of total)

Buy: 209 (4.16% of total)

Hold: 4587 (91.37% of total)
```

Figure 4-23 Breakdown of the Number of Training Data Rows for Each Class

In order to implement the variations to the training data for the Variation 3 experiments, we cannot train the Deep Learning models on training datasets built from the stock data of solely one company. This is due to the fact that the number of training samples for the “buy” and “sell” classes in training datasets, built from the stock data of solely one company, are too few as compared to the number of training samples for the “hold” class, as seen in Figure 4-23. If we were to trim the training datasets to satisfy the different variant ratios of the number of training samples for each different class, as

required for the experiments, there may be too few training samples for each class to train the Deep Learning models.

Therefore, in order to achieve the different variant ratios of the number of training samples for each different class, as required for the experiments and at the same time ensure that there is enough training data for the Deep Learning models, we gathered all the companies' stock data of stocks in each stock category (Cyclic and Non-Cyclic stocks), respectively, to create two large training datasets for each stock category, and utilized them to generate training datasets of different variant ratios of the number of training samples for each different class, as required for our experiments.

4.3.3.1 Results of CNN Models

For the **Variation 3** experiments conducted using CNN models, the results[10] for each of the CNN models trained on the stocks listed in Table 4-14, on each training dataset of a different variant ratio of the number of training samples for each different class, are also presented in a similar fashion as the example tables, Table 4-9, and Table 4-10, for the CNN models results of the **Variation 2** experiments.

In addition to presenting the results obtained for the experiments conducted for the **Variation 3** experiments in tabular format, we also plotted out the results of the various metrics against number of epochs trained, for all of the trained CNN models[11].

4.3.3.1.1 Summary Results of CNN Models

	Non-Recession Test Dataset				Recession Test Dataset			
	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells
25 Percent More Buy Class CNN Model Average	0.160159135	0.155264479	0.545162897	0.301674335	0.058442546	0.15394818	0.571474528	0.362101086
25 Percent More Hold Class CNN Model Average	0.260399317	0.02709651	0.673451519	0.431080615	0.126464616	0.12381356	0.822286491	0.418047012
25 Percent More sell Class CNN Model Average	0.239365292	0.075661893	0.879281455	0.287544235	0.0778467	0.105747064	0.677907498	0.247725468
50 Percent More Buy Class CNN Model Average	0.326726237	0.239779406	0.504845297	0.626879827	0.038462142	0.124326942	0.224037697	0.562045841
50 Percent More Hold Class CNN Model Average	0.151883703	0.1970446	0.804399119	0.612297149	0.102929555	0.125011126	0.237169894	0.470184519
50 Percent More Sell Class CNN Model Average	0.301224102	0.09214895	0.478711765	0.363516728	0.042612741	0.134787333	0.313852951	0.427229722
Balanced Class Ratio CNN Model Average	0.16477841	0.076127351	0.421146238	0.113772084	0.009991061	0.11067075	0.505374067	0.391404365
Original Ratio CNN Model Average	0.213113695	0.222064603	1.357722725	0.844510073	0.293225153	1.01353028	1.223645121	1.66506325

Table 4-15 Summary Results of CNN Models Trained Using Variation 3 Training Datasets

Using all the results obtained for the CNN Models trained on training data using the various variant training datasets for **Variation 3** experiments, for each of the stocks detailed in Table 4-14, we then find the average learning rates of the accuracy of correctly predicted "buy" labels , the accuracy of correctly predicted "sell" labels, the accuracy of "buy" labels predicted at low price points, the

[10] The detailed results of CNN experiments conducted for the **Variation 3** set are included in Appendix 8

[11] The detailed graph plots for the CNN experiments conducted for the **Variation 3** set are included in the supplemented Excel Workbook - Variation 3 Experiment results

accuracy of "sell" labels predicted at high price points, for all the CNN models trained, for results on both Non-Recession and Recession test datasets.

When we designed the experiments for **Variation 3**, we hypothesised that we should be able to achieve higher prediction accuracies for a particular class, if we were to increase the ratio of the number of training samples for that particular class in the training dataset, used to train the Deep Learning models. In addition, we also hypothesised that Deep Learning models trained with a training dataset of equal number of training samples for each class will allow the trained models to be able to predict each class with the same level of accuracy, thus, improving the learning rate of each class.

However, from the summary results obtained in Table 4-15, we can observe that by increasing the number of training samples for a particular class for the training data used to train the CNN models, the learning rate and the prediction accuracy of that particular class does not improve. For instance, for the models trained with a training data ratio of 25 and 50 percent more "buy" class training samples, the Average Learning Rate of the models for correctly predicting "buy" labels at low price points is not better than that of the other CNN models trained with other variant training datasets.

From the summary results, we are also able to observe that CNN models trained using the original training datasets, with the natural ratio of training samples for each class, performed better than all of the other models trained with training datasets of other variant ratio of training samples for each class, in terms of the average learning rate of accuracy of correctly predicting "buy" labels at low price points and the average learning rate of accuracy of correctly predicting "sell" labels at high price points, for both the Non-Recession and Recession test datasets.

The observations made on the summary results of the experiments conducted for the **Variation 3** variation set thus disproves our hypothesis that CNN models are able to achieve higher prediction accuracies for a particular class, if we were to increase the ratio of the number of training samples for that particular class in the training dataset, used to train the models. The observations also disproves our hypothesis that CNN models are able to predict each class with the same level of accuracy if trained with a training dataset of equal number of training samples for each class.

In conclusion, based on the results obtained for the experiments conducted for the **Variation 3** variation set, CNN models trained using training datasets with the natural ratio of training samples for each class, performs the best and that when training CNN models, training datasets of natural ratio of training samples for each class should be used for them to be able to better overcome the difficulty of learning the task of stock trading action prediction.

4.3.3.2 Results of LSTM Models

For the **Variation 3** experiments conducted using LSTM models, the results[12] for each of the LSTM models trained on the stocks listed in Table 4-14, on each training dataset of a different variant ratio of the number of training samples for each different class, are also presented in a similar fashion as the example tables, Table 4-9, and Table 4-10, for the CNN models results of the **Variation 2** experiments.

In addition to presenting the results obtained for the experiments conducted for the **Variation 3** experiments in tabular format, we also plotted out the results of the various metrics against number of epochs trained, for all of the trained LSTM models[13].

[12] The detailed results of CNN experiments conducted for the **Variation 3** set are included in Appendix 9

[13] The detailed graph plots for the CNN experiments conducted for the **Variation 3** set are included in the supplemented Excel Workbook - Variation 3 Experiment results

4.3.3.2.1 Summary Results of LSTM Models

	Non-Recession Test Dataset				Recession Test Dataset			
	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells
25 Percent More Buy Class LSTM Model Average	0.242254524	-0.056313573	0.710254494	0.394410987	0.141480941	-0.026013458	0.665990743	-0.230199917
25 Percent More Hold Class LSTM Model Average	0.232743949	0.005067775	0.576161075	0.077276838	0.154632123	0.111368078	0.40232147	0.048334194
25 Percent More sell Class LSTM Model Average	0.160675964	0.122660409	0.530827013	0.067908531	0.156207378	-0.238591405	0.61105504	-0.206473138
50 Percent More Buy Class LSTM Model Average	0.246028025	0.193230752	0.912658733	0.184638239	0.197486912	-0.026776037	0.647110617	0.081654786
50 Percent More Hold Class LSTM Model Average	0.271381419	0.143196081	1.12300142	0.17126728	0.326726966	0.137158988	1.033825293	0.08839073
50 Percent More Sell Class LSTM Model Average	0.202052121	0.198052151	0.912812257	-0.3500907	0.227110145	0.108055061	0.677794023	0.107184408
Balanced Class Ratio LSTM Model Average	0.205964126	-0.041024995	0.25237509	-0.161418308	0.164284536	-0.169495837	0.731837434	-0.392853247
Original Ratio LSTM Model Average	-0.078944558	0.365722282	0.618670273	2.130779975	0.057708372	0.576039117	0.967880043	0.996569365

Table 4-16 Summary Results of LSTM Models Trained Using Variation 3 Training Datasets

Using all the results obtained for the LSTM Models trained on training data using the various variant training datasets for **Variation 3** experiments, for each of the stocks detailed in Table 4-14, we then find the average learning rates of the accuracy of correctly predicted “buy” labels , the accuracy of correctly predicted “sell” labels, the accuracy of “buy” labels predicted at low price points, the accuracy of “sell” labels predicted at high price points, for all the LSTM models trained, for results on both Non-Recession and Recession test datasets.

However, from the summary results obtained in Table 4-16, similar to the observations made for the CNN models, we can observe that by increasing the number of training samples for a particular class for the training data used to train the LSTM models, the learning rate and the prediction accuracy of that particular class is not definitively better than models trained with training datasets of other variant ratio of training samples for each class. Although the average learning rate of accuracy of correctly predicting “buy” labels at low price points, for the LSTM models trained with training datasets containing 50 percent more “Buy” class training samples, is significantly higher than some of the other trained models, it does not have the highest average learning rate of accuracy of correctly predicting “buy” labels at low price points amongst all models for both Non-Recession and Recession test datasets. Also, the for the models trained with training datasets of a higher ratio of “sell” class training samples, the average learning rate of accuracy of correctly predicting “sell” labels at high price points is worse than most of the other models.

From the summary results, we are also able to observe that LSTM models trained using the original training datasets, with the natural ratio of training samples for each class, has the best overall performance in terms of the average learning rate of accuracy of correctly predicting “buy” labels at low price points and the average learning rate of accuracy of correctly predicting “sell” labels at high price points, amongst all the LSTM models trained.

The observations made on the summary results of the experiments conducted for the **Variation 3** variation set thus disproves our hypothesis that LSTM models are able to achieve higher prediction accuracies for a particular class, if we were to increase the ratio of the number of training samples for that particular class in the training dataset, used to train the models. The observations also disproves our hypothesis that LSTM models are able to predict each class with the same level of accuracy if trained with a training dataset of equal number of training samples for each class.

In conclusion, based on the results obtained for the experiments conducted for the **Variation 3** variation set, LSTM models trained using training datasets with the natural ratio of training samples for each class, performs the best and that when training LSTM models, training datasets of natural ratio of training samples for each class should be used for them to be able to better overcome the difficulty of learning the task of stock trading action prediction.

4.3.3.3 Conclusions of Experiments Conducted Using Variation 3 variations

Overall, the summary results of the experiments conducted for the **Variation 3** variation set using both CNN and LSTM models, disproves our hypothesis that Deep Learning models are able to achieve higher prediction accuracies for a particular class, if we were to increase the ratio of the number of training samples for that particular class in the training dataset, used to train the models. The observations made on the summary results also disproves our hypothesis that Deep Learning models are able to predict each class with the same level of accuracy if trained with a training dataset of equal number of training samples for each class.

The observations made on the summary results of the experiments also allowed us to conclude that changes to the ratio of the amount of training data samples for each of the classes, affects the difficulty in learning of the stock trading action prediction task for Deep Learning models. However, these effects are not positive, and changes made to the ratio of the number training samples for each class in the training dataset negatively affects the ability of Deep Learning models to learn the task of stock trading action prediction. For that reason, when training Deep Learning models to learn the task of stock trading action prediction, training datasets with the natural ratio of training samples for each class should be used, to ensure that learning is optimal for the Deep Learning models.

4.3.4 Results of Deep Learning Models Trained using Training Datasets Introduced with Variation 4 variations

For this set of experiments conducted, we varied the stock cycle phase in which to extract stock data from, to build the training datasets, to build variant training dataset with stock data extracted only from a particular phase of the stock cycle. From this set of experiments, we would like to observe if a model trained only with a training dataset built using only one particular stock cycle phase is able to achieve high prediction accuracies for making predictions on the test dataset built using data only from the same stock cycle phase, as well as how well will the model perform when making predictions on test datasets built with data from other phases of the stock cycle.

Similar to the experiments conducted for the **Variation 3** variation set, due to the fact that for each training dataset variant, we are only utilizing stock data from a particular phase of the stock cycle, we are not able to train the Deep Learning models on training datasets built using the stock data of just a single company, in order to ensure that there is enough training samples for the Deep Learning models to train on.

Therefore, in order to create the training datasets for the Variation 4 experiments, we have to create training datasets from stocks of both the Cyclic and Non-Cyclic stock categories, and in addition, we have to visually observe which phase of the stock cycle each period of the stocks' data belongs to, and from there extract that particular period of stock data to be used to build the training dataset that consists of stock data only from that particular phase of the stock cycle.

4.3.4.1 Results of CNN Models

For the **Variation 4** experiments conducted using CNN models, the results[14] for each of the CNN models trained on each training dataset of a different variant stock cycle's data, are also presented in a similar fashion as the example tables, Table 4-9, and Table 4-10, for the CNN models results of the **Variation 2** experiments.

In addition to presenting the results obtained for the experiments conducted for the **Variation 4** experiments in tabular format, we also plotted out the results of the various metrics against number of epochs trained, for all of the trained CNN models[15].

4.3.4.1.1 Summary Results of CNN Models

CNN Accumulation Phase Model	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Average Correctly Predicted
CNN Accumulation Phase Avg.	0.810483873	15.38461538	0	92.12962963	53.84615385	55.55555556	83.33333333	135.9248528	82.55793694	67.17711301
CNN Mark Up Phase Avg.	0.808219194	0	10.52631579	92.10526316	50	42.10526316	85.71428571	216.0413868	255.7316817	61.40350877
CNN Distribution Phase Avg.	0.814893603	18.51851852	13.88888889	91.64619165	59.25925926	65.71428571	86.24078624	1897.69042	-35.06524102	72.20657887
CNN Mark Down Phase Avg.	0.809352517	13.33333333	15	90.53497942	26.66666667	80	83.88429752	-91.59204105	-97.60414084	65.73388203
Model Avg.	0.810737297	11.80911681	9.85380117	91.60401596	47.44301994	60.84377611	84.7931757	539.5161545	51.4050592	66.63027067
CNN Mark Up Phase Model	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Average Correctly Predicted
CNN Accumulation Phase Avg.	0.790322602	7.142857143	0	93.26923077	57.14285714	33.33333333	84.05797101	-12.65404357	82.55793694	61.24847375
CNN Mark Up Phase Avg.	0.840182662	14.28571429	33.33333333	93.22916667	52.38095238	66.66666667	86.91099476	205.9863892	255.7316817	70.75892857
CNN Distribution Phase Avg.	0.79361701	8.510638298	10.52631579	90.84158416	48.93617021	68.42105263	85.11166253	201.9815604	-35.06524102	69.39960233
CNN Mark Down Phase Avg.	0.83453238	6.25	0	89.18918919	43.75	33.33333333	82.94573643	-96.60561469	-97.60414084	55.42417417
Model Avg.	0.814663664	9.047302432	10.96491228	91.6322927	50.55249493	50.43859649	84.75659119	74.67707285	51.4050592	64.20779471
CNN Distribution Phase Model	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Average Correctly Predicted
CNN Accumulation Phase Avg.	0.79838711	15.78947368	0	92.41706161	68.42105263	50	83.33333333	132.1316665	82.55793694	70.27937141
CNN Mark Up Phase Avg.	0.826484025	10.52631579	25	93.61702128	73.68421053	91.66666667	87.1657754	837.5216736	255.7316817	86.32263282
CNN Distribution Phase Avg.	0.814893603	11.9047619	7.692307692	90.84337349	54.76190476	53.84615385	84.5410628	136.8440862	-35.06524102	66.4838107
CNN Mark Down Phase Avg.	0.776978433	12.5	0	89.12133891	54.16666667	46.66666667	82.77310924	-97.03702494	-97.60414084	63.31822408
Model Avg.	0.804185793	12.68013784	8.173076923	91.49969882	62.75845865	60.54487179	84.4533202	252.3651003	51.4050592	71.60100976
CNN Mark Down Phase Model	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Average Correctly Predicted
CNN Accumulation Phase Avg.	0.616935492	7.547169811	2.941176471	91.92546584	52.83018868	52.94117647	83.125	227.4785362	82.55793694	65.89894366
CNN Mark Up Phase Avg.	0.666666687	8.888888889	5	91.55844156	51.11111111	55	83.66013072	103.8564233	255.7316817	65.88985089
CNN Distribution Phase Avg.	0.627659559	8.490566038	9.433962264	90.35369775	57.54716981	63.46153846	83.27974277	490.6026049	-35.06524102	70.45413534
CNN Mark Down Phase Avg.	0.640287757	14.66666667	14.81481481	92.61363636	52	53.84615385	86.36363636	-93.90170435	-97.60414084	66.1532634
Model Avg.	0.637887374	9.898322851	8.047488387	91.61281038	53.3721174	56.31221719	84.10712746	182.008965	51.4050592	67.09904832

[14] The detailed results of CNN experiments conducted for the **Variation 4** set are included in Appendix 10

[15] The detailed graph plots for the CNN experiments conducted for the **Variation 4** set are included in the supplemented Excel Workbook - Variation 4 Experiment results

Table 4-17 Results of The CNN Models Trained with Training Datasets of Varying Stock Phase

In Table 4-17, we record the results of the various CNN models trained with training datasets consisting of stock data extracted from only one particular phase of the stock cycle, after they are trained for 200 epochs. We recorded the results of the various evaluation metrics for these few models in order to observe if models trained only with a training dataset built using only one particular stock cycle phase are able to achieve high prediction accuracies for making predictions on the test dataset built using data only from the same stock cycle phase, as well as how well will the models perform when making predictions on test datasets built with data from other phases of the stock cycle.

In the results above, we can observe that models trained with a training dataset built using only one particular stock cycle phase, are generally able to achieve higher prediction accuracies for making predictions on the test dataset built using data only from the same stock cycle phase. The model trained with a training dataset built using only one particular stock cycle phase usually performs the best, if not the second best, out of all the four models above, when making predictions on the test dataset built using data only from the same stock cycle phase, with regards to accurately making predictions on average for all the three classes, “buy”, “hold”, and “sell”. The only exception is the CNN model trained using stock data solely from the Distribution Phase of the stock cycle. However, the CNN model trained using stock data solely from the Distribution Phase of the stock cycle, is the model that has the best average performance, in terms of making predictions across all the four different test datasets consisting of data solely from each stock phase, as compared to the other models.

	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells
CNN Accumulation Phase Model Avg.	0.789229764	0.33307468	0.863087001	1.489818324
CNN Mark Up Phase Model Avg.	0.349005959	0.93920201	1.82214572	5.934085861
CNN Distribution Phase Model Avg.	0.904325953	0.794498711	1.987722553	6.594691098
CNN Mark Down Phase Model Avg.	0.581353716	0.731017965	1.419328122	1.282418305
CNN Bull Phase Model Avg.	0.095104094	-0.007045867	0.370728312	1.39548133
CNN Bear Phase Model Avg.	0.456802613	0.044936936	0.633624095	0.370999048
CNN Full Cycle Model Avg.	0.311635918	0.450269063	0.453430871	0.573052369

Table 4-18 Summary Results of CNN Models Trained Using Variation 4 Training Datasets

Using all the results obtained for the CNN Models trained on training data using the various variant training datasets for **Variation 4** experiments, we then find the average learning rates of the accuracy of correctly predicted “buy” labels , the accuracy of correctly predicted “sell” labels, the accuracy of “buy” labels predicted at low price points, the accuracy of “sell” labels predicted at high price points, for all the CNN models trained, across the various test datasets build with different variant stock phase’s stock data.

From the summary results above, we are able to observe that the CNN Model trained using stock data solely from the Distribution Phase of the stock cycle, is the model that has the best performance amongst all the CNN models in terms of the average learning rate of the accuracy of correctly predicting “buy” labels at low price points, as well as the average learning rate of the accuracy of correctly predicting “sell” labels at high price points. One possible explanation for this observation is

that, if we were to take a look at the stock pattern of the Distribution Phase of a stock cycle as shown in Figure 4-9, we can see that the stock pattern of the Distribution Phase of a stock cycle has more volatility as compared to the other phases and there is a good mix of low and high price points within the phase, this volatility may have allowed the CNN Model trained using stock data solely from the Distribution Phase of the stock cycle to be more sensitive to the changes in stock trends and consequently, be able to learn the task of stock trading action prediction better than models trained with training datasets of other variant stock phases.

4.3.4.2 Results of LSTM Models

For the **Variation 4** experiments conducted using LSTM models, the results[16] for each of the LSTM models trained on each training dataset of a different variant stock cycle's data, are also presented in a similar fashion as the example tables, Table 4-9, and Table 4-10, for the CNN models results of the **Variation 2** experiments.

In addition to presenting the results obtained for the experiments conducted for the **Variation 4** experiments in tabular format, we also plotted out the results of the various metrics against number of epochs trained, for all of the trained LSTM models[17].

4.3.4.2.1 Summary Results of LSTM Models

LSTM Accumulation Phase Model	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Average Correctly Predicted
LSTM Accumulation Phase Avg.	0.745967746	13.33333333	0	93.29896907	46.66666667	54.16666667	83.41968912	4311.081815	82.55793694	64.71076747
LSTM Mark Up Phase Avg.	0.803652942	5.882352941	8.333333333	91.57894737	41.17647059	58.33333333	85.71428571	96.20117064	255.7316817	63.69625043
LSTM Distribution Phase Avg.	0.751063824	11.36363636	10	91.22340426	59.09090909	66	85.06666667	73.18611238	-35.06524102	72.10477112
LSTM Mark Down Phase Avg.	0.784172654	9.523809524	0	89.25619835	66.66666667	33.33333333	82.57261411	-77.81558895	-97.60414084	63.08539945
Model Avg.	0.771214291	10.02578304	4.583333333	91.33937976	53.40017825	52.95833333	84.1933139	1100.663377	51.4050592	65.89929712
LSTM Mark Up Phase Model	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Average Correctly Predicted
LSTM Accumulation Phase Avg.	0.79838711	14.28571429	4	93.30143541	35.71428571	44	84.13461538	-68.18287852	82.55793694	57.67190704
LSTM Mark Up Phase Avg.	0.826484025	0	12.5	92.74611399	20	56.25	86.45833333	27.95509829	255.7316817	56.332038
LSTM Distribution Phase Avg.	0.810638309	11.42857143	15.38461538	91.19804401	68.57142857	57.69230769	85.53921569	-58.01021042	-35.06524102	72.48726009
LSTM Mark Down Phase Avg.	0.762589931	7.407407407	5.263157895	90.0862069	40.74074074	36.84210526	83.54978355	-53.46293344	-97.60414084	55.8896843
Model Avg.	0.799524844	8.28042328	9.28694332	91.83295008	41.25661376	48.69610324	84.92048699	-37.92523102	51.4050592	60.59522236
LSTM Distribution Phase Model	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Average Correctly Predicted
LSTM Accumulation Phase Avg.	0.77822578	3.571428571	0	91.86602871	50	27.27272727	81.73076923	-17.08611303	82.55793694	56.37958533
LSTM Mark Up Phase Avg.	0.735159814	7.407407407	9.090909091	92.35294118	37.03703704	59.09090909	85.79881657	56.16648787	255.7316817	62.82696243

[16] The detailed results of LSTM experiments conducted for the **Variation 4** set are included in Appendix 10
[17] The detailed graph plots for the LSTM experiments conducted for the **Variation 4** set are included in the supplemented Excel Workbook - Variation 4 Experiment results

LSTM Distribution Phase Avg.	0.79361701	16.07142857	0	91.91919192	55.35714286	38.88888889	85.82278481	-62.10515334	-35.06524102	62.05507456
LSTM Mark Down Phase Avg.	0.74460429	9.756097561	15.38461538	89.73214286	53.65853659	30.76923077	83.85650224	-96.99290228	-97.60414084	58.0533034
Model Avg.	0.762901723	9.201590528	6.118881119	91.46757617	49.01317912	39.00543901	84.30221821	-30.00442019	51.4050592	59.82873143
LSTM Mark Down Phase Model	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Average Correctly Predicted
LSTM Accumulation Phase Avg.	0.834677398	0	0	92	50	58.82352941	82.58928571	20.99769509	82.55793694	66.94117647
LSTM Mark Up Phase Avg.	0.876712322	33.33333333	10	92.23300971	66.66666667	50	85.36585366	62.32520454	255.7316817	69.63322546
LSTM Distribution Phase Avg.	0.836170197	16.66666667	8	90.86651054	66.66666667	76	85.21126761	16741.94967	-35.06524102	77.8443924
LSTM Mark Down Phase Avg.	0.805755377	8.333333333	5.882352941	89.15662651	58.33333333	70.58823529	83.06451613	-23.51558409	-97.60414084	72.69273171
Model Avg.	0.838328823	14.58333333	5.970588235	91.06403669	60.41666667	63.85294118	84.05773078	4200.439246	51.4050592	71.77788151

Table 4-19 Results of The LSTM Models Trained with Training Datasets of Varying Stock Phase

In Table 4-19, we record the results of the various LSTM models trained with training datasets consisting of stock data extracted from only one particular phase of the stock cycle, after they are trained for 200 epochs. We recorded the results of the various evaluation metrics for these few models in order to observe if models trained only with a training dataset built using only one particular stock cycle phase are able to achieve high prediction accuracies for making predictions on the test dataset built using data only from the same stock cycle phase, as well as how well will the models perform when making predictions on test datasets built with data from other phases of the stock cycle.

In the results above, we can observe that LSTM models trained with a training dataset built using only one particular stock cycle phase, in general are not able to achieve higher prediction accuracies for making predictions on the test dataset built using data only from the same stock cycle phase. This is in contrast to the results obtained for the CNN models for this set of experiments. In addition, the model that has the best performance, in terms of making predictions across the four different test datasets consisting of data solely from each stock phase, as compared to the other models, is the LSTM model trained using stock data solely from the Mark Down Phase of the stock cycle.

	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells
LSTM Accumulation Phase Model Avg.	0.379164669	-0.368877737	0.469229028	0.201540838
LSTM Mark Up Phase Model Avg.	0.111557977	0.093774323	-0.334118929	0.427457499
LSTM Distribution Phase Model Avg.	0.454822821	-0.149290848	0.397626382	-0.652967926
LSTM Mark Down Phase Model Avg.	1.689627931	0.901426244	1.682968688	1.730652837
LSTM Bull Phase Model Avg.	-0.004756074	-0.188760786	0.006014967	0.523217714
LSTM Bear Phase Model Avg.	0.245834556	-0.007493458	1.3568858	0.169019597
LSTM Full Cycle Model Avg.	0.389360078	-0.439664068	-0.029982828	-0.877193317

Table 4-20 Summary Results of LSTM Models Trained Using Variation 4 Training Datasets

Using all the results obtained for the LSTM Models trained on training data using the various variant training datasets for **Variation 4** experiments, we then find the average learning rates of the accuracy of correctly predicted "buy" labels , the accuracy of correctly predicted "sell" labels, the accuracy of "buy" labels predicted at low price points, the accuracy of "sell" labels predicted at high price points, for all the LSTM models trained, across the various test datasets build with different variant stock phase's stock data.

From the summary results above, we are able to observe that the LSTM Model trained using stock data solely from the Mark Down Phase of the stock cycle, is the model that has the best performance amongst all the LSTM models in terms of the average learning rate of the accuracy of correctly predicting "buy" labels at low price points, as well as the average learning rate of the accuracy of correctly predicting "sell" labels at high price points.

4.3.4.3 Conclusions of Experiments Conducted Using Variation 4 variations

From the results obtained from the experiments conducted for **Variation 4**, we were able to make observations with regards to the ability of a model, when trained with a training dataset built using only one particular stock cycle phase, to achieve high prediction accuracies for making predictions on the test dataset built using data only from the same stock cycle phase, as well as how well will the model perform when making predictions on test datasets built with data from other phases of the stock cycle.

From the summary results obtained for the experiments, we discovered that for CNN models, models trained with a training dataset built using only one particular stock cycle phase, are generally able to achieve higher prediction accuracies for making predictions on the test dataset built using data only from the same stock cycle phase. In contrast, for LSTM models, models trained with a training dataset built using only one particular stock cycle phase, are generally not able to achieve higher prediction accuracies for making predictions on the test dataset built using data only from the same stock cycle phase. A possible explanation for this phenomenon, can be the way data from the training samples are presented to the CNN models and LSTM models. For CNN models, because the training samples are presented in the form of images, it may be easier for the models to "visually" identify the stock trends of various stock phases from the image data, and for LSTM models, because training samples are presented to the models in the form of sequential arrays, it may be harder for the models to identify the stock trends of various stock phases from the sequential data.

We also observed that for CNN models, the CNN Model trained using stock data solely from the Distribution Phase of the stock cycle, is the model that has the best performance amongst all the CNN models in terms of the average learning rate of the accuracy of correctly predicting "buy" labels at low price points, as well as the average learning rate of the accuracy of correctly predicting "sell" labels at high price points. For LSTM models, that the LSTM Model trained using stock data solely from the Mark Down Phase of the stock cycle, is the model that has the best performance amongst all the LSTM models in terms of the average learning rate of the accuracy of correctly predicting "buy" labels at low price points, as well as the average learning rate of the accuracy of correctly predicting "sell" labels at high price points.

From the observations made from the experiments conducted for **Variation 4**, we are able to conclude that for the training of CNN Deep Learning models, by training models with training datasets built using only one particular stock cycle phase, we are generally able to achieve higher prediction accuracies for making predictions on the test dataset built using data only from the same stock cycle phase, and that the models are better at overcoming the difficulty of learning of stock trading action predict for making predictions for that particular stock cycle. With this conclusion, we can build a Federated Network of CNN models, each trained with a training dataset built using only one particular stock cycle phase, to target the prediction of stock trading action of a particular stock cycle for each model, in order to achieve better learning of the task of stock trading action prediction using

the Federated model. However, for the training of LSTM Deep Learning models, by training models with training datasets built using only one particular stock cycle phase, we will not be able to achieve higher prediction accuracies for making predictions on the test dataset built using data only from the same stock cycle phase, consequently, we will not be able to make use of Federated Learning to train a Federated Network of LSTM models, each trained with a training dataset built using only one particular stock cycle phase, to target the prediction of stock trading action of a particular stock cycle for each model, in order to achieve better learning of the task of stock trading action prediction using the Federated model.

4.3.5 Results of Deep Learning Models Trained using Training Datasets Introduced with Variation 5 variations

For this set of experiments conducted, we introduced to the training data used to train the Deep Learning models for the task of stock trading action prediction, the inclusion of the stock price data of another stock from the same business sector, in addition to the data of the original four technical indicators of the particular stock being used to train the Deep Learning models, when training the Deep Learning models on a particular stock. From the experiments, we would like to observe if the inclusion of stock price data of the market leader stock in the same business sector, to the training data of the stock we are using to train the Deep Learning models, will aid the Deep Learning models in terms of the difficulty of learning the task of stock trading action prediction.

For the **Variation 5** experiments, we first have to find small or medium market capitalization stocks data from various business sectors to gather stock data from and build training datasets, for the Deep Learning models to train on, as well as stock price data of large market capitalization stocks from various business sectors to use as the support data for the **Variation 5** experiments.

The stocks selected to be used as training datasets to train the Deep Learning models are as follows:

- Apache Corporation (Energy Sector)
- JetBlue Airways Corporation (Airlines Sector)
- The Kroger Co. (Grocery Stores Sector)
- Manulife Financial Corporation (Financial Services Sector)
- ON Semiconductor Corporation (Semiconductors Sector)

The large market capitalization stocks that were used as support data are as follows:

- Exxon Mobil Corporation (Energy Sector)
- Delta Air Lines, Inc. (Airlines Sector)
- Walmart (Grocery Stores Sector)
- JPMorgan Chase & Co. (Financial Services Sector)
- Taiwan Semiconductor Manufacturing Company Limited (Semiconductors Sector)

After obtaining the stock data for the small market capitalization stocks, we then trained both the CNN and LSTM models using training datasets containing only the data of the small market capitalization stock's technical indicators, as well as using training datasets containing the data of the small market capitalization stock's technical indicators together with the stock price data of the large market capitalization stock from the same business sector as supporting data.

4.3.5.1 Results of CNN Models

For the **Variation 5** experiments conducted using CNN models, the results[18] for each of the CNN models trained on each variant training dataset, are also presented in a similar fashion as the example tables, Table 4-9, and Table 4-10, for the CNN models results of the **Variation 2** experiments.

In addition to presenting the results obtained for the experiments conducted for the **Variation 5** experiments in tabular format, we also plotted out the results of the various metrics against number of epochs trained, for all of the trained CNN models[19].

4.3.5.1.1 Summary Results of CNN Models

	Non-Recession Test Dataset				Recession Test Dataset			
	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells
APA Corporation CNN Model (No Support Stock Data)	-0.272331155	-0.637522769	-0.633169934	-1.600419782	0.201106083	-0.497512438	-1.015585722	1.807549177
JetBlue Airways Corporation CNN Model (No Support Stock Data)	-0.128824477	0.205761317	-0.966183574	-0.314465409	0.076923077	-0.782472613	1.562634897	-0.391236307
The Kroger Co. CNN Model (No Support Stock Data)	1.647509579	0.061728395	1.685823754	1.013277429	-0.03192848	0.479032192	0.682261209	0.466853408
Manulife Financial Corporation CNN Model (No Support Stock Data)	0.240870241	0.042087542	-1.002331002	1.962150239	0.215319338	0.461073318	0.674603174	-2.252456538
ON Semiconductor Corporation CNN Model (No Support Stock Data)	0.189393939	-0.34135518	-0.154761904	-0.085338794	0.445129259	-0.485008818	1.893939393	2.028218694
APA Corporation CNN Model (With Support Stock Data)	0.216450216	-0.740740741	2.220618888	0.246913581	-0.648148148	-0.529100529	0.987654321	3.081232492
JetBlue Airways Corporation CNN Model (With Support Stock Data)	0.332594235	0.617283951	1.561628556	4.938271604	0.113825409	1.587301588	2.185592186	7.936507937
The Kroger Co. CNN Model (With Support Stock Data)	0.640490114	0.447761194	2.31133389	1.450849346	1.67624521	0.39983165	0.721360897	1.220538721
Manulife Financial Corporation CNN Model (With Support Stock Data)	0.023684756	-0.077598332	1.708263019	1.144513213	0.112233446	-0.228060573	0.157855056	0.84382412
ON Semiconductor Corporation CNN Model (With Support Stock Data)	-0.805152979	0.529100529	0.933977456	-2.433862433	0.34135518	-0.256410256	2.210274791	-0.427350428

[18] The detailed results of CNN experiments conducted for the **Variation 5** set are included in Appendix 11

[19] The detailed graph plots for the CNN experiments conducted for the **Variation 5** set are included in the supplemented Excel Workbook - Variation 5 Experiment results

Table 4-21 Summary Results of CNN Models Trained Using Variation 5 Training Datasets

	Non-Recession Test Dataset				Recession Test Dataset			
	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells
Average Performance CNN Model (No Support Stock Data)	0.335323626	-0.133860139	-0.214124532	0.195040736	0.181309855	-0.164977672	0.75957059	0.331785687
Average Performance CNN Model (With Support Stock Data)	0.081613268	0.15516132	1.747164362	1.069337062	0.319102219	0.194712376	1.25254745	2.530950568

Table 4-22 Overall Summary Results of CNN Models Trained with Training Datasets with and without Support Data

For each of the CNN models trained with a different variant training dataset, we collated the results of training at every 20 epochs, from there, we then find the average learning rates of the accuracy of correctly predicted “buy” labels , the accuracy of correctly predicted “sell” labels, the accuracy of “buy” labels predicted at low price points, the accuracy of “sell” labels predicted at high price points, for all the CNN models trained, for both the Non-Recession and Recession test datasets.

From the results shown in Table 4-21, we are able to observe that amongst the two CNN models trained for each business sector, using the training datasets without and with the stock price data of the large market capitalization stock from the same business sector as supporting data respectively, the CNN model that is trained with supporting price data of the large market capitalization stock performs better than the model trained without supporting price data. With the exception of the models trained on the stock data of ON Semiconductor Corporation from the Semiconductors Business Sector.

In Table 4-22, we record the average learning rates of the accuracy of correctly predicted “buy” labels , accuracy of correctly predicted “sell” labels, accuracy of “buy” labels predicted at low price points, and the accuracy of “sell” labels predicted at high price points, for both CNN models trained with no supporting data and CNN models trained with supporting data. Overall, the CNN models that are trained with supporting price data of the large market capitalization stock from the same business sector performs better than the models trained without supporting price data.

4.3.5.2 Results of LSTM Models

For the **Variation 5** experiments conducted using LSTM models, the results[20] for each of the LSTM models trained on each variant training dataset, are also presented in a similar fashion as the example tables, Table 4-9, and Table 4-10, for the CNN models results of the **Variation 2** experiments.

In addition to presenting the results obtained for the experiments conducted for the **Variation 5** experiments in tabular format, we also plotted out the results of the various metrics against number of epochs trained, for all of the trained LSTM models[21].

	Non-Recession Test Dataset				Recession Test Dataset			
	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells
APA Corporation LSTM Model (No Support Stock Data)	0.521676561	0.810185185	1.693473089	5.380116959	0.622921247	0.566893424	0.97028731	5.215419501
JetBlue Airways Corporation LSTM Model (No Support Stock Data)	0.046641791	-0.226917058	-0.683922559	3.255086072	-1.068376068	-0.197930724	0.427350428	1.22357175
The Kroger Co. LSTM Model (No Support Stock Data)	-0.432359223	-0.167029775	-0.395895192	1.561365287	0.032615786	0.134310134	-0.793650793	0.671550671
Manulife Financial Corporation LSTM Model (No Support Stock Data)	-0.194444444	-0.823045267	1.611111111	-0.167714884	1.150097466	0.915750915	1.615445233	2.136752137
ON Semiconductor Corporation LSTM Model (No Support Stock Data)	-0.204342273	-0.529100529	1.111111111	1.180797522	1.367521368	-0.396825397	0.261437908	-0.352733687
APA Corporation LSTM Model (With Support Stock Data)	-1.021711367	-0.838574423	1.722652886	2.672955974	0.442834138	-0.540286587	1.756697409	0.375851539
JetBlue Airways Corporation LSTM Model (With Support Stock Data)	-0.165955429	-0.411522634	-0.234713768	-0.49382716	0.413105413	-0.453514739	-0.584045583	-2.210884353
The Kroger Co. LSTM Model (With Support Stock Data)	-0.284900285	0.952380953	2.393162393	1.541514041	-0.653594771	1.052631579	0.261437908	3.555555556
Manulife Financial Corporation LSTM Model (With Support Stock Data)	-1.178451179	1.245008222	-1.515151516	-1.241830066	-0.512820513	0.715488215	-1.458333333	-2.441077441
ON Semiconductor Corporation LSTM Model (With Support Stock Data)	-0.203500204	0.862794612	1.370234703	-1.096067054	-0.555555556	-0.966183575	-3.333333333	-1.265432099

Table 4-23 Summary Results of LSTM Models Trained Using Variation 5 Training Datasets

[20] The detailed results of LSTM experiments conducted for the **Variation 5** set are included in Appendix 11

[21] The detailed graph plots for the LSTM experiments conducted for the **Variation 5** set are included in the supplemented Excel Workbook - Variation 5 Experiment results

	Non-Recession Test Dataset				Recession Test Dataset			
	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells
Average Performance LSTM Model (No Support Stock Data)	-0.052565518	-0.187181489	0.667175512	2.241930191	0.42095596	0.20443967	0.496174017	1.778912074
Average Performance LSTM Model (With Support Stock Data)	-0.570903693	0.362017346	0.74723694	0.276549147	-0.173206258	-0.038373021	-0.671515387	-0.39719736

Table 4-24 Overall Summary Results of LSTM Models Trained with Training Datasets with and without Support Data

For each of the LSTM models trained with a different variant training dataset, we collated the results of training at every 20 epochs, from there, we then find the average learning rates of the accuracy of correctly predicted "buy" labels , the accuracy of correctly predicted "sell" labels, the accuracy of "buy" labels predicted at low price points, the accuracy of "sell" labels predicted at high price points, for all the LSTM models trained, for both the Non-Recession and Recession test datasets.

From the results shown in Table 4-23, we are able to observe that amongst the two LSTM models trained for each business sector, using the training datasets without and with the stock price data of the large market capitalization stock from the same business sector as supporting data respectively, the LSTM model that is trained without supporting price data of the large market capitalization stock from the same business sector performs better than the model trained with supporting price data.

In Table 4-24, we record the average learning rate of the accuracy of correctly predicted "buy" labels , accuracy of correctly predicted "sell" labels, accuracy of "buy" labels predicted at low price points, and the accuracy of "sell" labels predicted at high price points, for both LSTM models trained with no supporting data and LSTM models trained with supporting data. Overall, the LSTM models that are trained without supporting price data of the large market capitalization stock from the same business sector performs better than the models trained with supporting price data.

4.3.5.3 Conclusions of Experiments Conducted Using Variation 5 variations

From the results of the experiments conducted for **Variation 5**, we were able to make observations regarding the effects of the inclusion of stock price data of the market leader stock in the same business sector, to the training datasets of the stocks of different business sectors used to train the Deep Learning models, on the difficulty of learning of these models for the task of stock trading action prediction.

From the results, we are able to observe that for CNN models, the models that were trained with training datasets supplemented with supporting price data of a large market capitalization stock from the same business sector, perform better than the models trained with training datasets without supporting price data added to them. In contrast, for LSTM models, the models that were trained with training datasets without supporting price data added to them, perform better than the models trained with training datasets supplemented with supporting price data of a large market capitalization stock from the same business sector.

From the observations made on the results of the experiments conducted for **Variation 5**, we are able to conclude that training CNN models using training datasets supplemented with supporting price data of the market leader stock from the same business sector, aids the models in their ability to overcome the difficulty of learning the task of stock trading action prediction. However, for the case of LSTM

models, training them using training datasets supplemented with supporting price data of the market leader stock from the same business sector, does not aid the models in their ability to overcome the difficulty of learning the task of stock trading action prediction. A possible explanation for this phenomenon, can be the way data from the training samples are presented to the LSTM models. Training samples of stock data are presented to LSTM in the form of sequential time-series arrays and the addition of the stock price data of another stock may add noise to the sequential data presented to the model, therefore increasing the difficulty of the models in learning the task of stock trading action prediction.

4.3.6 Results of Deep Learning Models Trained using Training Datasets Introduced with Variation 6 variations

For this set of experiments conducted, we varied the category of the Market Capitalization of the stocks used to build the training datasets for training the Deep Learning models, in order to observe if the type of Market Capitalization of the underlying stocks used for the building the training datasets used to train the Deep Learning models, affect their performance in the task of stock trading action prediction, or in other words their ability to learning the stock trading action prediction task.

In order to build the training datasets for this set of experiments, we first have to retrieve the stock data of stocks from various business sectors, with stock data from three different stocks retrieved for each business sector, where each stock is from a different Market Capitalization category (small, medium, or large capitalization).
For the set of experiments conducted for **Variation 7**, we will be using stocks from these business sectors:

- Chinese Liquor
- American Airline
- Financial
- Pharmaceuticals

4.3.6.1 Results of CNN Models

For the **Variation 6** experiments conducted using CNN models, the results[22] for each of the CNN models trained on each variant training dataset, are also presented in a similar fashion as the example tables, Table 4-9, and Table 4-10, for the CNN models results of the **Variation 2** experiments.

In addition to presenting the results obtained for the experiments conducted for the **Variation 6** experiments in tabular format, we also plotted out the results of the various metrics against number of epochs trained, for all of the trained CNN models[23].

[22] The detailed results of CNN experiments conducted for the **Variation 6** set are included in Appendix 12
[23] The detailed graph plots for the CNN experiments conducted for the **Variation 6** set are included in the supplemented Excel Workbook - Variation 6 Experiment results

4.3.6.1.1 Summary Results of CNN Models

	Non-Recession Test Dataset				Recession Test Dataset			
	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells
Hawaiian Airlines Model Average	-0.108653094	0.070118002	0.658845967	0.666253349	-0.278473792	-0.019966614	-0.217029199	0.807844195
Sichuan Swellfun Co.,Ltd Model Average	0.546327666	0.412519331	0.291969511	0.300788353	-0.045802962	-0.110607121	1.324076113	0.389263659
First BanCorp Model Average	-0.075469054	0.605941671	1.417353147	0.273561773	-0.197609065	1.454646718	0.491833034	2.31906644
Vaxart, Inc Model Average	0.613670412	1.107951352	0.587339272	1.05552918	0.010814948	0.048995098	-0.999359911	1.557805018
Jet Blue Airlines Model Average	-0.389099926	0.498355878	0.432146729	-0.41381981	0.141190045	0.010879826	0.726022744	1.03105955
Wuliangye Yibin Co.,Ltd Model Average	0.463608101	0.110726238	1.35307126	0.389421762	0.413255598	-0.00164377	2.16858779	-0.259762965
American Financial Group, Inc Model Average	0.958222322	0.444082667	1.922954266	-0.558650454	0.19500657	0.096467319	0.788442326	-1.166693389
Inovio Pharmaceuticals, Inc. Model Average	-0.184297642	1.161642511	-0.230162783	0.655316486	0.393836551	0.108211129	0.944919278	-0.11909826
American Airlines Model Average	-0.075305821	0.353747493	0.639714643	1.096774011	0.252898922	0.438597694	0.113296605	1.112605466
Kweichow Moutai Co., Ltd Model Average	0.420553451	0.356990109	1.033908543	0.420751131	0.545547693	0.003929826	2.323070828	1.032928293
JPMorgan Chase & Co Model Average	0.09007067	0.52858912	2.900485507	0.698958829	0.590035319	-0.45300677	0.412115896	-0.206429373
Novavax, Inc Model Average	0.294928321	0.55456526	1.15667101	2.43392531	-0.175357269	-2.45342312	0.547720847	-2.467131634

Table 4-25 Summary Results of CNN Models Trained Using Variation 6 Training Datasets

	Non-Recession Test Dataset				Recession Test Dataset			
	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells
Small Cap Models Average Performance	0.243968982	0.549132589	0.738876974	0.574033164	0.201988087	-0.225032291	0.792204128	-0.335169239
Mid Cap Models Average Performance	0.212108214	0.553701823	0.869502368	0.018066996	0.300425034	-0.069815415	0.062962478	0.018217186
Large Cap Models Average Performance	0.182561655	0.448472996	1.432694926	1.16260232	-0.072134343	-0.199228959	1.192668685	0.297076148

Table 4-26 Overall Summary Results of CNN Models Trained with Training Datasets of Various Variant Market Capitalization Stocks

From the overall summary results obtained by taking the average of the learning rates of the CNN models trained using the various variant training datasets, for each category of Market Capitalization of the stocks, as shown in Table 4-26, we are able to observe that on average across all the four business sectors, the CNN models trained with training datasets built using the stock data of large

market capitalization stocks perform better than the CNN models trained with training datasets built using the stock data of small market capitalization and medium market capitalization stocks.

4.3.6.2 Results of LSTM Models

For the **Variation 6** experiments conducted using LSTM models, the results[24] for each of the LSTM models trained on each variant training dataset, are also presented in a similar fashion as the example tables, Table 4-9, and Table 4-10, for the CNN models results of the **Variation 2** experiments.

In addition to presenting the results obtained for the experiments conducted for the **Variation 6** experiments in tabular format, we also plotted out the results of the various metrics against number of epochs trained, for all of the trained LSTM models[25].

4.3.6.2.1 Summary Results of LSTM Models

	Non-Recession Test Dataset				Recession Test Dataset			
	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells
Hawaiian Airlines Model Average	-0.479027222	-0.328769054	-0.05078049	-0.631735631	0.605651012	0.108050031	0.420388468	-0.413692936
Sichuan Swellfun Co.,Ltd Model Average	0.902711829	-0.293136265	1.009441513	-0.19454028	-0.437603887	0.254714205	1.271345665	-0.343084421
First BanCorp Model Average	-0.143647753	0.27293694	0.408569489	1.041522535	-0.53002553	-0.467438855	-0.640933141	-0.090777052
Vaxart, Inc Model Average	0.1434667	-0.15437378	1.897281	0.063151843	1.169930752	-0.795454546	2.118015519	-0.493122546
Jet Blue Airlines Model Average	-0.214797191	0.151348952	0.882482961	0.877776773	0.528797679	1.013904388	-0.170322571	1.15121067
Wuliangye Yibin Co.,Ltd Model Average	0.133331175	0.355063495	-0.55941358	1.268447065	0.26636273	-0.102148454	0.996786359	0.989144022
American Financial Group, Inc Model Average	0.433428587	-0.274153046	-1.10391769	0.080639847	-0.152935091	-0.902184235	0.24308694	-0.336700337
Inovio Pharmaceuticals, Inc. Model Average	-0.023358819	0.207412831	0.716156365	0.679568377	0.559474819	-0.288833356	-0.817700817	-1.730785612
American Airlines Model Average	0.630890452	-1.458739441	0.667854636	0.41603191	0.217602243	-0.741086558	0.171610113	0.223225093
Kweichow Moutai Co., Ltd Model Average	-0.278456112	0.176438247	0.624550587	0.529814565	0.086341938	0.028267815	1.795076857	1.48283815
JPMorgan Chase & Co Model Average	0.538263907	0.425766828	0.460275626	-0.105511151	-0.016423671	0.210456107	1.028635967	0.161283651
Novavax, Inc Model Average	-0.264753586	0.769575311	1.01824153	1.098060727	-0.576057881	-0.2945532	1.775351804	-0.679042302

Table 4-27 Summary Results of LSTM Models Trained Using Variation 6 Training Datasets

[24] The detailed results of CNN experiments conducted for the **Variation 6** set are included in Appendix 12

[25] The detailed graph plots for the CNN experiments conducted for the **Variation 6** set are included in the supplemented Excel Workbook - Variation 6 Experiment results

	Non-Recession Test Dataset				Recession Test Dataset			
	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells	Learning Rate of correct buys	Learning Rate of correct sells	Learning Rate of correct low buys	Learning Rate of correct high sells
Small Cap Models Average Performance	0.105875888	-0.12583554	0.816127878	0.069599617	0.201988087	-0.225032291	0.792204128	-0.335169239
Mid Cap Models Average Performance	0.082150938	0.109918058	-0.016172986	0.726608016	0.300425034	-0.069815415	0.062962478	0.018217186
Large Cap Models Average Performance	0.156486165	-0.021739764	0.692730595	0.484599013	-0.072134343	-0.199228959	1.192668685	0.297076148

Table 4-28 Overall Summary Results of LSTM Models Trained with Training Datasets of Various Variant Market Capitalization Stocks

From the overall summary results obtained by taking the average of the learning rates of the LSTM models trained using the various variant training datasets, for each category of Market Capitalization of the stocks, as shown in Table 4-28, we are able to observe that similar to the results obtained for the CNN models, on average across the four business sectors, the LSTM models trained with training datasets built using the stock data of large market capitalization stocks perform better than the LSTM models trained with training datasets built using the stock data of small market capitalization and medium market capitalization stocks.

4.3.6.3 Conclusions of Experiments Conducted Using Variation 6 variations

From the results obtained for the set of experiments done on the **Variation 6** variation set, we observed that for both CNN and LSTM models, the models trained with training datasets built using the stock data of large market capitalization stocks, perform better than the models trained with training datasets built using the stock data of small market capitalization and medium market capitalization stocks.

The observations made on the results, allowed us to conclude that the type of Market Capitalization of the underlying stocks used for the building the training datasets used to train the Deep Learning models, does affect their performance in the task of stock trading action prediction, or in other words their ability to learning the stock trading action prediction task.

From this set of experiments, we are able to gain knowledge that by training Deep Learning models with training datasets built using the stock data of large market capitalization stocks, we are able to obtain better results in terms of the average learning rates of the accuracy of correctly predicting “buy” points at low stock prices and the accuracy of correctly predicting “sell” points at high stock prices, as compared to training Deep Learning models with training datasets built using the stock data of small market capitalization and medium market capitalization stocks. Therefore, in order to allow the Deep learning models to overcome the difficulty of learning the task of stock trading action prediction more easily, we should train Deep Learning models with training datasets built using the stock data of large market capitalization stocks.

A possible explanation for the performance of models trained with training datasets built using the stock data of large market capitalization stocks, can be that the stock data of large market capitalization stocks are less volatile and by using them to train the Deep Learning models, the models are less sensitive to small changes in stock prices and as a consequence be able to learn to predict “buy” and “sell” points closer to the exact throughs and peaks of the stock cycles, making the predictions of “buy” and “sell” points more accurate.

4.4 Overall Conclusions for Experiments Conducted in Third Phase of Project

The objective of the experiments conducted in the third phase of the Final Year Project is to introduce different variations to the training data used to train Deep Learning models for the task of stock market prediction, in order to determine the effects of variations present in the training data on the difficulty of learning for these models.

From the experiments conducted for the third phase of the project using the various sets of variations defined in section 4.2.2, we were able to draw conclusions regarding the effects that different kinds of variations present in the training data have on the difficulty of learning for Deep Learning models. From the various experiments, we also learnt which variations introduced to the training data used to train the Deep Leaning models are beneficial to the Deep Learning models in terms of helping them better overcome the difficulty of learning during training, for the task of stock trading action predictions. The summarized conclusions for experiments done on each set of variations, introduced to the training data used to train the Deep Leaning models, are in the subsections below.

4.4.1 Summary Conclusions for Variation 1 Experiments

For the experiments conducted based on the **Variation 1** variations, we were able to conclude that CNN models trained using training data presented in the form of image representation, are able to overcome the difficulty of learning better than that of CNN models trained using training data presented in the form of time-series representation, for the task of stock trading action prediction. For LSTM models, LSTM models trained using training data presented in the form of time-series representation, are able to overcome the difficulty of learning better than that of LSTM models trained using training data presented in the form of image representation, for the task of stock trading action prediction. This knowledge is useful towards the training of Deep Learning models for the task of stock trading action prediction, as there is now conclusive evidence to prove that for both the CNN and LSTM Deep Learning models, there is a method of data representation that is better able to help them overcome the difficulty of learning when training them for the task of stock trading action prediction.

In addition, we also observed from the results obtained that the “profit gained” metric of the Deep Learning models fluctuates randomly with each epoch, therefore we can conclude that profitability is not a good metric to use, when observing the difficulty of learning of Deep Learning models as the models are being trained. A possible explanation for the random fluctuations of percentage of profit gained by the Deep Learning models as they are being trained can be due to the fact that the number of predicted “buy” and “sell” labels changes as the models learn from the training data, causing the profitability of the model to change with each epoch of training. Adding on, while the model is being trained to optimize the prediction of buy” labels at low price points, and “sell” labels at high price points, there is no way of ensuring that the profitability of the model is optimized as the model is being trained, as the training data does not enclose information regarding profitability. Therfore, while the model learns to optimize the prediction of buy” labels at low price points, and “sell” labels at high price points, the difference of price in the “buy” points and “sell” points may not be maximize, thus the profitability of the models may also be not optimized after learning the training data.

4.4.2 Summary Conclusions for Variation 2 Experiments

For the experiments conducted based on the **Variation 2** variations, we were able to conclude that CNN models trained on training data using 20 lookback trading days, are able to overcome the difficulty of learning better than that of CNN models trained on training data using other number of lookback trading days, for the task of stock trading action prediction. For LSTM models, LSTM models trained on training data using 5 lookback trading days, are able to overcome the difficulty of

learning better than that of LSTM models trained on training data using other number of lookback trading days, for the task of stock trading action prediction.

From the conclusions drawn from the experiments conducted on both the CNN and LSTM Deep Learning models, we are able to prove that the number of days used as the lookback period training samples fed to Deep Learning models, does affect their ability to identify the cycle and the trend of the stock, for it to accurately make stock trading action predictions. Not only that, but we were also able to observe that the optimal number of trading days used as the lookback period for CNN and LSTM models are different. This can be due to the fact that the training samples are presented to the CNN models in the form of images, which requires a larger lookback period for the models to identify stock trends and patterns to accurately make predictions for stock trading actions. On the other hand, the training samples are presented to the LSTM models in the form of time-series arrays, where a larger lookback period will result in the models having to learn a longer sequential data which may increase the difficulty of learning for the models, and a shorter lookback period is more ideal for LSTM models to learn the time-series sequence of stock data to accurately make predictions for stock trading actions.

As a consequence, using the conclusions drawn from the **Variation 2** experiments, we can more effectively train the CNN and LSTM Deep Learning models for the task of stock trading action prediction, by providing the models with training samples applied with the optimal number of trading days used as the lookback period. This will allow the models to more effectively overcome the difficulty of learning the task of stock trading action prediction, and thus improve the performance of the models.

4.4.3 Summary Conclusions for Variation 3 Experiments

The results of the experiments conducted for the **Variation 3** variation set on both CNN and LSTM models, disproves our hypothesis that Deep Learning models are able to achieve higher prediction accuracies for a particular class, if we were to increase the ratio of the number of training samples for that particular class in the training dataset, used to train the models. The observations made on the results also disproves our hypothesis that Deep Learning models are able to predict each class with the same level of accuracy if trained with a training dataset of equal number of training samples for each class.

The observations made on the results of the experiments also allowed us to conclude that changes to the ratio of the amount of training data samples for each of the classes, affects the difficulty in learning of the stock trading action prediction task for Deep Learning models. However, these effects are not positive, and changes made to the ratio of the number training samples for each class in the training dataset negatively affects the ability of Deep Learning models to learn the task of stock trading action prediction. On that account, when training Deep Learning models to learn the task of stock trading action prediction, training datasets with the natural ratio of training samples for each class should be used, to ensure that learning is optimal for the Deep Learning models.

4.4.4 Summary Conclusions for Variation 4 Experiments

From the results obtained for the **Variation 4** experiments, we discovered that for CNN models, models trained with a training dataset built using only one particular stock cycle phase, are generally able to achieve high prediction accuracies for making predictions on the test dataset built using data only from the same stock cycle phase. In contrast, for LSTM models, models trained with a training dataset built using only one particular stock cycle phase, are generally not able to achieve high prediction accuracies for making predictions on the test dataset built using data only from the same stock cycle phase. A possible explanation for this phenomenon, can be the way data from the training samples are presented to the CNN models and LSTM models. For CNN models, because the training samples are presented in the form of images, it may be easier for the models to “visually” identify the

stock trends of various stock phases from the image data, and for LSTM models, because training samples are presented to the models in the form of sequential arrays, it may be harder for the models to identify the stock trends of various stock phases from the sequential data.

From the observations made from the experiments conducted for **Variation 4**, we are able to conclude that for the training of CNN Deep Learning models, by training models with training datasets built using only one particular stock cycle phase, we are generally able to achieve higher prediction accuracies for making predictions on the test dataset built using data only from the same stock cycle phase, and that the models are better at overcoming the difficulty of learning of stock trading action predict for making predictions for that particular stock cycle. With this conclusion, it may be possible to build a Federated Network of CNN models, each trained with a training dataset built using only one particular stock cycle phase, to target the prediction of stock trading action of a particular stock cycle for each model, in order to achieve better learning of the task of stock trading action prediction using Federated Learning. However, for the training of LSTM Deep Learning models, by training models with training datasets built using only one particular stock cycle phase, we will not be able to achieve higher prediction accuracies for making predictions on the test dataset built using data only from the same stock cycle phase, as a result, we will not be able to make use of Federated Learning to train a Federated Network of LSTM models to try and achieve better learning of the task of stock trading action prediction using the Federation.

4.4.5 Summary Conclusions for Variation 5 Experiments

From the observations made on the results of the experiments conducted for **Variation 5**, we are able to conclude that training CNN models using training datasets supplemented with supporting price data of the market leader stock from the same business sector, aids the models in their ability to overcome the difficulty of learning the task of stock trading action prediction. However, for the case of LSTM models, training them using training datasets supplemented with supporting price data of the market leader stock from the same business sector, does not aid the models in their ability to overcome the difficulty of learning the task of stock trading action prediction. A possible explanation for this phenomenon, can be the way data from the training samples are presented to the LSTM models. Training samples of stock data are presented to LSTM in the form of sequential time-series arrays and the addition of the stock price data of another stock may add noise to the sequential data presented to the model, therefore increasing the difficulty of the models in learning the task of stock trading action prediction.

4.4.6 Summary Conclusions for Variation 6 Experiments

From the results the **Variation 6** experiments, we observed that for both CNN and LSTM models, the models trained with training datasets built using the stock data of large market capitalization stocks, perform better than the models trained with training datasets built using the stock data of small market capitalization and medium market capitalization stocks. The observations made on the results, allowed us to conclude that the type of Market Capitalization of the underlying stocks used for the building the training datasets used to train the Deep Learning models, does affect their performance in the task of stock trading action prediction, or in other words their ability to learning the stock trading action prediction task.

From this set of experiments, we learnt that by training Deep Learning models with training datasets built using the stock data of large market capitalization stocks, we are able to obtain better results in terms of the average learning rate of the accuracy of correctly predicting “buy” points at low stock prices and the accuracy of correctly predicting “sell” points at high stock prices, as compared to training Deep Learning models with training datasets built using the stock data of small market capitalization and medium market capitalization stocks. Therefore, in order to allow the Deep learning models to overcome the difficulty of learning the task of stock trading action prediction more easily,

we should train Deep Learning models with training datasets built using the stock data of large market capitalization stocks.

5 Conclusions for Final Year Project and Future Work to be Done

5.1 Overall Conclusions for Final Year Project

To conclude, let us first recap on the main objective of this Final Year Project. The main focus and objective of our Final Year Project is to conduct an experimental investigation on the effects of introducing different variations to the training data used to train Deep Learning models(CNN and LSTM models), towards the ability of these models to learn the task of stock trading action prediction. The variations introduced to the training data, should be carried out in a way that will allow us to better understand how various variations present in the training data, affect the ability of Deep Learning models to learn the task of stock trading action prediction. The variations introduced to the training data should also take into consideration stock market specific characteristics that may be present in stock data(such as stock market cycles, or the ripple effect of one company's stock price on the stock prices of other companies belonging to the same business sector).

From the experimental investigation, we were able to better understand the effects of introducing certain types of data variation towards the ability of these models to learn the task of stock trading action prediction, based on the observations of the results obtained for the experimental investigation. From the experimental investigation, we also learnt which variations, when introduced to the training data used to train the Deep Leaning models, are beneficial towards helping Deep Learning models better overcome the difficulty of learning information from the training data during training, to enable them to solve the task of stock trading action prediction.

The insights gained from the experimental investigation will allow us to be better train Deep Learning models for the task of stock trading action prediction, by introducing beneficial variations to the training datasets used to train the Deep Learning models, so that they will be able to learn better from the training datasets during training, for the task of stock trading action prediction. Furthermore, for future work on the use of Deep Learning models for the task of stock trading action prediction will be able make use of Federated Learning to train Deep Learning models to tackle the task of stock trading action prediction based on the knowledge gained from this experimental investigation. By using Federate Learning, we can build a Federated Network of Deep Learning models, where each model is trained using training data with a certain variation introduced to it, therefore, each model will be able to tackle the task of stock trading action prediction more effectively for stock data of a specific variation or characteristic, and the main Federated model will be able to perform better generally for the task of stock trading action prediction.

5.2 Future Work

The purpose of experimental investigation on the effects of the various variations derived in our work, towards the difficulty of learning for deep learning models, for the specific Fintech task of stock market action prediction, is so that in the future, we will be able to hopefully train different Deep Learning models, where each model is trained with a training dataset of a specific variation, in order to allow each model to learn to overcome the difficulty of learning for the specific variation and can make accurate predictions for data of that specific variation. Not only that, but we would also want to have a general model that can make predictions with satisfactory accuracy for stock data in general, despite the variations the data might have.

This can be done through the use of federated learning. Federated learning is a machine learning technique that trains an algorithm across multiple decentralized edge devices or servers holding local

data samples, without exchanging their data samples. This approach stands in contrast to traditional centralized machine learning techniques where all data samples are uploaded to one server, as well as to more classical decentralized approaches which assume that local data samples are identically distributed.

Typical Federated learning solutions start by training a generic machine learning model in a centrally located server, this model is not personalized but acts as a baseline to start with. Next, the server sends this model to clients. As client systems generate data, local models (on respective client devices) learn and get better with time. Periodically all clients send their learning to the central server without ever exposing the user's personal data to servers. This is done with the help of homomorphic encryption. The server then aggregates the new learnings from the clients and continues to improve the shared model. The new shared model is again sent back to the client's systems.

For the task of Stock Trading Action prediction, Federated Learning can be utilized where each local models involved in the Federated Learning process is trained using a training dataset with a specific variation introduced to the training data. This will allow each local federated model to be able to learn a specific variation for stock data and will be able to accurately make Stock Predictions for input data with that specific variation.

In addition, the trained local models on each Federated Learning device will be then used to update a centralized general model so that the generalized model can learn better with the help of the trained local models, improving its weights to be able to make accurate prediction on stock data in general.

Therefore, with the results and observations obtained from our experimental investigation, we were able to make conclusions on the effects of the various variations derived in our work, towards the difficulty of learning for deep learning models, for the specific Fintech task of stock market action prediction.

Using the conclusions derived, future work can then be done to build a Federated Learning system, that is able to make use of local models involved in the Federated Learning system, each trained using a training datasets with specific variations introduced to the training data, to accurately make stock predictions for input data with specific variations. In addition, the trained local models on each Federated Learning device will be then used to update a centralized general model so that the generalized model can learn better with the help of the trained local models, improving its weights to be able to make accurate prediction on stock data in general.

This Federated Learning system will then be able to help overcome the difficulty of learning for Deep Learning models for the specific task of stock trading action prediction, which can be utilized as part of an algorithmic trading system that can be used for real world stock trading.

6 Appendix 1

Indicator Removed	10 Epochs Moving Average Accuracy Learning Rate (percent per epoch)	Accuracy Learning Rate (percent per epoch) with respect to final Accuracy	Rank
Original Indicators	0.08897	0.073515021	15
Remove Close Price	0.0943	0.079647666	5
Remove CCI	0.09215	0.076069825	12
Remove CMO	0.09438	0.079264099	7
Remove DMI	0.09882	0.08204827	3
Remove EMA	0.09413	0.079428777	6
Remove KAMA	0.09547	0.080179525	4
Remove Momentum	0.09245	0.07602256	13
Remove ROC	0.09205	0.075179997	14
Remove RSI	0.09403	0.078445468	10
Remove SMA	0.09381	0.079084644	9
Remove Stochastic	0.08546	0.070751479	16
Remove TEMA	0.09335	0.078399064	11
Remove WILLR	0.08591	0.069275247	17
Remove WMA	0.09392	0.079251574	8
Remove Moving Averages	0.10502	0.087782017	2
Remove Momentum Indicators	0.08473	0.058737378	18
Remove all except mom Indicators	0.10735	0.089643691	1

Table 6-1 Second Phase Experiments CNN Models Results for 10 Epochs Moving Average Accuracy Learning Rate

Indicator Removed	10 Epochs Moving Average Accuracy Learning Rate (percent per epoch)	Accuracy Learning Rate (percent per epoch) with respect to final Accuracy	Rank
Original Indicators	0.10655	0.081359449	1
Remove Close Price	0.0964	0.07522574	7
Remove CCI	0.0963	0.073532754	13
Remove CMO	0.09354	0.072022994	15
Remove DMI	0.09901	0.074178292	11
Remove EMA	0.09625	0.07449365	9
Remove KAMA	0.09421	0.07201224	16
Remove Momentum	0.09865	0.077139368	4
Remove ROC	0.09282	0.072654855	14
Remove RSI	0.10023	0.077493827	3
Remove SMA	0.09637	0.075510714	6
Remove Stochastic	0.09812	0.076881926	5
Remove TEMA	0.09096	0.069818167	17
Remove WILLR	0.08959	0.069053284	18
Remove WMA	0.09474	0.073628138	12
Remove Moving Averages	0.09667	0.074896049	8
Remove Momentum Indicators	0.10469	0.080106694	2
Remove all except mom Indicators	0.09788	0.074425994	10

Table 6-2 Second Phase Experiments LSTM Models Results for 10 Epochs Moving Average Accuracy Learning Rate

7 Appendix 2

OCBC Bank Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.068807341	6.557377049	7.291666667	0	50	49.47368421	0	-92.33375626	-55.90202866	0.065116279	6.818181818	6.024096386	0	46.96969697	48.7804878	0	-44.3418712	-24.56291964
Epochs 40	0.100917429	7.843137255	7.272727273	100	52.94117647	51.37614679	100	-91.8137721	-55.90202866	0.120930232	8.695652174	8.695652174	100	51.30434783	53.84615385	100	1499.454865	-24.56291964
Epochs 60	0.133027524	8.24742268	7.407407407	100	54.63917526	51.40186916	92.30769231	-79.51420211	-55.90202866	0.158139542	6.542056075	10.34482759	85.71428571	49.53271028	54.65116279	76.19047619	1785.361727	-24.56291964
Epochs 80	0.252293587	9.090909091	6.896551724	95.34883721	55.68181818	52.3255814	93.02325581	-95.03474492	-55.90202866	0.306976736	7.446808511	13.43283582	92.59259259	52.12765957	54.54545455	87.03703704	2315.773169	-24.56291964
Epochs 100	0.449541271	9.836065574	6.451612903	92.63157895	59.01639344	52.45901639	86.31578947	-42.36327944	-55.90202866	0.465116292	8.333333333	15.09433962	95.55555556	52.77777778	53.84615385	92.22222222	202.7421112	-24.56291964
Epochs 120	0.477064222	8.928571429	6.779661017	92.23300971	57.14285714	53.44827586	87.37864078	-87.72426987	-55.90202866	0.502325594	5.797101449	19.04761905	92.30769231	47.82608696	53.65853659	89.42307692	4956.757343	-24.56291964
Epochs 140	0.655963302	4.166666667	7.142857143	91.44736842	58.33333333	47.61904762	84.10596026	-65.79814232	-55.90202866	0.688372076	0	14.81481481	90	42.85714286	53.84615385	86.25	23.75932259	-24.56291964
Epochs 160	0.747706413	5.263157895	8	91.95402299	63.15789474	56	84.97109827	2.12414809	-55.90202866	0.786046505	0	12.5	90.27027027	57.14285714	50	86.41304348	-52.50041901	-24.56291964
Epochs 180	0.711009145	4.347826087	6.896551724	91.56626506	60.86956522	51.72413793	84.24242424	-72.24593976	-55.90202866	0.753488362	0	20	90.8045977	61.9047619	52.63157895	87.35632184	29.08526291	-24.56291964
Epochs 200	0.80733943	0	11.76470588	92.06349206	58.33333333	58.82352941	85.63829787	280.8633109	-55.90202866	0.827906966	0	22.22222222	89.79591837	60	55.55555556	85.64102564	87.54059795	-24.56291964
CNOOC Limited Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.037914693	3.791469194	0	0	42.85714286	0	0	-54.68960087	-54.68960087	0.046948358	4.694835681	0	0	39.1509434	0	0	-84.2898875	-84.2898875
Epochs 40	0.379146934	2.325581395	4.705882353	90.36144578	44.18604651	46.42857143	79.51807229	8.150034846	-54.68960087	0.408450693	8.333333333	9.278350515	93.75	33.33333333	48.95833333	85	167.6231547	-84.2898875
Epochs 60	0.118483409	3.296703297	5.050505051	80.95238095	51.64835165	51.02040816	76.19047619	-7.033040987	-54.68960087	0.187793434	8.045977011	8	96.15384615	42.52873563	51.51515152	80.76923077	-82.50391541	-84.2898875
Epochs 80	0.165876776	2.702702703	4.807692308	84.84848485	54.05405405	52.42718447	78.78787879	179.6149983	-54.68960087	0.276995301	9.375	8	91.83673469	45.3125	48.48484848	75.51020408	-92.12317476	-84.2898875
Epochs 100	0.17061612	4.225352113	4.587155963	90.32258065	54.92957746	52.77777778	83.87096774	-44.80331192	-54.68960087	0.262910783	9.836065574	7.547169811	91.30434783	47.54098361	50.47619048	78.26086957	88.51945448	-84.2898875
Epochs 120	0.255924165	5.479452055	5.747126437	88.23529412	56.16438356	50	80.39215686	-50.05530011	-54.68960087	0.370892018	10.60606061	8.974358974	94.20289855	48.48484848	54.54545455	82.60869565	-89.45349043	-84.2898875
Epochs 140	0.616113722	0	12	90.71428571	56.52173913	56	79.85611511	-64.07922607	-54.68960087	0.624413133	10.63829787	10.34482759	91.24087591	53.19148936	41.37931034	80.88235294	-70.48422663	-84.2898875
Epochs 160	0.654028416	4.255319149	15	92.36111111	55.31914894	55	81.81818182	-95.03736901	-54.68960087	0.661971807	10.20408163	15	92.36111111	55.10204082	50	82.51748252	-38.29326682	-84.2898875
Epochs 180	0.720379174	3.571428571	10	91.41104294	64.28571429	50	81.48148148	-94.72353349	-54.68960087	0.713615	11.11111111	15.78947368	91.7721519	55.55555556	47.36842105	82.1656051	-66.01973649	-84.2898875
Epochs 200	0.744075835	4.545454545	9.523809524	91.66666667	54.54545455	52.38095238	81.43712575	-95.13115429	-54.68960087	0.713615	10.71428571	12	91.25	50	40	81.13207547	-80.52185945	-84.2898875
JP Morgan Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.573394477	8	2.702702703	91.60305344	56	35.13513514	82.30769231	1254.152148	1576.179166	0.579908669	8.510638298	7.692307692	90.22556391	45.65217391	51.28205128	83.45864662	-70.01219565	-31.90034799

Epochs 40	0.091743119	9.195402299	3.333333333	72.72727273	47.6744186	45	72.72727273	1973.568087	1576.179166	0.132420093	10.34482759	9.677419355	100	51.1627907	49.19354839	100	144.1032953	-31.90034799
Epochs 60	0.110091746	9.345794393	3.03030303	91.66666667	44.33962264	44.44444444	75	1698.285353	1576.179166	0.155251145	9.259259259	9.375	100	48.59813084	51.04166667	86.66666667	355.3657079	-31.90034799
Epochs 80	0.233944952	12.19512195	4.12371134	94.87179487	52.43902439	45.36082474	86.84210526	3225.438181	1576.179166	0.296803653	9.333333333	9.090909091	89.28571429	44.59459459	52.27272727	82.14285714	61.0909248	-31.90034799
Epochs 100	0.353211015	9.836065574	4.819277108	90.54054054	50.81967213	46.98795181	82.19178082	3404.913158	1576.179166	0.424657524	12.5	6.944444444	89.01098901	46.42857143	54.16666667	81.11111111	127.909699	-31.90034799
Epochs 120	0.504587173	8.333333333	5.263157895	91.15044248	45.83333333	45.61403509	82.14285714	3104.074666	1576.179166	0.547945201	7.317073171	8	88.28125	39.02439024	58	81.88976378	6602.412265	-31.90034799
Epochs 140	0.619266033	12	2.040816327	90.97222222	64	44.89795918	84.61538462	5500.730881	1576.179166	0.652968049	4.761904762	9.302325581	89.03225806	28.57142857	60.46511628	81.81818182	-30.56582805	-31.90034799
Epochs 160	0.674311936	11.11111111	2.380952381	91.13924051	72.22222222	45.23809524	84.7133758	25104.05388	1576.179166	0.726027369	6.666666667	12.12121212	90.05847953	33.33333333	60.60606061	82.94117647	-19.47047887	-31.90034799
Epochs 180	0.74311924	14.28571429	3.846153846	92.39766082	66.66666667	42.30769231	85.29411765	33690.63594	1576.179166	0.744292259	5.555555556	12.5	89.83050847	38.88888889	58.33333333	82.38636364	113.9798321	-31.90034799
Epochs 200	0.775229335	12.5	0	91.75824176	68.75	45	84.53038674	55235.43307	1576.179166	0.762557089	5.555555556	11.11111111	89.61748634	33.33333333	55.55555556	82.41758242	-36.48392167	-31.90034799
American Axle (small cap) Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.454128444	3.797468354	10	92.92929293	44.30379747	58.97435897	86.86868687	-89.98433626	-40.19620025	0.547945201	5.357142857	6.25	87.78625954	39.28571429	53.125	80.76923077	-69.27188559	-32.50977019
Epochs 40	0.481651366	4.587155963	0	91.74311927	41.28440367	0	87.03703704	-40.19620025	-40.19620025	0.534246564	9	0	90.75630252	50.50505051	0	84.03361345	-8.105837446	-32.50977019
Epochs 60	0.224770635	3.125	7.692307692	90.90909091	42.70833333	47.43589744	86.04651163	-25.9186696	-40.19620025	0.242009133	8.791208791	9.195402299	90.24390244	52.22222222	63.2183908	82.92682927	45.52179872	-32.50977019
Epochs 80	0.183486238	4.716981132	7.317073171	96.66666667	41.9047619	46.34146341	93.33333333	-38.34265404	-40.19620025	0.223744288	9.090909091	9.302325581	94.11764706	52.04081633	61.62790698	85.29411765	-11.84344223	-32.50977019
Epochs 100	0.247706428	1.162790698	7.407407407	92.15686275	41.17647059	46.91358025	90.19607843	-34.27494655	-40.19620025	0.378995448	11.94029851	10	93.05555556	53.73134328	62.5	88.73239437	261.6913336	-32.50977019
Epochs 120	0.417431206	3.75	10	94.31818182	43.03797468	58	88.63636364	-54.61035742	-40.19620025	0.570776284	13.33333333	12.82051282	93.33333333	53.33333333	74.35897436	87.39495798	290.8277173	-32.50977019
Epochs 140	0.513761461	1.408450704	4.166666667	89.43089431	41.42857143	54.16666667	81.30081301	-39.45917815	-40.19620025	0.643835604	13.46153846	5	90.47619048	53.84615385	75	85.61643836	8.254301993	-32.50977019
Epochs 160	0.550458729	1.818181818	3.03030303	90.76923077	42.59259259	48.48484848	83.84615385	-63.12538679	-40.19620025	0.675799072	12.82051282	4.545454545	89.87341772	56.41025641	72.72727273	85.98726115	37.36664075	-32.50977019
Epochs 180	0.678899109	2.5	5	92.40506329	48.71794872	45	85.44303797	-62.59048182	-40.19620025	0.744292259	12.5	8.333333333	90.28571429	56.25	83.33333333	85.63218391	-68.92431166	-32.50977019
Epochs 200	0.775229335	3.703703704	9.090909091	92.77777778	51.85185185	54.54545455	86.03351955	-7.036786109	-40.19620025	0.83561641	19.04761905	33.33333333	91.28205128	57.14285714	100	86.08247423	84.27723435	-32.50977019

Table 7-1 Results of Experiment for CNN Model Trained Using Cyclic Stocks, Using Image Representation Input

Kweichow Moutai Co., Ltd. Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.053140096	5.945945946	0	0	42.39130435	36.36363636	0	1293.264993	1666.892281	0.043269232	4.838709677	0	0	40	45.45454545	0	727.8338785	678.7940879
Epochs 40	0.082125604	10.30927835	6.363636364	0	50.51546392	47.70642202	0	4156.995761	1666.892281	0.07692308	9.195402299	6.611570248	0	43.67816092	48.33333333	0	335.3668148	678.7940879
Epochs 60	0.096618354	11.68831169	8.461538462	0	57.14285714	48.0620155	0	1422.974524	1666.892281	0.067307696	9.090909091	5.633802817	0	50	48.22695035	0	246.8702455	678.7940879
Epochs 80	0.149758458	12	8.474576271	85.71428571	53.33333333	47.00854701	78.57142857	1019.218952	1666.892281	0.129807696	9.677419355	5.426356589	82.35294118	50	50	70.58823529	294.0562419	678.7940879
Epochs 100	0.260869563	13.63636364	8	90.24390244	54.54545455	50.50505051	87.80487805	1190.243839	1666.892281	0.259615391	11.53846154	6.25	93.18181818	53.84615385	48.64864865	84.09090909	463.2593698	678.7940879
Epochs 120	0.270531386	12.5	8.080808081	90.90909091	54.6875	47.95918367	86.36363636	675.2710469	1666.892281	0.346153855	12.76595745	7.070707071	95.16129032	55.31914894	50.50505051	90.16393443	512.6666141	678.7940879
Epochs 140	0.376811594	13.20754717	9.411764706	91.30434783	54.71698113	48.23529412	86.76470588	1207.666505	1666.892281	0.427884609	11.9047619	8.235294118	95.0617284	54.76190476	54.11764706	91.25	395.5443876	678.7940879
Epochs 160	0.439613521	14.89361702	9.333333333	90.58823529	55.31914894	46.66666667	86.9047619	1096.912858	1666.892281	0.456730783	11.11111111	8.536585366	93.33333333	58.33333333	54.87804878	88.76404494	429.2308278	678.7940879
Epochs 180	0.516908228	14.89361702	11.66666667	93	55.31914894	45	87.87878788	1271.23794	1666.892281	0.538461566	11.76470588	6.666666667	91.22807018	58.82352941	56.66666667	86.72566372	364.6057792	678.7940879
Epochs 200	0.589371979	15.38461538	10.86956522	90.98360656	56.41025641	36.95652174	85.95041322	880.1742882	1666.892281	0.639423072	12	8.695652174	91.97080292	68	63.04347826	86.02941176	320.9025227	678.7940879
Midea Group Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.067632847	5.960264901	8.928571429	0	48.66666667	51.78571429	0	17756.56373	1245.275482	0.043269232	4.545454545	3.703703704	0	43.79084967	46.2962963	0	74.45148628	468.5733088
Epochs 40	0.178743958	7.547169811	8	88.46153846	56.19047619	52	88.46153846	26739.65211	1245.275482	0.225961536	6.862745098	2.941176471	100	46.07843137	49.25373134	94.73684211	153.0369662	468.5733088
Epochs 60	0.106280193	6.18556701	7.142857143	75	54.63917526	51.54639175	75	2666.663841	1245.275482	0.163461536	8.75	2.941176471	92.30769231	51.25	49.5049505	84.61538462	86.94981131	468.5733088
Epochs 80	0.212560385	7.207207207	8.333333333	86.11111111	54.95495495	52.54237288	77.77777778	35394.20887	1245.275482	0.245192304	6.666666667	3.333333333	97.6744186	48.57142857	51.66666667	90.47619048	57.0352015	468.5733088
Epochs 100	0.227053136	9.090909091	9.210526316	96.875	58.58585859	56	87.5	21977.02164	1245.275482	0.182692304	6.315789474	2.5	90.90909091	48.42105263	50	81.25	-24.87378023	468.5733088
Epochs 120	0.256038636	7.446808511	10	90.69767442	56.38297872	55.07246377	83.72093023	16526.56435	1245.275482	0.283653855	3.703703704	2.985074627	90	48.75	50.74626866	81.66666667	5.796280984	468.5733088
Epochs 140	0.314009666	8.163265306	11.11111111	92.72727273	55.10204082	56.60377358	85.45454545	12053.9056	1245.275482	0.326923072	3.409090909	2.040816327	90.14084507	45.97701149	57.14285714	81.69014085	15.51363893	468.5733088
Epochs 160	0.410628021	8.974358974	12	91.13924051	58.97435897	55.10204082	82.27848101	22800.1985	1245.275482	0.418269217	3.896103896	2.5	91.20879121	48.68421053	57.5	84.61538462	112.005591	468.5733088
Epochs 180	0.38164252	7.246376812	11.11111111	89.33333333	56.52173913	56.4516129	82.66666667	2307.335473	1245.275482	0.370192319	4.838709677	4.285714286	93.42105263	50.81967213	52.85714286	84.21052632	136.7149458	468.5733088
Epochs 200	0.574879229	5.660377358	8	88.37209302	56.60377358	54.16666667	78.29457364	31590.32891	1245.275482	0.682692289	4.651162791	6.25	93.2885906	52.38095238	56.25	86.57718121	384.57319	468.5733088
Walmart Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.729357779	4.761904762	14.70588235	93.86503067	47.61904762	58.82352941	88.27160494	28.33575519	9380.979094	0.639269412	9.677419355	8.888888889	93.00699301	48.38709677	44.44444444	85.91549296	13.53306887	255.7316817
Epochs 40	0.211009175	3.03030303	6.306306306	90.24390244	50	42.72727273	85.36585366	145.9623946	9380.979094	0.242009133	6.818181818	6.976744186	91.11111111	53.40909091	48.8372093	79.54545455	467.1358722	255.7316817
Epochs 60	0.110091746	6.25	6.422018349	84.61538462	53.125	45.37037037	76.92307692	517.5494573	9380.979094	0.09589041	4.958677686	5.747126437	90.90909091	53.33333333	45.97701149	81.81818182	244.1973899	255.7316817

Epochs 80	0.151376143	4.054054054	5.982905983	85.18518519	55.40540541	43.10344828	81.48148148	453.6841552	9380.979094	0.155251145	6.315789474	6.12244898	84.61538462	54.25531915	44.89795918	80.76923077	216.579807	255.7316817
Epochs 100	0.284403682	4.347826087	6.666666667	89.83050847	53.62318841	42.22222222	81.03448276	308.0428356	9380.979094	0.319634706	6.976744186	5.882352941	92.30769231	51.76470588	45.58823529	89.23076923	371.9097033	255.7316817
Epochs 120	0.417431206	4.444444444	7.228915663	92.22222222	51.11111111	43.37349398	80.8988764	81.85363947	9380.979094	0.433789968	7.692307692	6.451612903	93.47826087	50	48.38709677	86.95652174	222.2328686	255.7316817
Epochs 140	0.527522922	6	9.259259259	93.85964912	58	48.14814815	84.95575221	26.19862937	9380.979094	0.506849289	7.352941176	9.302325581	94.44444444	48.52941176	46.51162791	88.78504673	160.4745187	255.7316817
Epochs 160	0.69266057	6.666666667	6.666666667	93.03797468	46.66666667	43.33333333	85.35031847	70.66074201	9380.979094	0.680365324	10.25641026	10.34482759	94.0397351	43.58974359	48.27586207	87.33333333	-95.16023024	255.7316817
Epochs 180	0.798165143	12.5	0	92.47311828	50	43.75	84.86486486	107.2159474	9380.979094	0.767123282	5.263157895	13.04347826	92.65536723	36.84210526	47.82608696	85.79545455	102.2484212	255.7316817
Epochs 200	0.788990855	12.5	4.761904762	93.37016575	50	42.85714286	85.55555556	80.77473174	9380.979094	0.735159814	4.166666667	11.53846154	92.89940828	33.33333333	50	86.30952381	-93.08795429	255.7316817
Fresh Del Monte Produce Inc (small cap) Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.325688064	4.081632653	8.510638298	86.30136986	41.83673469	46.80851064	80.55555556	86.7448441	5.320148705	0.378995448	5.747126437	8.163265306	89.15662651	56.97674419	57.14285714	81.92771084	2230.644502	-65.97131265
Epochs 40	0.201834857	6.818181818	7.52688172	83.78378378	42.04545455	47.31182796	77.77777778	22.42368076	5.320148705	0.19178082	6.976744186	6.060606061	88.23529412	55.29411765	45.45454545	85.29411765	-34.04062489	-65.97131265
Epochs 60	0.233944952	7.142857143	6.837606838	86.66666667	42.85714286	46.55172414	77.77777778	730.3012492	5.320148705	0.223744288	7.936507937	6.086956522	90.24390244	61.29032258	46.95652174	82.92682927	234.0586602	-65.97131265
Epochs 80	0.238532111	5.769230769	6.779661017	85.41666667	42.30769231	45.2991453	75	-42.71002699	5.320148705	0.264840186	8.620689655	6.363636364	90.19607843	63.79310345	49.09090909	82	309.2202896	-65.97131265
Epochs 100	0.334862381	8.064516129	7.865168539	91.04477612	41.93548387	47.19101124	81.81818182	9.881490819	5.320148705	0.383561641	10.34482759	6.25	90.12345679	62.06896552	47.5	80	180.8030439	-65.97131265
Epochs 120	0.431192666	5.660377358	8.571428571	89.47368421	39.62264151	54.28571429	81.91489362	-50.51265523	5.320148705	0.474885851	12	7.352941176	92.07920792	60	50	81	754.883604	-65.97131265
Epochs 140	0.56422019	5.128205128	10	89.92248062	38.46153846	60	83.59375	-81.58173783	5.320148705	0.602739751	11.62790698	9.523809524	91.79104478	62.79069767	57.14285714	82.70676692	674.823591	-65.97131265
Epochs 160	0.720183492	5.555555556	12.12121212	91.01796407	44.44444444	63.63636364	84.93975904	18.47073826	5.320148705	0.739726007	18.18181818	7.407407407	91.76470588	68.18181818	59.25925926	82.84023669	774.0764554	-65.97131265
Epochs 180	0.720183492	6.25	9.090909091	90.53254438	43.75	60.60606061	85.11904762	85.10202203	5.320148705	0.748858452	20	7.407407407	91.86046512	80	55.55555556	83.62573099	1437.861942	-65.97131265
Epochs 200	0.775229335	8.333333333	12	91.16022099	41.66666667	64	85	569.0665047	5.320148705	0.79908675	21.42857143	10	91.89189189	71.42857143	60	83.69565217	739.6868125	-65.97131265

Table 7-2 Results of Experiment for CNN Model Trained Using Non-Cyclic Stocks, Using Image Representation Input

Singapore Airlines Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.16055046	8.108108108	8.045977011	95	50	48.27586207	85	-90.43181113	-64.15459983	0.125581399	5.46875	10.95890411	85.71428571	46.09375	58.33333333	85.71428571	-85.8971715	-78.23835547
Epochs 40	0.215596333	9.278350515	9.782608696	100	53.125	52.17391304	86.20689655	-83.70670631	-64.15459983	0.153488368	5.785123967	11.68831169	100	47.10743802	60.52631579	94.11764706	-87.98062242	-78.23835547
Epochs 60	0.238532111	9.278350515	9.411764706	97.22222222	53.125	50.58823529	83.33333333	-87.04093126	-64.15459983	0.213953495	5.93220339	13.63636364	96.77419355	47.45762712	64.61538462	90.32258065	-85.39741012	-78.23835547
Epochs 80	0.238532111	8.602150538	10.11235955	97.22222222	53.26086957	51.68539326	88.88888889	-82.71875035	-64.15459983	0.204651162	6.034482759	11.5942029	96.66666667	47.4137931	61.76470588	90	-89.32683173	-78.23835547
Epochs 100	0.275229365	8.988764045	9.638554217	95.65217391	53.40909091	53.01204819	84.7826087	-75.37630593	-64.15459983	0.28372094	6.481481481	13.33333333	97.87234043	48.14814815	62.71186441	89.36170213	-85.22735064	-78.23835547
Epochs 120	0.311926603	9.756097561	9.756097561	96.2962963	51.85185185	53.65853659	81.48148148	-74.49330037	-64.15459983	0.316279083	5.714285714	14.81481481	96.42857143	47.61904762	67.9245283	87.5	-81.96876083	-78.23835547
Epochs 140	0.330275238	10.38961039	9.638554217	96.55172414	53.94736842	53.01204819	86.20689655	-51.85639548	-64.15459983	0.339534879	5.940594059	13.7254902	95.23809524	48.51485149	68	87.3015873	-83.14175226	-78.23835547
Epochs 160	0.408256888	12.12121212	10.38961039	97.33333333	55.38461538	54.54545455	85.33333333	-36.53421253	-64.15459983	0.38139534	6.25	14.89361702	95.83333333	48.95833333	67.39130435	90.27777778	-84.49885757	-78.23835547
Epochs 180	0.408256888	11.76470588	10.66666667	97.33333333	55.2238806	54.66666667	86.66666667	-36.13755108	-64.15459983	0.390697688	6.315789474	15.2173913	95.94594595	49.47368421	66.66666667	90.54054054	-83.23789988	-78.23835547
Epochs 200	0.463302761	10.52631579	11.42857143	95.6043956	53.57142857	54.28571429	84.61538462	-36.50150308	-64.15459983	0.455813944	7.058823529	13.15789474	94.56521739	50.58823529	70.27027027	88.04347826	-89.29168938	-78.23835547
OCBC Bank Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.096330278	5.681818182	7.5	70	55.68181818	51.2605042	70	-96.00201822	-55.90202866	0.153488368	7.920792079	9.278350515	94.11764706	52.47524752	55.20833333	88.23529412	-8.626881147	-24.56291964
Epochs 40	0.123853214	6.896551724	7.692307692	85.71428571	55.17241379	52.5862069	85.71428571	-92.01681918	-55.90202866	0.186046511	7.52688172	9.278350515	96	51.61290323	56.25	92	-26.13568517	-24.56291964
Epochs 60	0.151376143	7.608695652	8.333333333	94.44444444	55.43478261	52.3364486	88.88888889	-74.51354276	-55.90202866	0.200000003	7.368421053	8.045977011	87.87878788	50.52631579	56.97674419	87.87878788	-51.19238704	-24.56291964
Epochs 80	0.174311921	8.139534884	8.181818182	100	55.81395349	51.37614679	86.36363636	-96.5364905	-55.90202866	0.218604654	7.777777778	8.888888889	91.42857143	52.22222222	57.30337079	85.71428571	-63.21971831	-24.56291964
Epochs 100	0.192660555	7.142857143	6.930693069	87.87878788	54.76190476	53	78.78787879	-75.44977596	-55.90202866	0.265116274	7.954545455	8.75	91.4893617	52.27272727	59.49367089	87.23404255	-57.63471831	-24.56291964
Epochs 120	0.188073397	6.818181818	7.070707071	90.32258065	53.40909091	52.04081633	83.87096774	-91.15742251	-55.90202866	0.246511623	8.510638298	8.641975309	95	53.19148936	57.5	90	-61.48531303	-24.56291964
Epochs 140	0.24311927	7.692307692	7.291666667	90.90909091	53.84615385	52.63157895	84.09090909	-51.1459629	-55.90202866	0.297674417	8.988764045	8.450704225	90.90909091	53.93258427	55.71428571	85.45454545	-60.03299774	-24.56291964
Epochs 160	0.288990825	8.108108108	7.777777778	92.59259259	51.35135135	55.05617978	85.18518519	-60.16746693	-55.90202866	0.339534879	9.302325581	9.230769231	92.1875	53.48837209	53.125	87.5	-52.76290511	-24.56291964
Epochs 180	0.412844032	8.771929825	7.894736842	92.94117647	54.38596491	54.66666667	85.88235294	-46.36819256	-55.90202866	0.479069769	7.936507937	11.53846154	92	53.96825397	54.90196078	88	-23.33028408	-24.56291964
Epochs 200	0.472477078	5.769230769	9.375	92.15686275	53.84615385	61.9047619	86.2745098	-70.99238654	-55.90202866	0.544186056	7.547169811	13.04347826	92.24137931	58.49056604	55.55555556	88.79310345	-20.70245886	-24.56291964
CNOOC Limited Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.104265399	4.807692308	6.315789474	91.66666667	51.92307692	56.38297872	66.66666667	111.3496659	-54.68960087	0.10798122	6.140350877	8.791208791	100	47.36842105	52.22222222	100	-61.21404657	-84.2898875
Epochs 40	0.123222746	5.102040816	5.319148936	84.21052632	54.08163265	58.06451613	63.15789474	326.2034894	-54.68960087	0.17840375	7	8.888888889	100	48	53.93258427	82.60869565	-66.10112633	-84.2898875
Epochs 60	0.17061612	5.434782609	5.617977528	86.66666667	55.43478261	60.22727273	73.33333333	344.4139844	-54.68960087	0.234741777	7.692307692	9.195402299	100	48.35164835	53.48837209	85.71428571	-86.72152534	-84.2898875

Epochs 80	0.17061612	5.494505495	7.368421053	96	56.04395604	59.57446809	80	411.9733391	-54.68960087	0.239436626	7.608695652	9.411764706	100	48.91304348	53.57142857	86.11111111	-85.75324917	-84.2898875
Epochs 100	0.175355449	5.681818182	6.382978723	89.65517241	56.81818182	58.06451613	75.86206897	442.3483452	-54.68960087	0.267605633	7.954545455	9.638554217	100	48.86363636	52.43902439	80.95238095	-86.8251846	-84.2898875
Epochs 120	0.222748816	5.952380952	7.865168539	92.10526316	55.95238095	59.09090909	81.57894737	436.1662043	-54.68960087	0.300469488	7.228915663	10.12658228	98.03921569	46.98795181	51.28205128	78.43137255	-86.66915502	-84.2898875
Epochs 140	0.218009472	5.882352941	7.777777778	94.44444444	56.47058824	58.42696629	83.33333333	570.4534347	-54.68960087	0.319248825	7.228915663	10.66666667	98.18181818	46.98795181	52.7027027	80	-78.64545243	-84.2898875
Epochs 160	0.298578203	5.797101449	7.228915663	89.83050847	56.52173913	58.53658537	81.3559322	913.3729288	-54.68960087	0.370892018	6.756756757	10.14492754	95.71428571	44.59459459	52.94117647	81.42857143	-87.67376847	-84.2898875
Epochs 180	0.34123224	4.285714286	8.450704225	90	54.28571429	60	82.85714286	925.1040485	-54.68960087	0.43192488	6.666666667	12.96296296	95.23809524	45.33333333	56.60377358	82.14285714	-78.90306656	-84.2898875
Epochs 200	0.374407589	4.109589041	8.474576271	89.87341772	52.05479452	65.51724138	84.81012658	709.03197	-54.68960087	0.474178404	6.944444444	13.33333333	93.75	45.83333333	54.54545455	83.33333333	-71.59384464	-84.2898875
JP Morgan Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.174311921	11.9047619	3.703703704	92.30769231	50	47.6635514	84.61538462	2686.733592	1576.179166	0.205479458	9.259259259	11.9047619	92.59259259	49.53271028	52.38095238	81.48148148	85.78327969	-31.90034799
Epochs 40	0.142201841	12.04819277	3.47826087	85	50.60240964	48.24561404	75	1904.330496	1576.179166	0.187214613	9.615384615	10.86956522	91.30434783	51.45631068	53.26086957	86.95652174	21.16090477	-31.90034799
Epochs 60	0.192660555	11.23595506	4.04040404	93.33333333	49.43820225	50	80	387.2303786	1576.179166	0.223744288	8.849557522	13.15789474	96.66666667	50	59.21052632	93.33333333	41.47220835	-31.90034799
Epochs 80	0.224770635	11.49425287	4.255319149	94.59459459	50.57471264	48.38709677	72.97297297	1137.499394	1576.179166	0.273972601	8.928571429	15.15151515	97.56097561	50.45045045	60.60606061	95.12195122	29.57345544	-31.90034799
Epochs 100	0.201834857	10.22727273	4.166666667	91.17647059	51.13636364	48.42105263	73.52941176	1135.765385	1576.179166	0.273972601	9.259259259	14.28571429	97.56097561	50.46728972	61.42857143	95.12195122	26.98483473	-31.90034799
Epochs 120	0.302752286	10.11235955	5.479452055	94.64285714	53.93258427	45.20547945	83.63636364	1483.318601	1576.179166	0.351598173	9.900990099	15.51724138	96.66666667	50	63.79310345	88.33333333	57.32471642	-31.90034799
Epochs 140	0.348623842	10.58823529	5.970149254	95.45454545	54.11764706	44.7761194	87.69230769	1058.339819	1576.179166	0.365296811	10.30927835	12.72727273	94.02985075	48.95833333	61.81818182	86.56716418	61.35539896	-31.90034799
Epochs 160	0.37155962	11.68831169	5.714285714	95.77464789	55.84415584	46.37681159	87.32394366	1024.386947	1576.179166	0.392694056	9.411764706	11.11111111	90	47.61904762	57.40740741	83.75	32.42420188	-31.90034799
Epochs 180	0.394495428	10.81081081	6.060606061	94.87179487	56.75675676	46.15384615	85.8974359	1375.852629	1576.179166	0.420091331	5.633802817	11.11111111	87.23404255	42.85714286	55.55555556	80.85106383	56.14270757	-31.90034799
Epochs 200	0.366972476	10.46511628	6.451612903	95.71428571	52.3255814	50.81967213	90	1172.864115	1576.179166	0.383561641	7.228915663	11.11111111	87.80487805	43.90243902	53.7037037	81.70731707	51.16577295	-31.90034799
American Axle (small cap) Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.100917429	4.424778761	7.446808511	90.90909091	43.36283186	51.61290323	63.63636364	-72.43222034	-40.19620025	0.12328767	10.18518519	7	81.81818182	52.3364486	60	72.72727273	825.5661842	-32.50977019
Epochs 40	0.142201841	4.716981132	7.608695652	95	45.28301887	53.84615385	90	-48.2651554	-40.19620025	0.155251145	10.89108911	7.920792079	88.23529412	56	58.41584158	82.35294118	1462.746226	-32.50977019
Epochs 60	0.16055046	3.80952381	7.142857143	86.20689655	44.76190476	53.01204819	79.31034483	-45.95110161	-40.19620025	0.200913236	10.67961165	8.988764045	92.59259259	54.90196078	64.04494382	85.18518519	2062.290974	-32.50977019
Epochs 80	0.192660555	3.921568627	7.5	88.88888889	45.09803922	53.16455696	80.55555556	-45.93535528	-40.19620025	0.210045666	10.78431373	8.139534884	90.32258065	55.44554455	65.11627907	83.87096774	1435.650749	-32.50977019
Epochs 100	0.192660555	3.96039604	7.5	86.48648649	45.54455446	53.16455696	78.37837838	-45.93535528	-40.19620025	0.228310496	11.2244898	10	96.77419355	55.67010309	63.33333333	90.32258065	1558.308505	-32.50977019
Epochs 120	0.224770635	4.12371134	7.894736842	86.66666667	46.39175258	53.33333333	80	-51.32562588	-40.19620025	0.260273963	10.52631579	10.71428571	95	55.31914894	63.0952381	90	1378.858301	-32.50977019
Epochs 140	0.24311927	4.081632653	8.333333333	89.58333333	44.89795918	53.52112676	83.33333333	-65.53586503	-40.19620025	0.264840186	9.574468085	8.974358974	89.36170213	54.83870968	65.38461538	87.23404255	1480.190805	-32.50977019

Epochs 160	0.302752286	4.545454545	7.575757576	89.0625	45.45454545	55.38461538	82.8125	-59.48090373	-40.19620025	0.378995448	10.81081081	9.85915493	91.89189189	52.05479452	66.1971831	87.83783784	10.80464557	-32.50977019
Epochs 180	0.316513747	4.494382022	7.936507937	90.90909091	44.94382022	54.83870968	83.33333333	-66.64636275	-40.19620025	0.392694056	10.66666667	9.230769231	91.13924051	54.05405405	64.61538462	88.60759494	-71.28744091	-32.50977019
Epochs 200	0.348623842	4.705882353	8.333333333	91.78082192	45.88235294	54.23728814	83.56164384	-66.20732225	-40.19620025	0.424657524	10.44776119	11.76470588	92.85714286	55.2238806	63.23529412	90.36144578	-59.65493119	-32.50977019

Table 7-3 Results of Experiment for CNN Model Trained Using Cyclic Stocks, Using Time Series Representation Input

Kweichow Moutai Co., Ltd. Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Test accuracy	Correct buys	Test accuracy	Correct buys	Test accuracy	Correct buys	Test accuracy	Correct buys	Test accuracy	Correct buys	Test accuracy	Correct buys	Test accuracy	Correct buys	Test accuracy	Correct buys
Epochs 20	0.159420297	15.27777778	7.5	86.66666667	56.94444444	47.05882353	80	1382.878533	1666.892281	0.168269232	11.47540984	7.086614173	95	55.73770492	48.41269841	75	200.2504709	678.7940879
Epochs 40	0.164251208	14.28571429	7.826086957	93.33333333	58.44155844	48.24561404	80	1518.915834	1666.892281	0.168269232	11.29032258	7.142857143	95	58.06451613	49.6	90	195.596219	678.7940879
Epochs 60	0.227053136	14.49275362	8.333333333	93.33333333	59.42028986	46.72897196	83.33333333	2697.467208	1666.892281	0.230769232	12.72727273	7.5	96.96969697	56.36363636	50	90.625	244.7776165	678.7940879
Epochs 80	0.236714974	15.15151515	8.333333333	90.90909091	62.12121212	45.79439252	84.84848485	2789.902737	1666.892281	0.235576928	13.20754717	7.438016529	97.05882353	58.49056604	49.58677686	93.93939394	246.6399028	678.7940879
Epochs 100	0.251207739	14.51612903	8.411214953	89.47368421	62.90322581	45.28301887	81.57894737	1389.867796	1666.892281	0.25	14	7.438016529	97.2972973	60	49.58677686	91.66666667	236.7233611	678.7940879
Epochs 120	0.280193239	11.53846154	8.571428571	86	59.61538462	47.11538462	78	1485.480148	1666.892281	0.288461536	17.5	7.317073171	97.77777778	62.5	49.18032787	93.33333333	215.9423418	678.7940879
Epochs 140	0.280193239	12.06896552	8.910891089	87.5	60.34482759	46	81.25	1681.144485	1666.892281	0.288461536	14.89361702	7.75862069	97.77777778	61.70212766	50	93.18181818	210.6404838	678.7940879
Epochs 160	0.299516916	10.52631579	9.375	87.03703704	59.64912281	48.42105263	81.48148148	1640.095163	1666.892281	0.322115391	16.27906977	6.422018349	94.64285714	65.11627907	47.70642202	90.90909091	201.3312251	678.7940879
Epochs 180	0.318840593	11.47540984	10	89.28571429	57.37704918	44.94382022	85.71428571	3080.558939	1666.892281	0.322115391	15.55555556	6.542056075	94.64285714	62.22222222	48.59813084	89.09090909	204.7660409	678.7940879
Epochs 200	0.33816424	11.47540984	9.523809524	88.70967742	55.73770492	45.78313253	85.48387097	3080.558939	1666.892281	0.360576928	15	6.862745098	93.93939394	62.5	50	87.69230769	204.7660409	678.7940879
Midea Group Model	Non-Recession									Recession								
	Non-Recession	Recession	Non-Recession	Recession	Non-Recession	Recession	Non-Recession	Recession	Non-Recession	Recession	Non-Recession	Recession	Non-Recession	Recession	Non-Recession	Recession	Non-Recession	Recession
Epochs 20	0.091787443	6.306306306	6.741573034	85.71428571	53.63636364	49.43820225	85.71428571	48255.34479	1245.275482	0.07692308	6.12244898	3.846153846	100	47.95918367	48.54368932	100	27.72792588	468.5733088
Epochs 40	0.14009662	7.070707071	7.954545455	75	57.14285714	55.68181818	65	34449.17144	1245.275482	0.15384616	7.594936709	3.80952381	91.66666667	53.16455696	49.03846154	83.33333333	97.65922639	468.5733088
Epochs 60	0.285024166	9.302325581	9.589041096	91.66666667	60	57.53424658	75	38838.55385	1245.275482	0.307692319	9.230769231	3.571428571	93.22033898	58.46153846	51.80722892	91.52542373	67.27789273	468.5733088
Epochs 80	0.280193239	10.75268817	10.95890411	97.56097561	61.95652174	60.2739726	75.6097561	71465.25214	1245.275482	0.331730783	10.76923077	4.87804878	95.08196721	64.61538462	53.65853659	90	13.00803022	468.5733088
Epochs 100	0.285024166	10.63829787	11.26760563	97.61904762	62.3655914	60.56338028	73.80952381	67482.24562	1245.275482	0.346153855	10.9375	5	95.3125	64.0625	56.25	88.88888889	28.56562937	468.5733088
Epochs 120	0.314009666	12.04819277	10.52631579	97.91666667	63.41463415	60.52631579	75	90012.11542	1245.275482	0.375	11.76470588	4.761904762	93.15068493	66.66666667	55.95238095	86.11111111	27.49452709	468.5733088
Epochs 140	0.36714977	11.11111111	9.836065574	93.84615385	63.75	59.01639344	75.38461538	62500.02629	1245.275482	0.418269217	11.32075472	5.479452055	93.90243902	67.9245283	56.16438356	86.41975309	45.50062236	468.5733088
Epochs 160	0.415458947	11.26760563	10.16949153	93.50649351	64.28571429	57.62711864	76.62337662	225272.5129	1245.275482	0.4375	11.11111111	5.333333333	93.18181818	66.66666667	54.66666667	85.05747126	36.01604584	468.5733088
Epochs 180	0.405797094	10.66666667	10.52631579	93.33333333	62.16216216	56.14035088	78.66666667	4614.569776	1245.275482	0.4375	10.41666667	5.555555556	93.18181818	68.75	55.55555556	86.20689655	35.19331599	468.5733088

Epochs 200	0.473429948	10.52631579	9.259259259	90.625	64.28571429	55.55555556	77.08333333	869.3125465	1245.275482	0.5	12.5	4.615384615	93.2038835	67.5	52.30769231	86.2745098	7.561789815	468.5733088
Walmart Model	Non-Recession									Recession								
	Non-Recession	Recession	Non-Recession	Recession	Non-Recession	Recession	Non-Recession	Recession	Non-Recession	Recession	Non-Recession	Recession	Non-Recession	Recession	Non-Recession	Recession	Non-Recession	Recession
Epochs 20	0.174311921	5.194805195	6.306306306	90	50.64935065	46.36363636	76.66666667	44.4170561	9380.979094	0.19178082	5.434782609	10.20408163	93.10344828	51.64835165	48.97959184	86.20689655	178.530685	255.7316817
Epochs 40	0.142201841	4.109589041	5.833333333	84	53.42465753	45.37815126	76	19.46757958	9380.979094	0.187214613	6.52173913	10.67961165	100	51.64835165	47.57281553	91.66666667	3803.455976	255.7316817
Epochs 60	0.197247714	5.714285714	6.194690265	91.42857143	54.28571429	46.42857143	85.71428571	86.64292753	9380.979094	0.210045666	6.451612903	11.45833333	96.66666667	52.17391304	47.91666667	86.66666667	3837.589802	255.7316817
Epochs 80	0.233944952	5.970149254	6.542056075	90.90909091	58.20895522	47.16981132	81.81818182	40.34316183	9380.979094	0.237442926	6.666666667	11.82795699	97.22222222	52.80898876	49.46236559	88.88888889	7540.433655	255.7316817
Epochs 100	0.220183492	5.172413793	6.611570248	94.87179487	60.34482759	45.83333333	92.30769231	88.07095524	9380.979094	0.228310496	7.142857143	10.78431373	100	55.42168675	45.09803922	90.90909091	7770.036888	255.7316817
Epochs 120	0.238532111	6.349206349	6.363636364	91.11111111	60.31746032	46.36363636	81.81818182	92.61054198	9380.979094	0.260273963	6.666666667	12.5	97.56097561	52.80898876	48.86363636	85.36585366	9743.008538	255.7316817
Epochs 140	0.24311927	6.349206349	5.607476636	89.58333333	58.73015873	46.72897196	80.85106383	192.16328	9380.979094	0.310502291	7.058823529	13.25301205	100	51.19047619	48.19277108	88.23529412	8509.006584	255.7316817
Epochs 160	0.316513747	5.454545455	6.18556701	90.90909091	58.18181818	46.39175258	81.53846154	418.2246253	9380.979094	0.388127863	7.894736842	13.69863014	98.57142857	54.66666667	50.68493151	90	8085.687317	255.7316817
Epochs 180	0.37155962	3.636363636	6.25	89.15662651	54.54545455	48.75	81.70731707	277.027448	9380.979094	0.470319629	8.219178082	17.54385965	97.75280899	56.94444444	52.63157895	89.88764045	11351.21962	255.7316817
Epochs 200	0.444954127	4.444444444	5.479452055	91	57.77777778	47.94520548	84.84848485	55.47017689	9380.979094	0.520547926	9.523809524	15.09433962	97.08737864	61.29032258	54.71698113	90.29126214	14213.45704	255.7316817
Fresh Del Monte Produce Inc (small cap) Model	Non-Recession									Recession								
	Non-Recession	Recession	Non-Recession	Recession	Non-Recession	Recession	Non-Recession	Recession	Non-Recession	Recession	Non-Recession	Recession	Non-Recession	Recession	Non-Recession	Recession	Non-Recession	Recession
Epochs 20	0.192660555	10.41666667	9.183673469	95.83333333	51.04166667	49.48453608	91.66666667	95.90916894	5.320148705	0.19178082	9.090909091	7.619047619	100	56.32183908	46.66666667	92.30769231	189.0597408	-65.97131265
Epochs 40	0.206422016	10.75268817	9.183673469	96.2962963	53.76344086	51.54639175	85.18518519	206.6924238	5.320148705	0.200913236	9.677419355	8.163265306	96.42857143	56.52173913	50	89.28571429	-37.71786327	-65.97131265
Epochs 60	0.215596333	10.98901099	10	100	56.04395604	54.54545455	92.59259259	381.5927694	5.320148705	0.223744288	10.86956522	8.333333333	100	56.04395604	48.95833333	90.32258065	25.18304539	-65.97131265
Epochs 80	0.220183492	10.98901099	10.1010101	100	58.24175824	54.08163265	89.28571429	494.5066254	5.320148705	0.228310496	10.75268817	8.510638298	100	56.52173913	48.93617021	90.625	29.45120466	-65.97131265
Epochs 100	0.25688073	12.32876712	9.345794393	97.36842105	63.01369863	53.77358491	86.84210526	736.4617831	5.320148705	0.246575341	10.52631579	7.843137255	92.68292683	60	50.98039216	78.04878049	46.92754989	-65.97131265
Epochs 120	0.252293587	12.04819277	9.183673469	97.2972973	61.44578313	52.57731959	86.48648649	577.4905455	5.320148705	0.278538823	10.46511628	9.195402299	95.65217391	61.17647059	54.02298851	78.26086957	50.21281448	-65.97131265
Epochs 140	0.279816508	10.97560976	9.89010989	95.55555556	59.75609756	54.44444444	86.66666667	358.141239	5.320148705	0.278538823	9.090909091	9.638554217	93.75	58.62068966	55.42168675	81.25	470.6863315	-65.97131265
Epochs 160	0.316513747	13.04347826	9.375	96.22641509	65.2173913	52.63157895	86.79245283	1023.550618	5.320148705	0.319634706	9.090909091	8.641975309	91.80327869	56.57894737	54.32098765	78.68852459	172.2184989	-65.97131265
Epochs 180	0.330275238	13.23529412	7.777777778	93.33333333	64.70588235	51.68539326	85	433.3654972	5.320148705	0.360730588	9.459459459	8.333333333	90.4109589	57.53424658	52.77777778	78.08219178	79.44077747	-65.97131265
Epochs 200	0.399082571	12.90322581	7.792207792	92.40506329	66.12903226	51.94805195	83.33333333	697.9024761	5.320148705	0.415525109	9.090909091	6.451612903	89.01098901	58.46153846	51.61290323	80.21978022	64.99823348	-65.97131265

Table 7-4 Results of Experiment for CNN Model Trained Using Non-Cyclic Stocks, Using Time Series Representation Input

8 Appendix 3

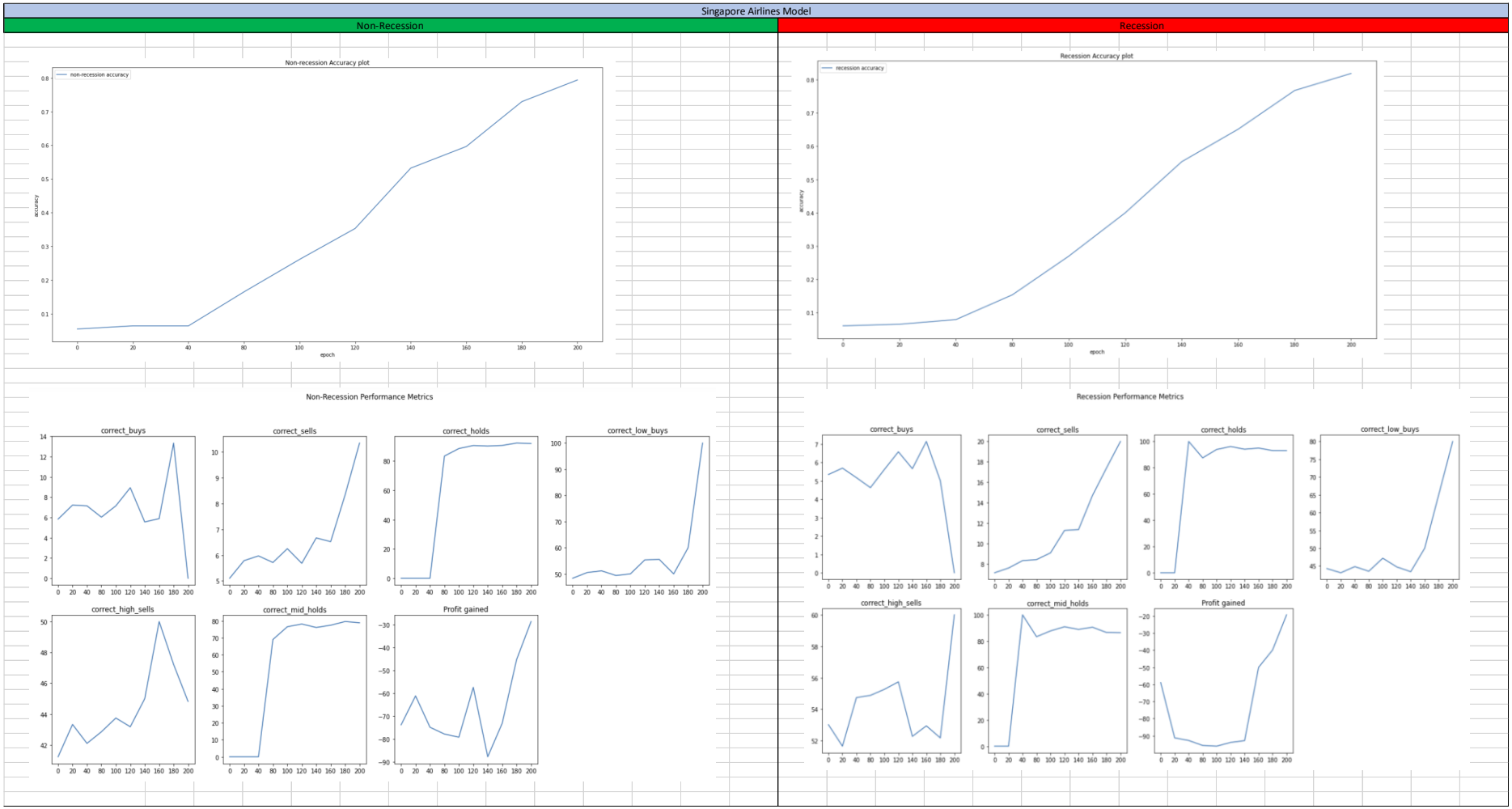


Figure 8-1 Image Representation Models Results

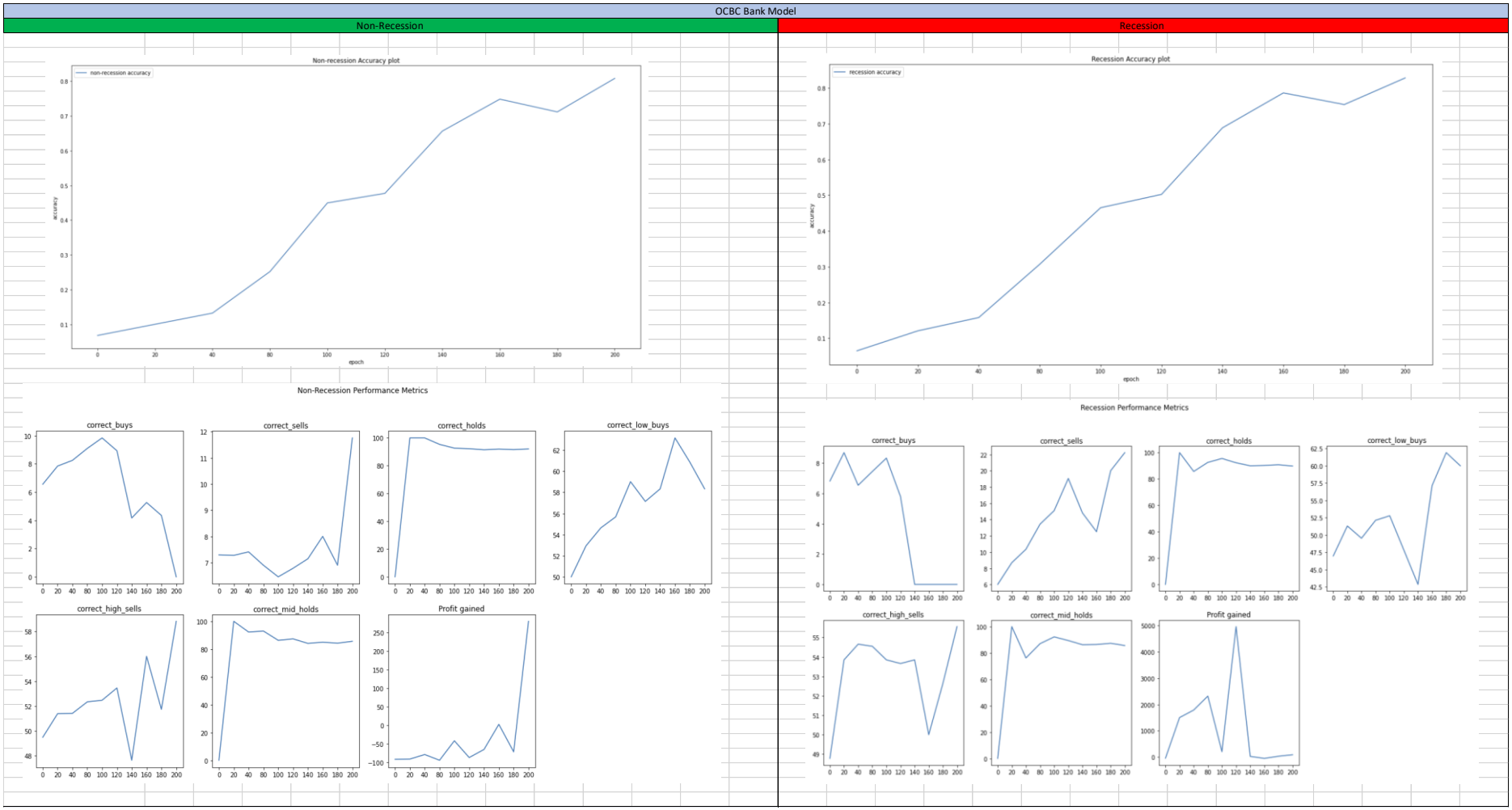


Figure 8-2 Image Representation Models Results

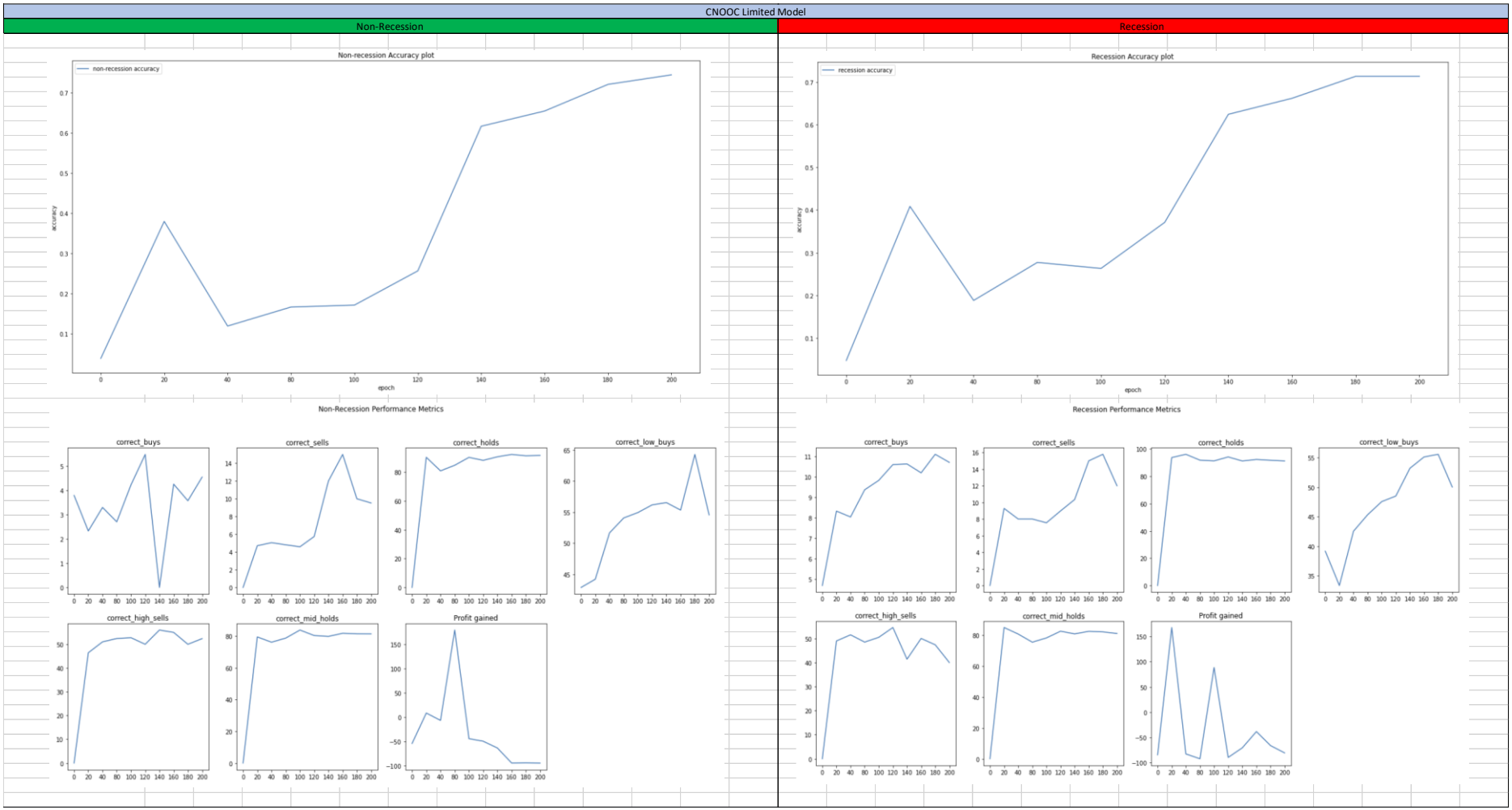


Figure 8-3 Image Representation Models Results

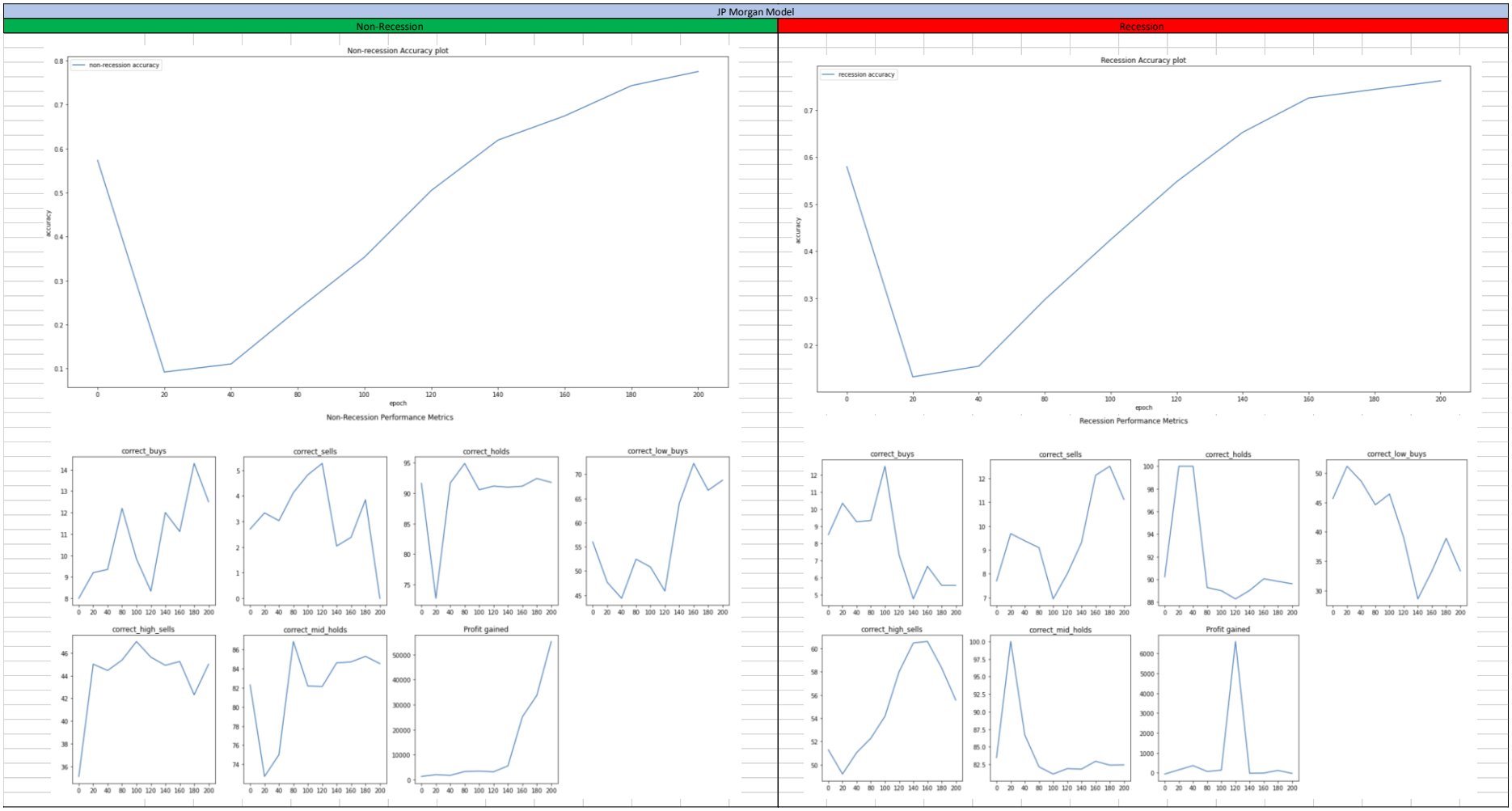


Figure 8-4 Image Representation Models Results

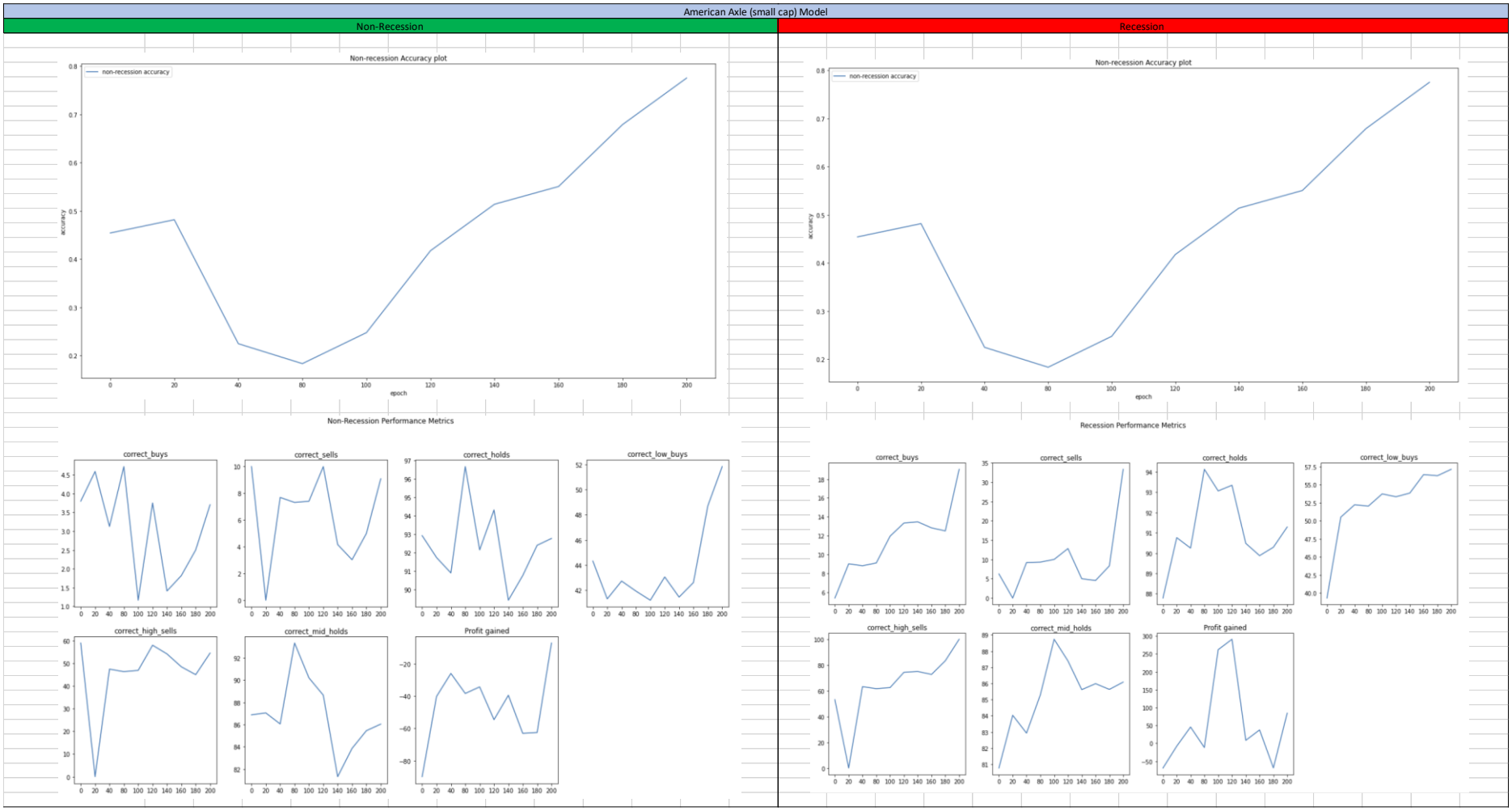


Figure 8-5 Image Representation Models Results

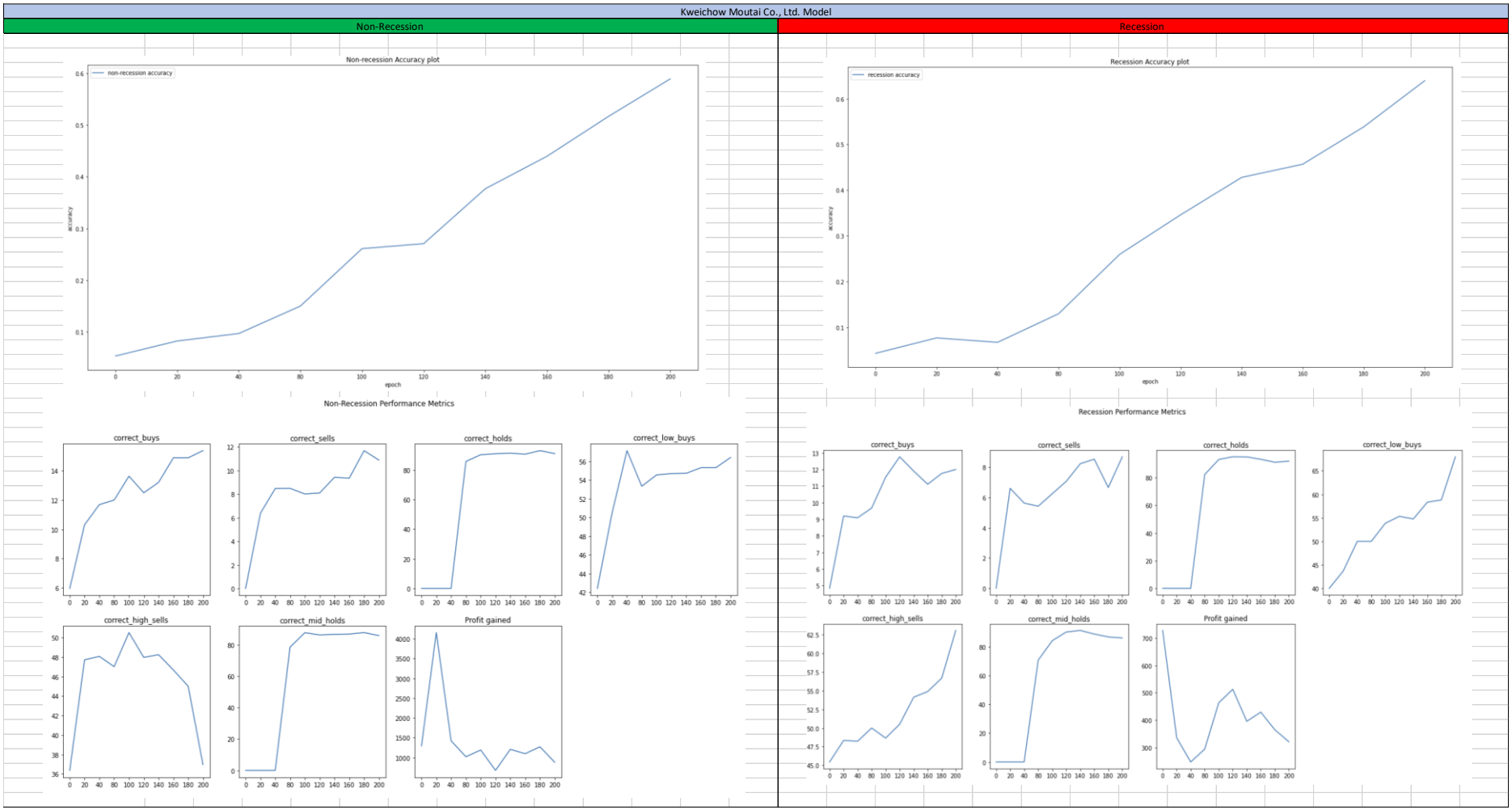


Figure 8-6 Image Representation Models Results

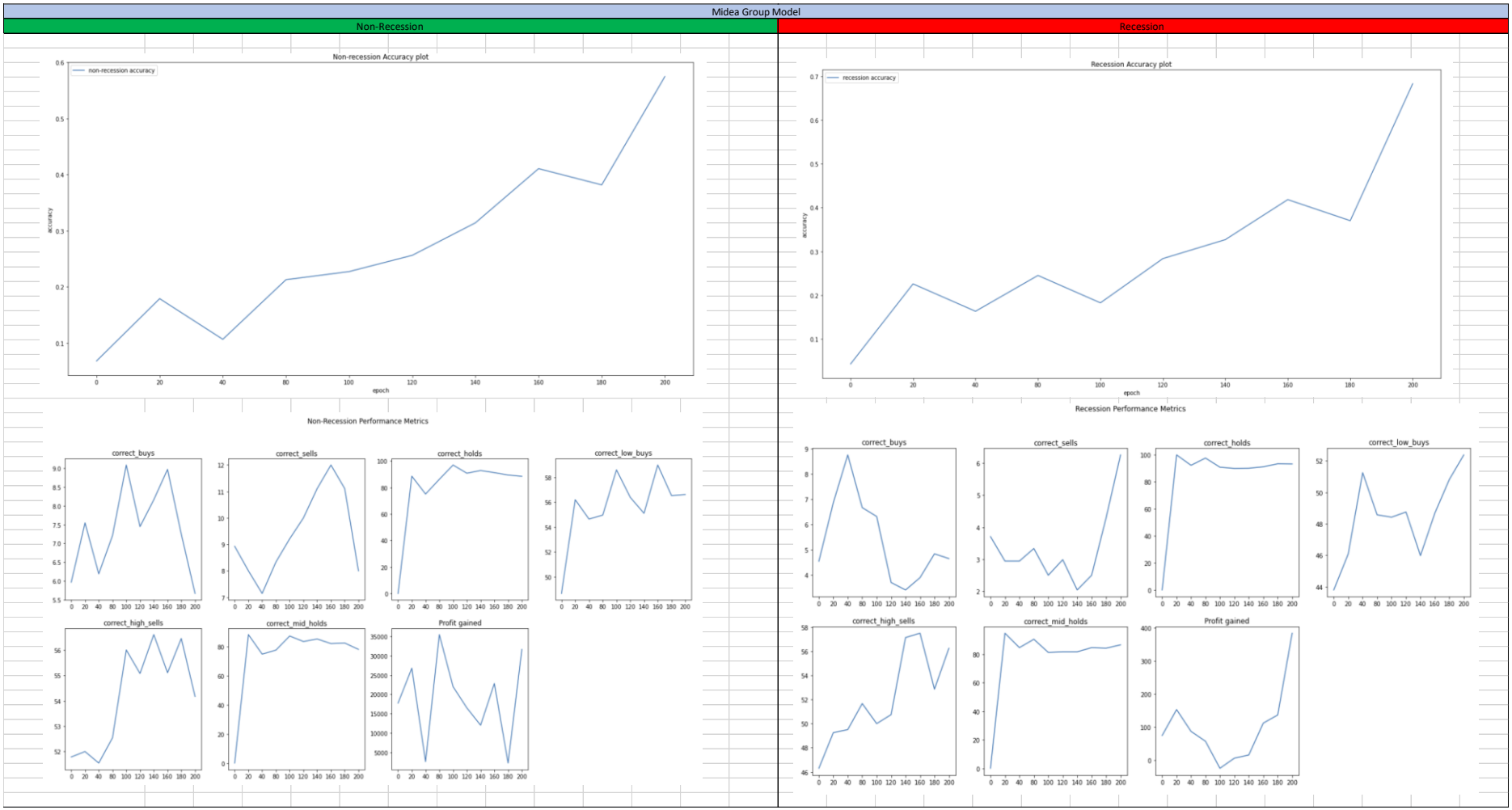


Figure 8-7 Image Representation Models Results

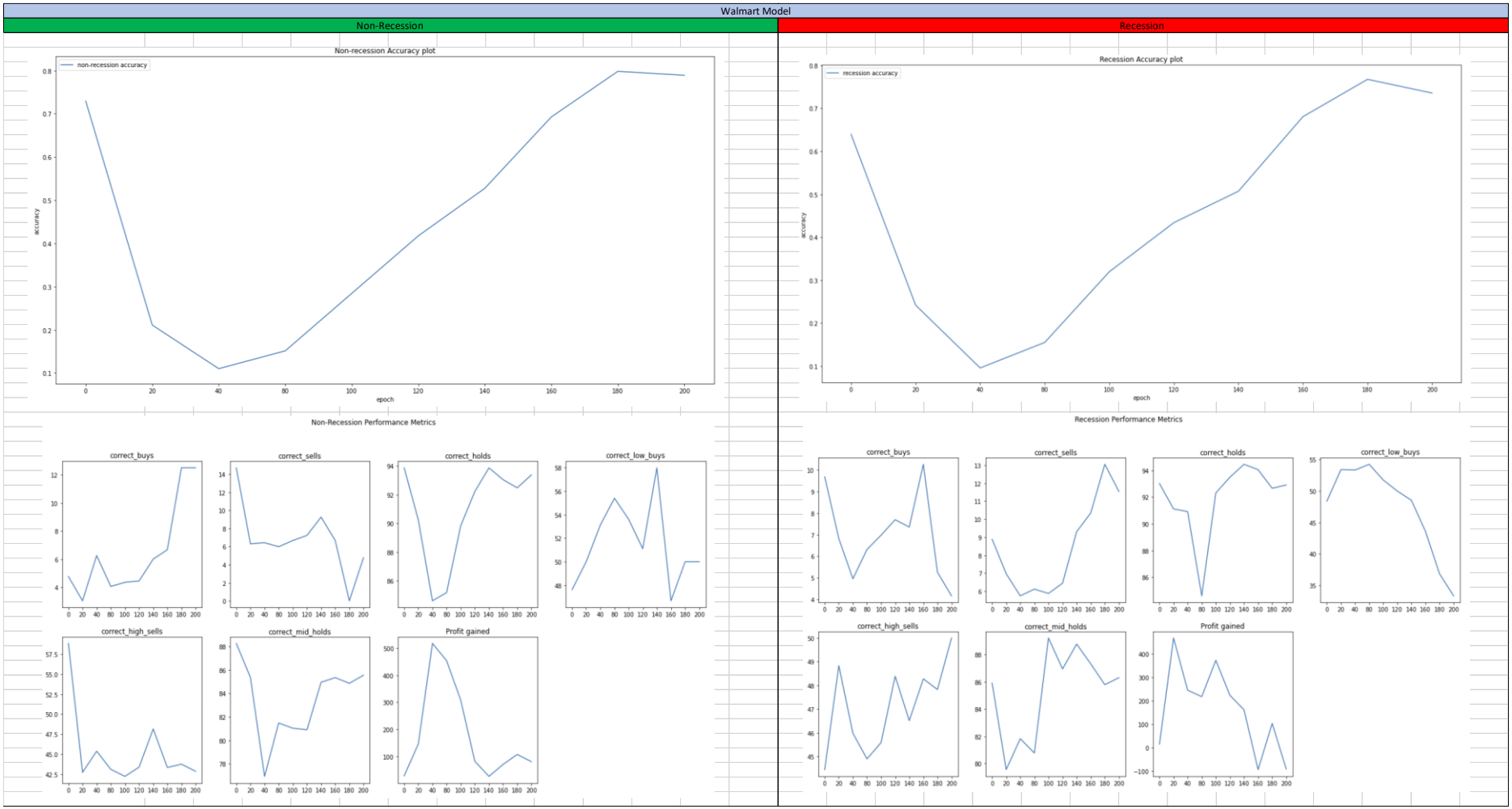


Figure 8-8 Image Representation Models Results

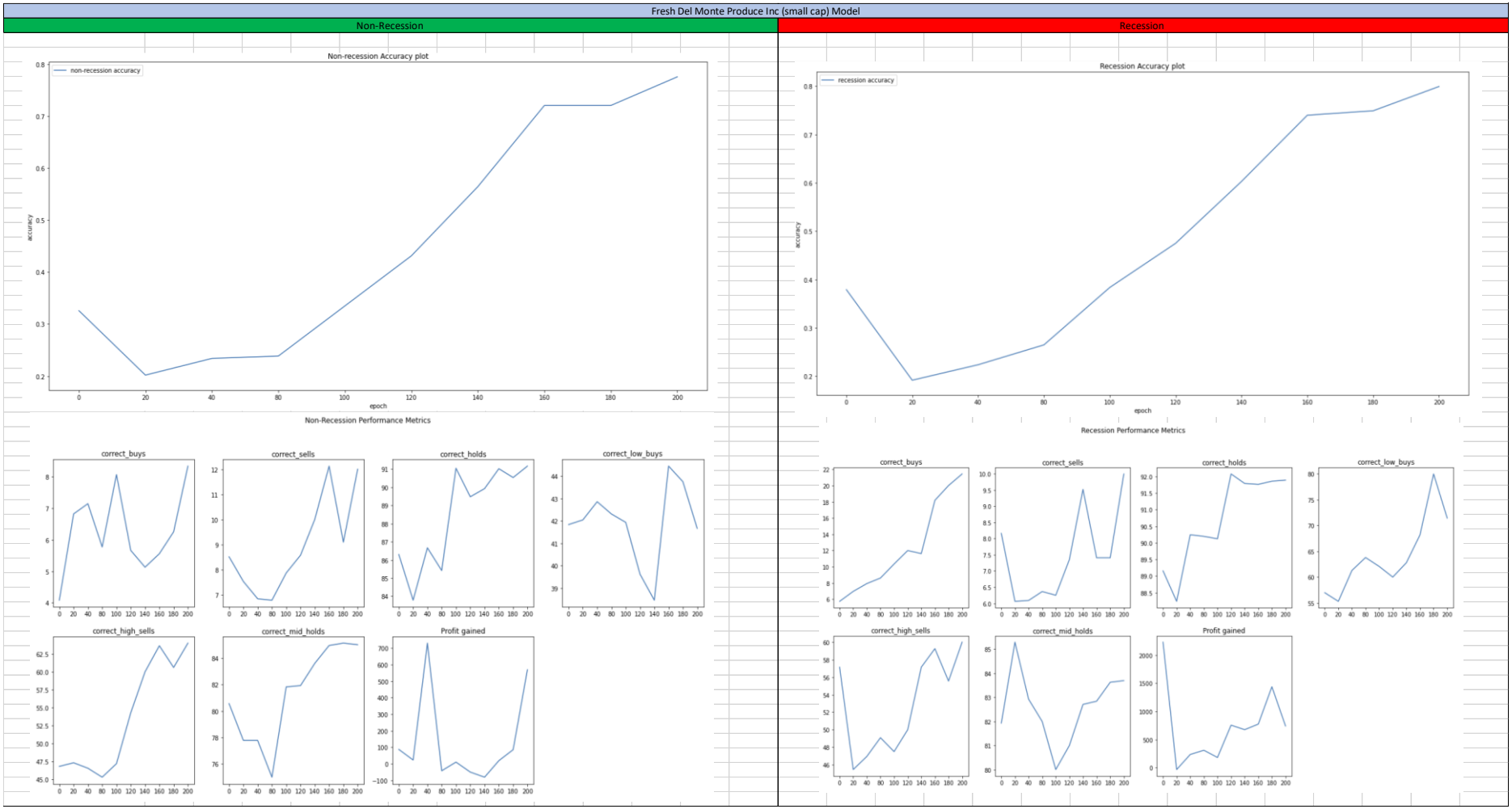


Figure 8-9 Image Representation Models Results

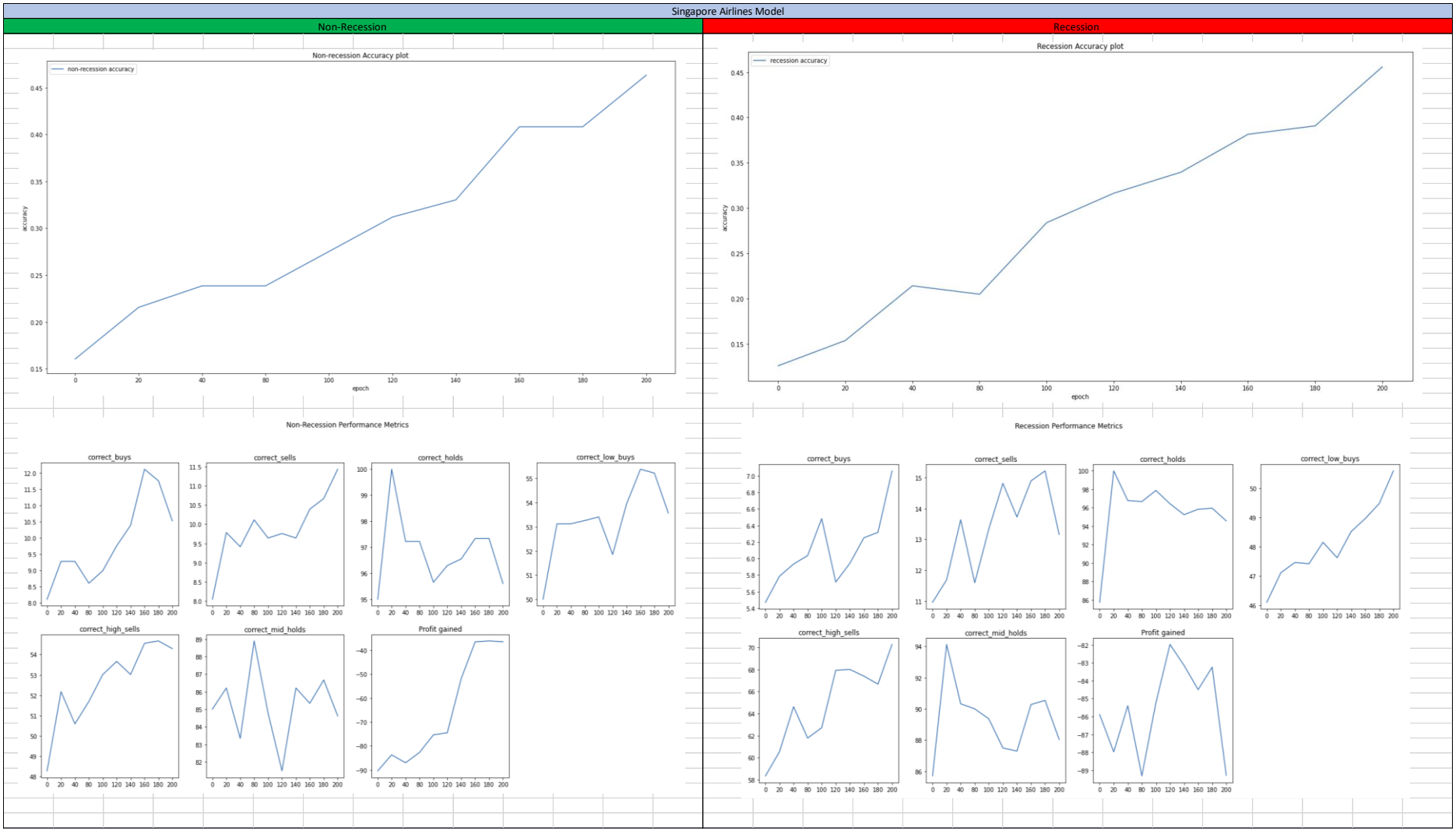


Figure 8-10 Time Series Representation Models Results

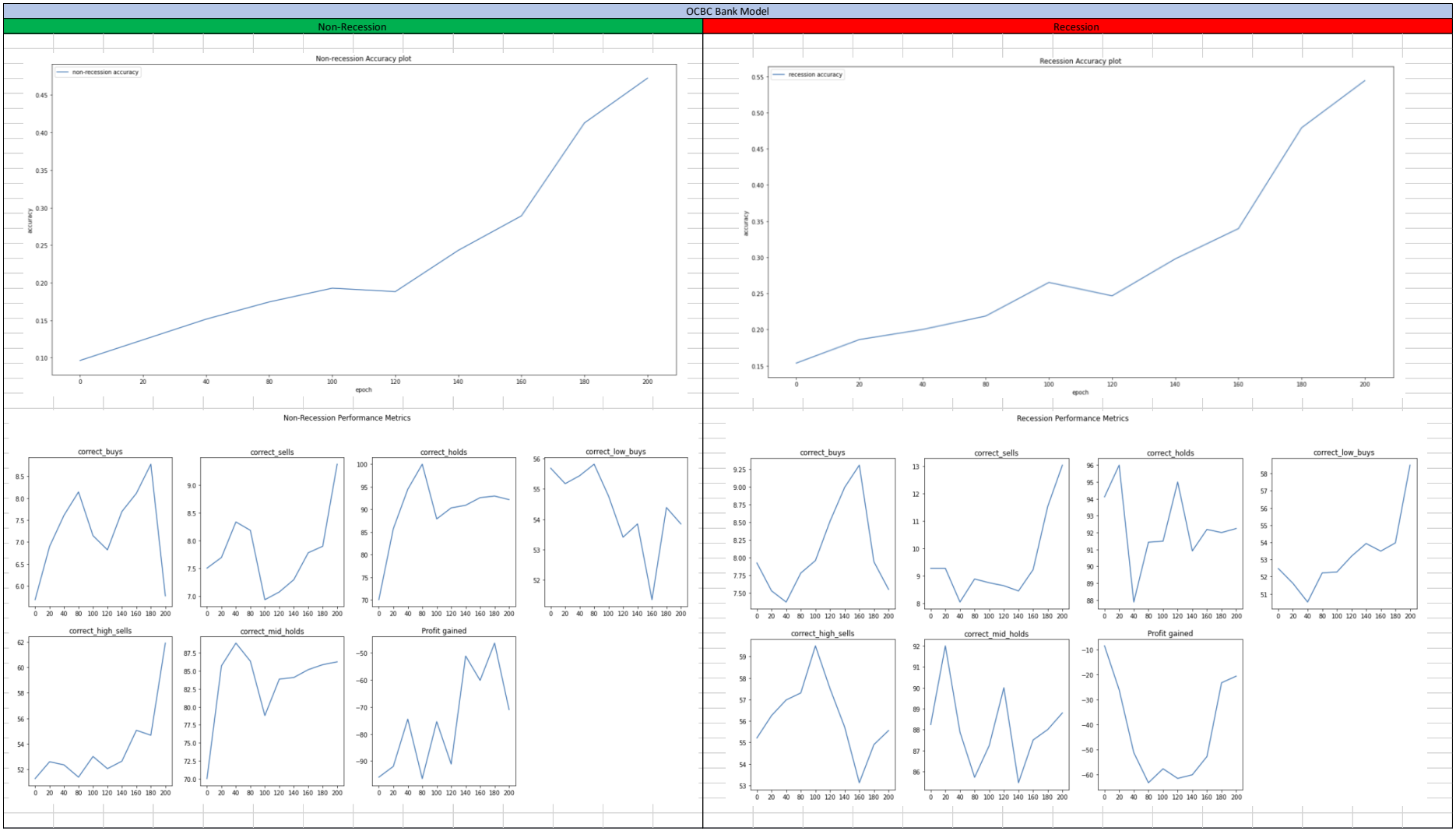


Figure 8-11 Time Series Representation Models Results

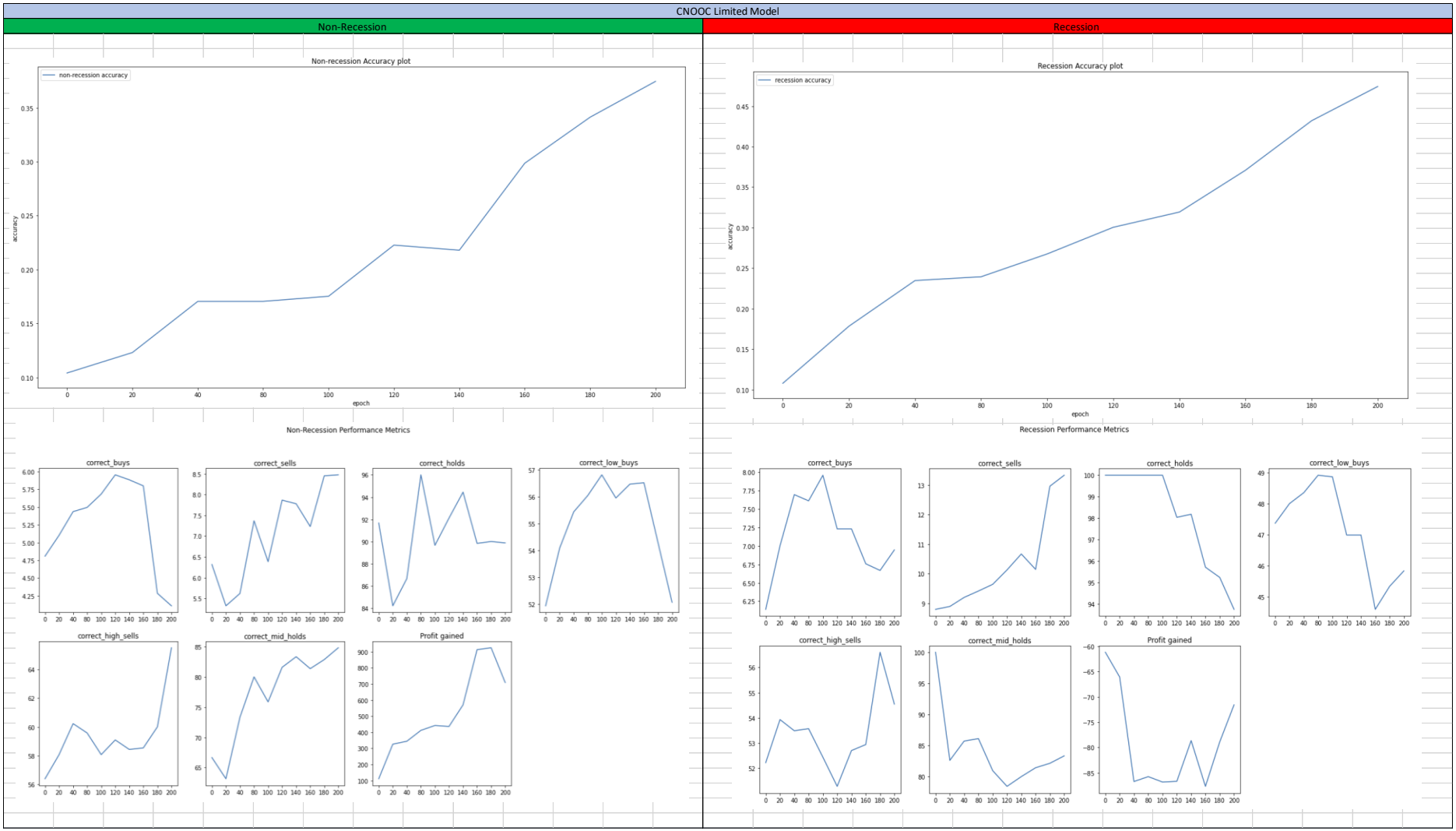


Figure 8-12 Time Series Representation Models Results

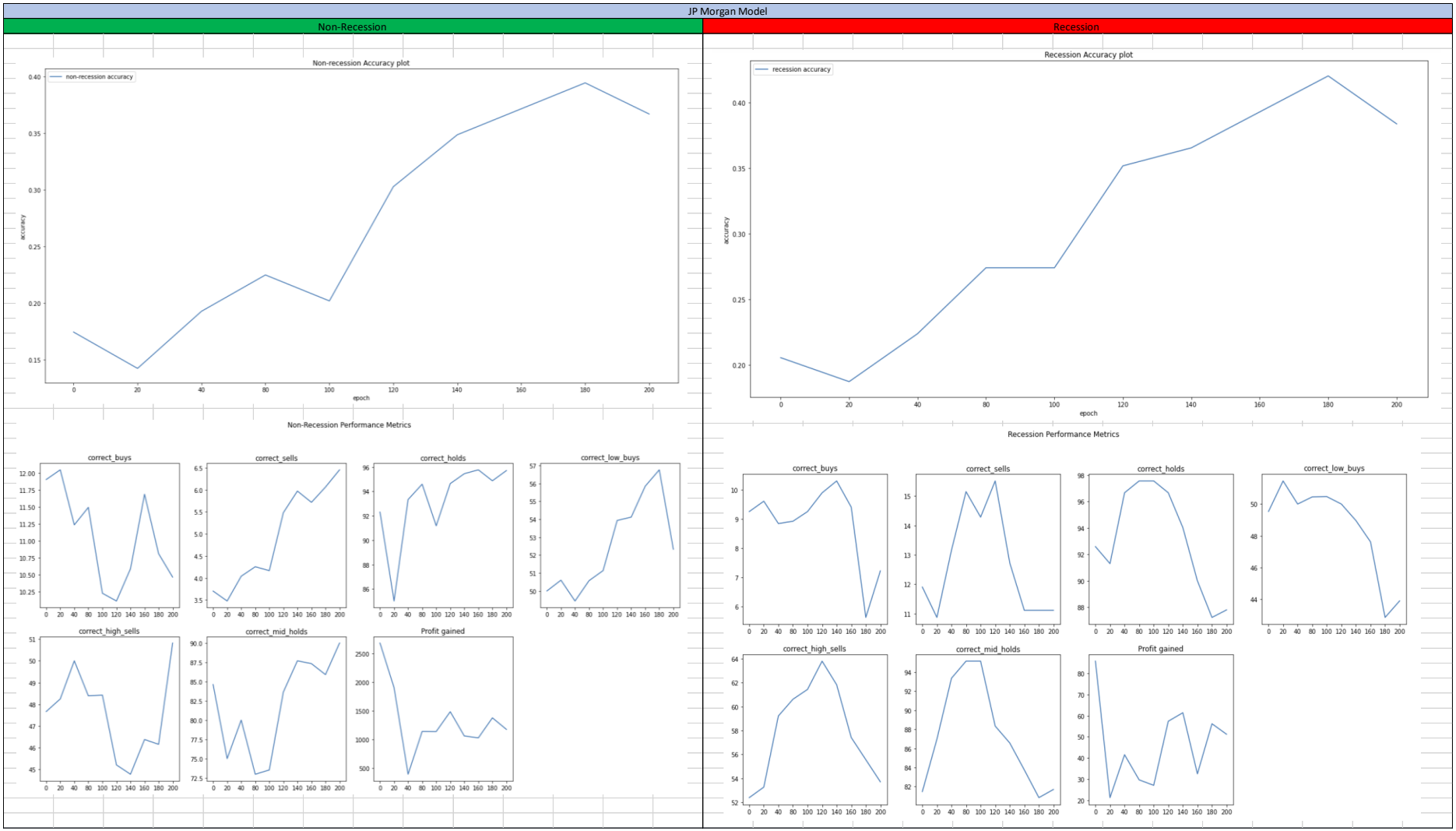


Figure 8-13 Time Series Representation Models Results

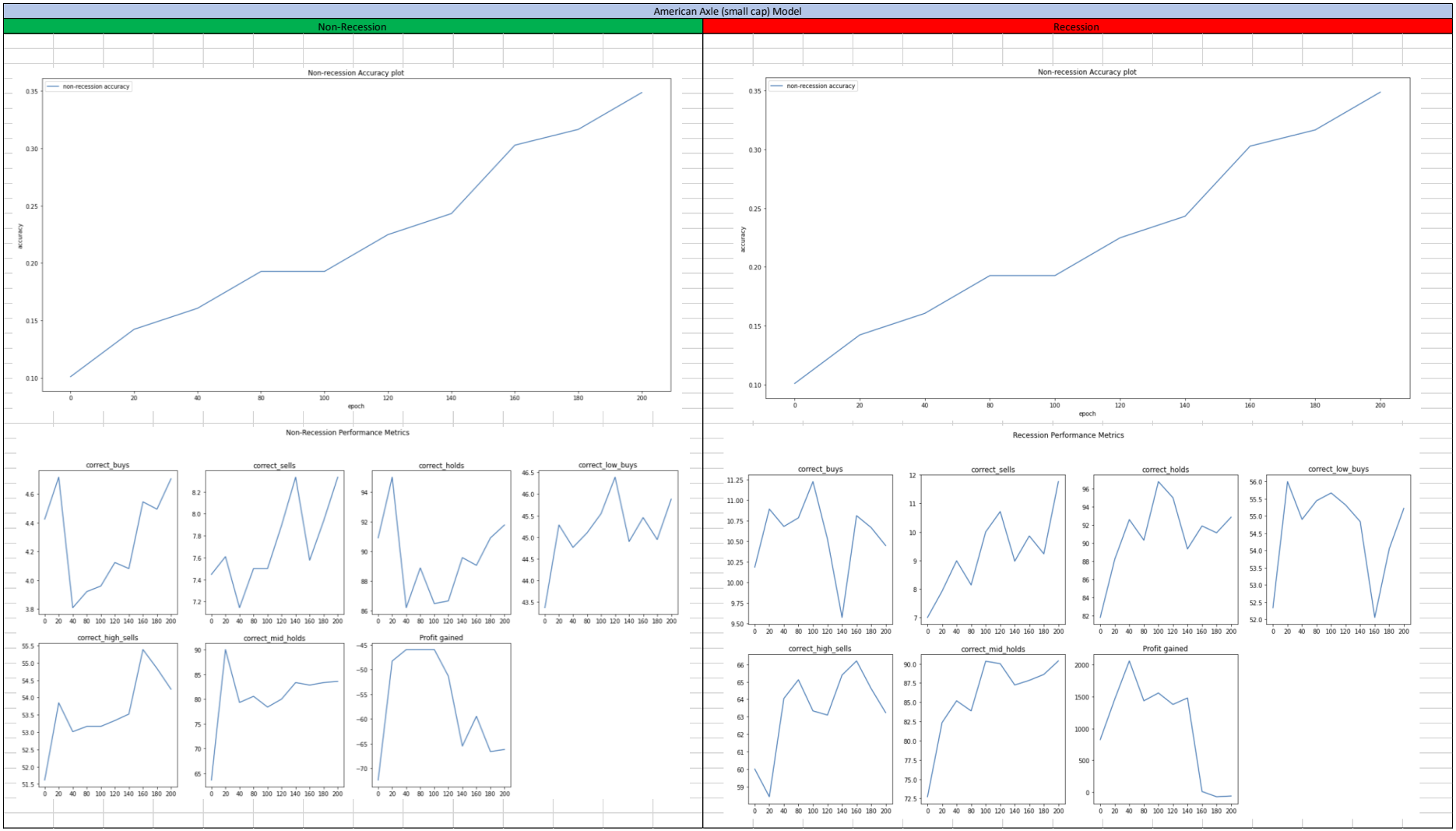


Figure 8-14 Time Series Representation Models Results

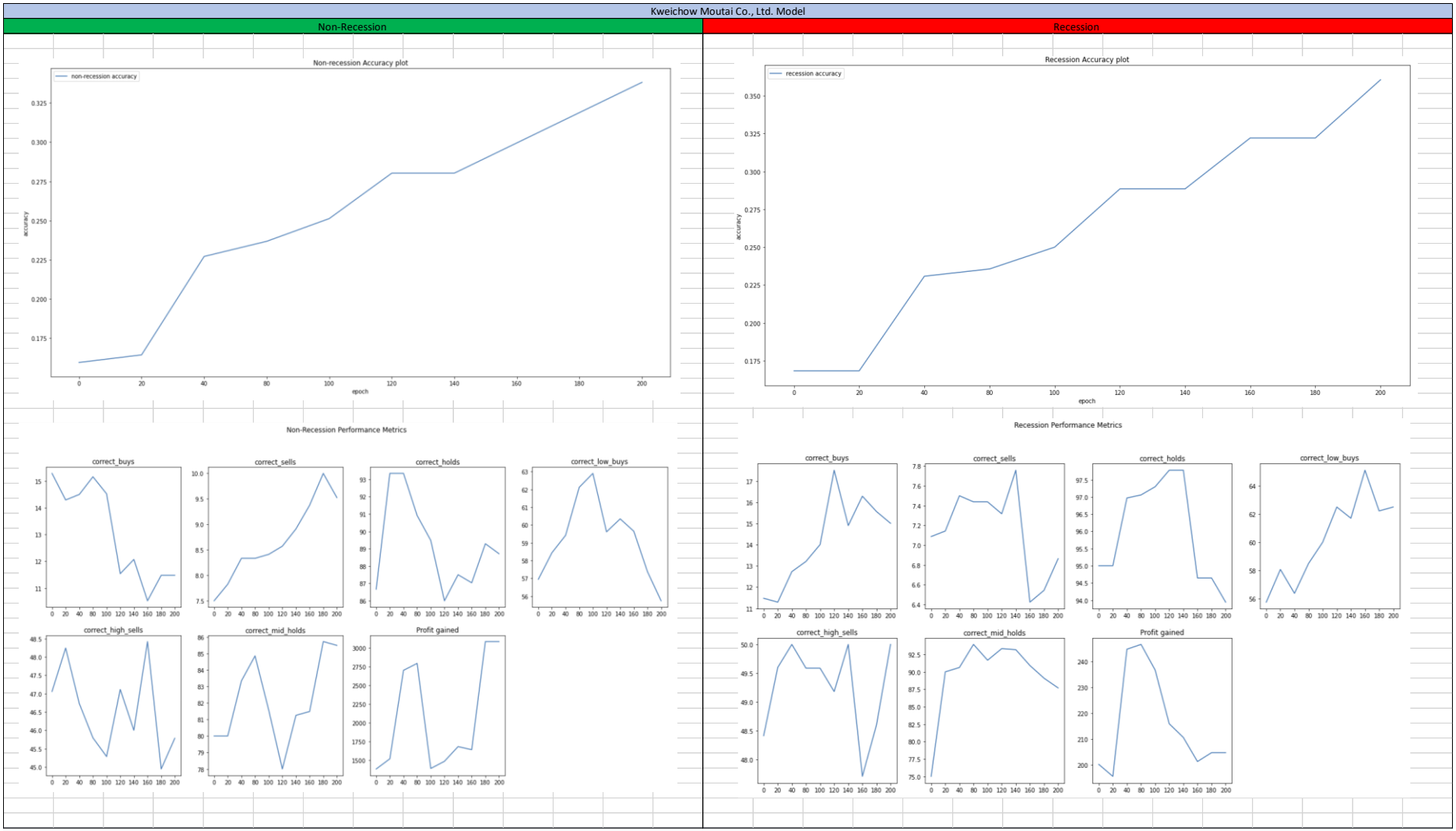


Figure 8-15 Time Series Representation Models Results

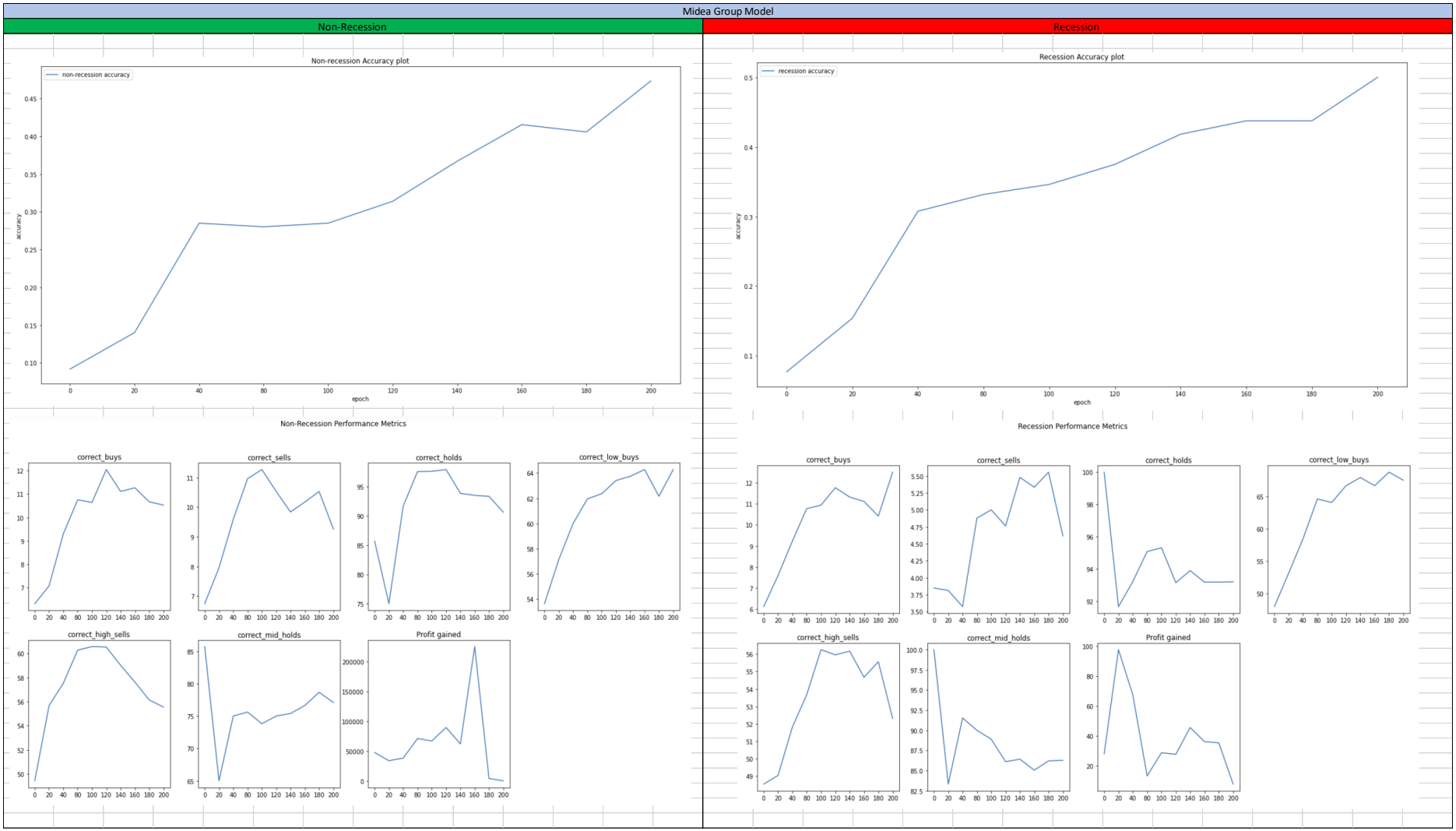


Figure 8-16 Time Series Representation Models Results

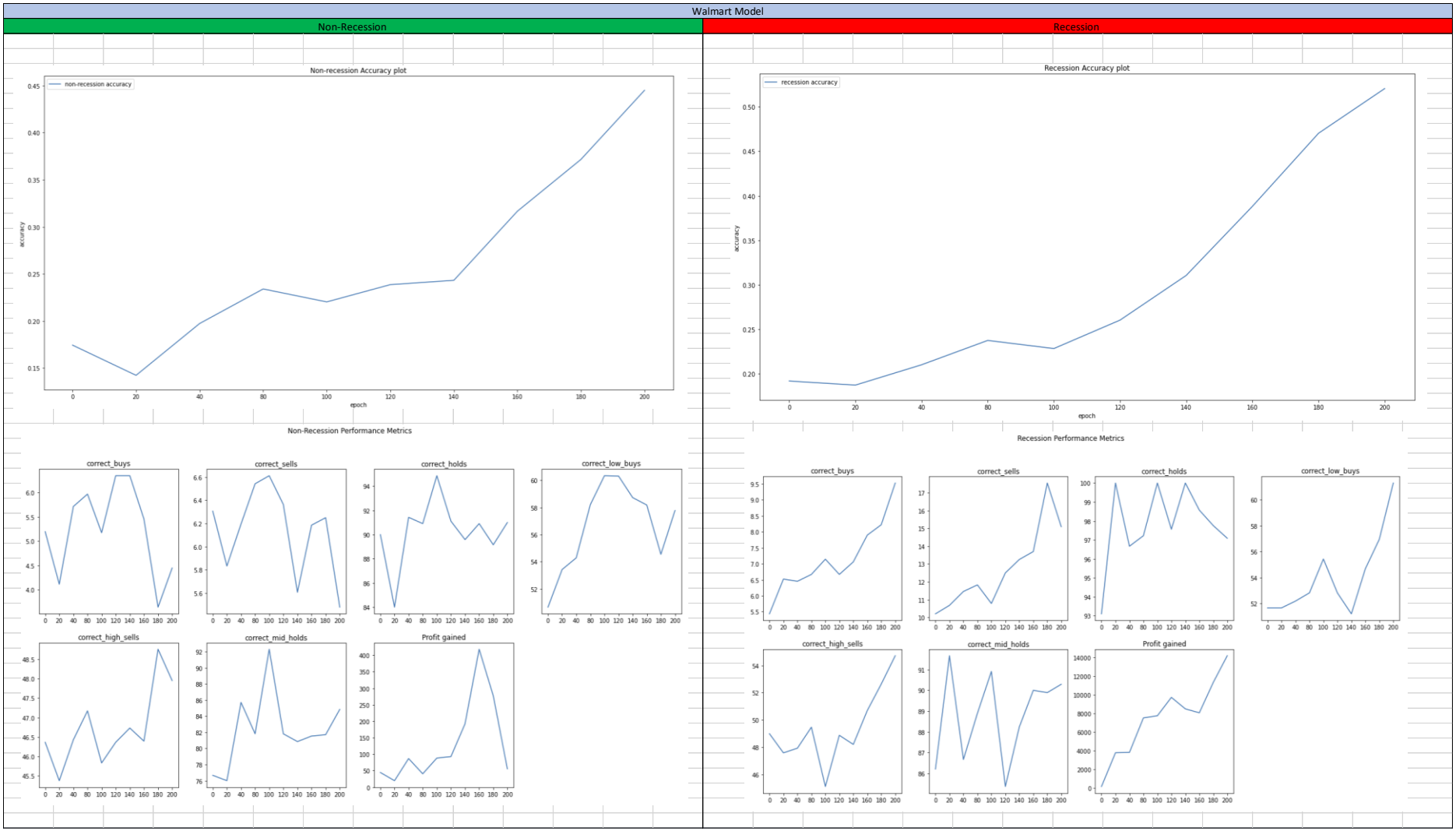


Figure 8-17 Time Series Representation Models Results

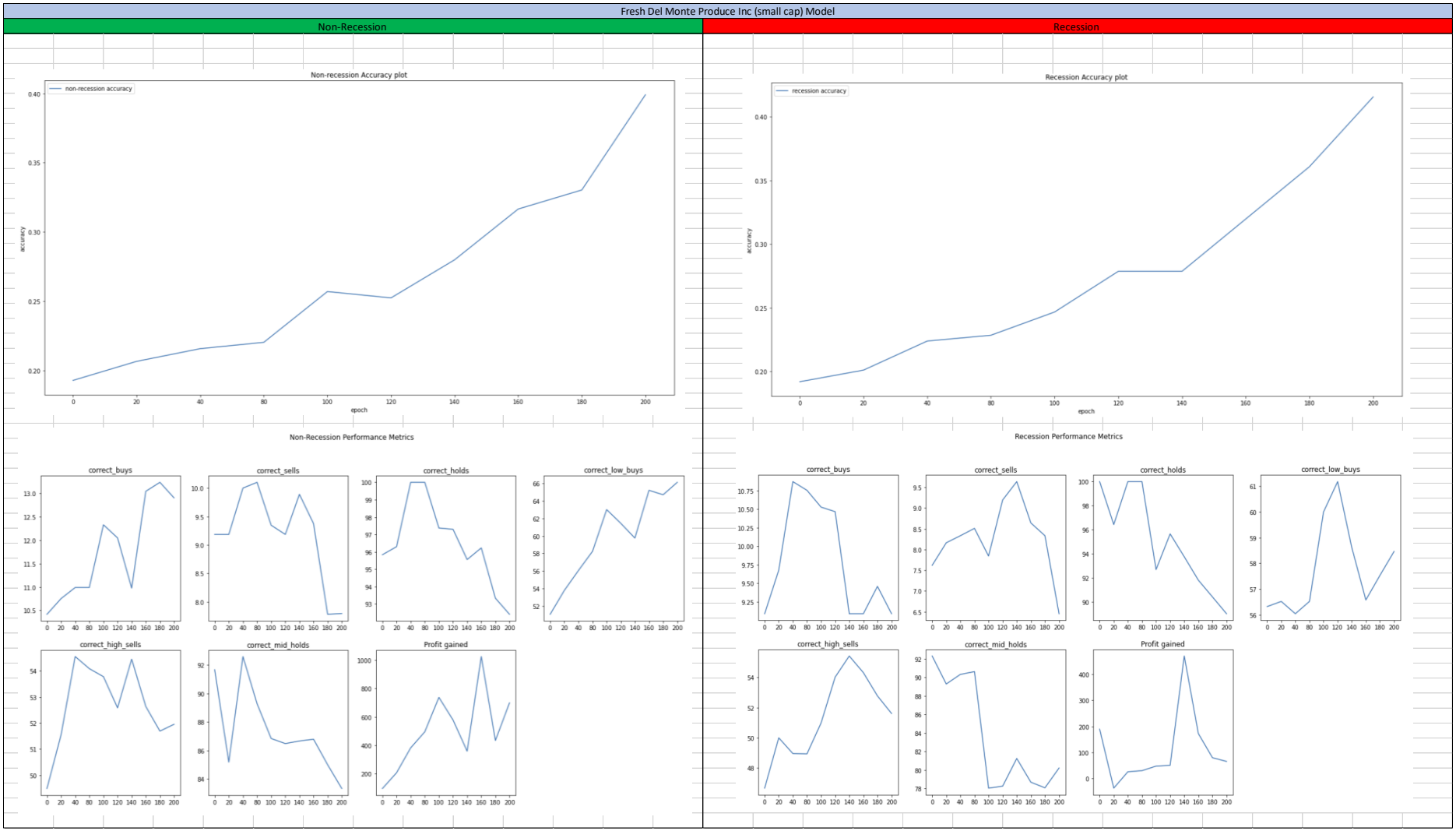


Figure 8-18 Time Series Representation Models Results

9 Appendix 4

Singapore Airlines Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.509174287	0	2.127659574	88.61788618	100	43.61702128	79.50819672	-20.13109251	-64.15459983	0.534883738	0	5.263157895	91.66666667	0	37.89473684	85.71428571	0	-78.23835547
Epochs 40	0.821100891	6.666666667	10	91.70984456	73.33333333	80	79.16666667	15.67654913	-64.15459983	0.851162791	10	0	91.91919192	80	42.85714286	85.27918782	103.8705994	-78.23835547
Epochs 60	0.293577969	0	4.487179487	95	50	43.22580645	76.66666667	7.418729592	-64.15459983	0.306976736	0	5.22875817	95.08196721	0	46.40522876	91.66666667	-10.01674843	-78.23835547
Epochs 80	0.715596318	0	0	90.69767442	50	38.0952381	78.94736842	1.276758809	-64.15459983	0.734883726	15.38461538	0	91.76470588	53.84615385	37.5	85.20710059	413.1966334	-78.23835547
Epochs 100	0.866972506	0	0	91.74757282	100	27.27272727	79.02439024	11.89593781	-64.15459983	0.832558155	22.22222222	0	92.1875	66.66666667	35.71428571	86.38743455	896.3129257	-78.23835547
Epochs 120	0.894495428	0	0	91.98113208	0	33.33333333	79.62085308	0	-64.15459983	0.888372064	25	0	92.23300971	50	40	86.34146341	540.2843171	-78.23835547
Epochs 140	0.899082541	0	0	92.01877934	0	20	79.71698113	0	-64.15459983	0.888372064	25	0	92.23300971	50	40	86.34146341	540.2843171	-78.23835547
Epochs 160	0.899082541	0	0	91.58878505	0	25	79.342723	0	-64.15459983	0.888372064	25	0	92.23300971	50	40	86.34146341	540.2843171	-78.23835547
Epochs 180	0.899082541	0	0	91.58878505	0	25	79.342723	0	-64.15459983	0.883720934	25	0	92.19512195	50	33.33333333	86.2745098	540.2843171	-78.23835547
Epochs 200	0.899082541	0	0	91.58878505	0	25	79.342723	0	-64.15459983	0.883720934	33.33333333	0	92.61083744	50	33.33333333	86.63366337	259.8325156	-78.23835547
OCBC Bank Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.912844062	0	40	92.9245283	0	40	87.20379147	36.33189621	-55.90202866	0.851162791	0	0	89.26829268	0	40	85.29411765	0	-24.56291964
Epochs 40	0.912844062	25	0	92.52336449	75	0	86.85446009	-61.33717872	-55.90202866	0.846511602	7.142857143	0	90.04975124	57.14285714	0	86	-20.85171797	-24.56291964
Epochs 60	0.917431176	0	0	92.16589862	0	0	86.11111111	172.7958126	-55.90202866	0.893023252	0	0	89.71962617	0	0	85.91549296	173.0464702	-24.56291964
Epochs 80	0.839449525	0	10	92.34693878	50	40	86.15384615	-41.27757131	-55.90202866	0.823255837	0	5.882352941	90.25641026	100	29.41176471	86.08247423	135.4746275	-24.56291964
Epochs 100	0.885321081	0	22.22222222	92.7184466	66.66666667	44.44444444	86.34146341	422.2075093	-55.90202866	0.869767427	0	25	90.68627451	66.66666667	37.5	86.69950739	12.25466909	-24.56291964
Epochs 120	0.899082541	0	33.33333333	92.82296651	100	50	86.53846154	108.3459424	-55.90202866	0.851162791	0	0	89.70588235	60	16.66666667	85.71428571	18.89203251	-24.56291964
Epochs 140	0.889908254	0	33.33333333	92.75362319	80	50	86.40776699	108.3459424	-55.90202866	0.851162791	0	0	89.70588235	60	16.66666667	85.71428571	18.89203251	-24.56291964
Epochs 160	0.885321081	0	33.33333333	92.7184466	66.66666667	50	86.34146341	108.3459424	-55.90202866	0.851162791	0	0	89.70588235	50	20	85.71428571	-3.399612242	-24.56291964
Epochs 180	0.885321081	0	33.33333333	92.7184466	66.66666667	50	86.34146341	108.3459424	-55.90202866	0.851162791	0	0	89.70588235	50	20	85.71428571	-3.399612242	-24.56291964
Epochs 200	0.885321081	0	33.33333333	92.7184466	66.66666667	50	86.34146341	108.3459424	-55.90202866	0.851162791	0	0	89.70588235	50	20	85.71428571	-3.399612242	-24.56291964
CNOOC Limited Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit

Epochs 20	0.838862538	0	0	91.70984456	58.82352941	100	81.77083333	-34.55817843	-54.68960087	0.830985904	10.52631579	0	90.67357513	52.63157895	100	82.29166667	-68.12396586	-84.2898875
Epochs 40	0.293838859	3.846153846	3.225806452	93.44262295	53.84615385	47.15447154	85.24590164	196.9550263	-54.68960087	0.309859157	7.407407407	3.361344538	89.55223881	44.44444444	39.83050847	82.08955224	-99.68058378	-84.2898875
Epochs 60	0.65876776	0	3.225806452	93.19727891	50	49.18032787	83.67346939	-57.41463386	-54.68960087	0.629107952	0	1.639344262	88.66666667	50	36.06557377	80.53691275	13.2266814	-84.2898875
Epochs 80	0.729857802	0	2.325581395	91.61676647	0	48.8372093	81.92771084	-31.76316296	-54.68960087	0.746478856	0	2.702702703	89.77272727	0	35.13513514	81.14285714	0	-84.2898875
Epochs 100	0.881516576	0	20	92.039801	40	40	83	58.50732106	-54.68960087	0.873239458	33.33333333	0	90.68627451	33.33333333	50	82.26600985	120.6511995	-84.2898875
Epochs 120	0.857819915	0	14.28571429	91.83673469	37.5	28.57142857	83.07692308	-26.06530558	-54.68960087	0.873239458	20	0	91.13300493	20	40	82.67326733	-92.62696944	-84.2898875
Epochs 140	0.843601882	0	16.66666667	91.70984456	50	33.33333333	82.8125	-34.001821	-54.68960087	0.840375602	9.090909091	0	90.81632653	36.36363636	33.33333333	82.05128205	-86.93252046	-84.2898875
Epochs 160	0.848341227	0	16.66666667	91.75257732	45.45454545	50	83.41968912	2.243153616	-54.68960087	0.849765241	10	0	90.90909091	30	40	82.23350254	-89.91426966	-84.2898875
Epochs 180	0.853080571	0	20	91.79487179	45.45454545	40	82.98969072	-8.777954426	-54.68960087	0.849765241	10	0	90.90909091	30	40	82.23350254	-84.9137094	-84.2898875
Epochs 200	0.853080571	0	16.66666667	91.79487179	40	50	83.50515464	2.243153616	-54.68960087	0.835680723	10	0	90.76923077	30	25	81.95876289	-95.42951673	-84.2898875
JP Morgan Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.30733946	6.918238994	0	94.91525424	39.24050633	0	84.74576271	1576.179166	1576.179166	0.315068483	5.882352941	0	90.90909091	42.76315789	0	84.84848485	-31.31681736	-31.90034799
Epochs 40	0.165137619	0	2.732240437	88.57142857	0	40.65934066	85.71428571	0	1576.179166	0.223744288	0	5.780346821	84.7826087	0	41.61849711	75.55555556	0	-31.90034799
Epochs 60	0.912844062	0	0	92.12962963	0	0	85.58139535	0	1576.179166	0.89041096	0	0	89.86175115	0	50	82.87037037	0	-31.90034799
Epochs 80	0.56422019	8.510638298	2.380952381	91.47286822	38.29787234	45.23809524	83.59375	55.6937427	1576.179166	0.616438329	11.9047619	8.108108108	90.71428571	51.2195122	45.94594595	85.71428571	-83.56865239	-31.90034799
Epochs 100	0.683486223	8.571428571	0	91.25	31.42857143	39.13043478	82.38993711	554.4875276	1576.179166	0.698630154	16.12903226	0	90.24390244	48.38709677	37.5	83.43558282	-72.63356386	-31.90034799
Epochs 120	0.75688076	7.692307692	0	91.57303371	42.30769231	35.71428571	83.61581921	4241.172151	1576.179166	0.762557089	10.52631579	0	89.67391304	36.84210526	37.5	81.96721311	-61.48558838	-31.90034799
Epochs 140	0.788990855	10.52631579	0	91.89189189	36.84210526	42.85714286	84.23913043	4718.145598	1576.179166	0.79908675	16.66666667	0	90.10416667	33.33333333	40	82.72251309	-68.41520555	-31.90034799
Epochs 160	0.821100891	14.28571429	0	92.1875	35.71428571	41.66666667	84.81675393	3951.178761	1576.179166	0.81735158	22.22222222	0	90.30612245	22.22222222	42.85714286	83.07692308	-66.58314705	-31.90034799
Epochs 180	0.816513777	7.692307692	0	91.70984456	30.76923077	50	84.375	3051.578821	1576.179166	0.821917832	25	0	90.35532995	25	42.85714286	83.16326531	-66.58314705	-31.90034799
Epochs 200	0.816513777	7.692307692	0	91.70984456	30.76923077	50	84.375	3051.578821	1576.179166	0.821917832	25	0	90.35532995	25	42.85714286	83.16326531	-66.58314705	-31.90034799
American Axle (small cap) Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.619266033	0	14.28571429	91.15646259	31.74603175	42.85714286	84.3537415	-67.5021432	-40.19620025	0.666666687	6.779661017	33.33333333	89.8089172	48.27586207	66.66666667	84.7133758	5.887071018	-32.50977019
Epochs 40	0.697247684	4.255319149	10	92.54658385	42.55319149	40	85	-88.91792699	-40.19620025	0.675799072	5.660377358	0	89.50617284	46.15384615	50	84.56790123	-67.73781608	-32.50977019
Epochs 60	0.688073397	4.166666667	10.25641026	93.5483871	37.5	46.15384615	85.71428571	-72.08993872	-40.19620025	0.680365324	11.11111111	3.225806452	90.0621118	44.44444444	41.93548387	85	-52.71984342	-32.50977019
Epochs 80	0.857798159	0	7.692307692	92.53731343	25	46.15384615	85.5	-78.21311414	-40.19620025	0.840182662	0	0	89.32038835	100	45.45454545	83.90243902	13.26419632	-32.50977019

Epochs 100	0.87155962	12.5	0	92.64705882	25	16.66666667	85.71428571	-42.59233924	-40.19620025	0.853881299	0	0	89.90384615	60	33.33333333	84.5410628	33.42056114	-32.50977019
Epochs 120	0.866972506	12.5	0	92.61083744	25	28.57142857	85.64356436	-52.84155853	-40.19620025	0.844748855	0	0	89.80582524	42.85714286	33.33333333	84.3902439	94.03904264	-32.50977019
Epochs 140	0.87155962	0	0	92.68292683	14.28571429	16.66666667	85.78431373	-86.71396448	-40.19620025	0.844748855	0	0	89.80582524	42.85714286	33.33333333	84.3902439	94.03904264	-32.50977019
Epochs 160	0.862385333	0	0	92.61083744	11.11111111	16.66666667	85.64356436	-87.5960755	-40.19620025	0.83561641	0	0	89.70588235	37.5	28.57142857	84.2364532	67.3108906	-32.50977019
Epochs 180	0.866972506	0	0	92.64705882	12.5	16.66666667	85.71428571	-89.18484615	-40.19620025	0.83561641	0	0	89.70588235	37.5	28.57142857	84.2364532	67.3108906	-32.50977019
Epochs 200	0.876146793	0	0	92.7184466	14.28571429	20	85.85365854	-35.49257359	-40.19620025	0.840182662	0	0	89.75609756	37.5	33.33333333	84.31372549	67.3108906	-32.50977019

Table 9-1 Results of Experiment for LSTM Model Trained Using Cyclic Stocks, Using Image Representation Input

Kweichow Moutai Co., Ltd. Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.893719792	0	0	89.37198068	0	0	85.4368932	0	1666.892281	0.908653855	0	0	90.86538462	0	0	85.02415459	0	678.7940879
Epochs 40	0.251207739	0	4.575163399	83.33333333	0	40.52287582	79.24528302	0	1666.892281	0.278846145	0	5.22875817	90.90909091	0	43.42105263	87.27272727	0	678.7940879
Epochs 60	0.555555582	0	5.128205128	87.4015748	50	48.05194805	83.46456693	368.1494897	1666.892281	0.615384638	0	10.25641026	93.02325581	0	50	88.28125	1.098752255	678.7940879
Epochs 80	0.830917895	0	7.142857143	89.0625	0	57.14285714	84.81675393	-19.57801075	1666.892281	0.894230783	0	33.33333333	92.85714286	0	66.66666667	86.66666667	0	678.7940879
Epochs 100	0.874396145	25	50	90.76923077	50	75	87.11340206	1780.657137	1666.892281	0.894230783	50	0	91.13300493	50	0	85.14851485	8.751511167	678.7940879
Epochs 120	0.845410645	15.38461538	33.33333333	90.05235602	38.46153846	66.66666667	86.31578947	2749.307394	1666.892281	0.894230783	40	0	91.54228856	60	0	86	103.8031219	678.7940879
Epochs 140	0.850241542	20	0	89.69072165	50	66.66666667	86.01036269	4267.174216	1666.892281	0.889423072	25	0	91.08910891	50	0	85.5721393	103.8031219	678.7940879
Epochs 160	0.850241542	20	0	89.69072165	50	66.66666667	86.01036269	4267.174216	1666.892281	0.889423072	25	0	91.08910891	50	0	85.5721393	103.8031219	678.7940879
Epochs 180	0.855072439	22.22222222	0	89.74358974	44.44444444	66.66666667	86.08247423	4536.080856	1666.892281	0.889423072	25	0	91.08910891	50	0	85.5721393	103.8031219	678.7940879
Epochs 200	0.859903395	25	0	89.79591837	50	66.66666667	86.15384615	4536.080856	1666.892281	0.889423072	25	0	91.08910891	50	0	85.5721393	103.8031219	678.7940879
Midea Group Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.541062772	9.677419355	0	90.35087719	53.76344086	0	78.76106195	1245.275482	1245.275482	0.629807711	6.756756757	0	94.02985075	41.89189189	0	86.46616541	468.5733088	468.5733088
Epochs 40	0.71980679	8.888888889	0	89.50617284	60	0	77.63975155	1947.978709	1245.275482	0.759615362	9.090909091	0	93.90243902	45.45454545	0	85.88957055	468.5733088	468.5733088
Epochs 60	0.893719792	0	0	89.80582524	0	100	79.51219512	0	1245.275482	0.923076928	0	0	92.75362319	0	100	85.4368932	0	468.5733088
Epochs 80	0.893719792	0	0	89.80582524	0	100	79.51219512	0	1245.275482	0.918269217	0	0	92.7184466	0	100	85.36585366	0	468.5733088
Epochs 100	0.888888896	0	0	89.75609756	0	0	79.41176471	0	1245.275482	0.903846145	0	0	92.61083744	50	100	85.64356436	12.67926789	468.5733088
Epochs 120	0.855072439	0	0	89.39393939	50	33.33333333	79.18781726	-2.629241339	1245.275482	0.865384638	0	0	92.30769231	60	100	85.05154639	375.1936873	468.5733088
Epochs 140	0.840579689	0	0	89.23076923	50	37.5	78.35051546	-21.49253551	1245.275482	0.889423072	0	0	92.5	50	100	85.42713568	58.32691102	468.5733088

Epochs 160	0.845410645	0	10	89.69072165	33.33333333	40	78.75647668	-21.49253551	1245.275482	0.894230783	0	0	92.53731343	33.33333333	100	85.5	58.32691102	468.5733088
Epochs 180	0.845410645	0	10	89.69072165	33.33333333	40	78.75647668	-21.49253551	1245.275482	0.889423072	0	0	92.5	33.33333333	80	85.42713568	58.32691102	468.5733088
Epochs 200	0.845410645	0	10	89.69072165	33.33333333	40	78.75647668	-21.49253551	1245.275482	0.884615362	0	0	92.46231156	25	80	85.35353535	58.32691102	468.5733088
Walmart Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.380733937	6.024096386	5.660377358	91.46341463	49.39759036	45.28301887	83.95061728	297.8845319	9380.979094	0.392694056	6.25	10	91.56626506	50.52631579	35	84.3373494	41.73748373	255.7316817
Epochs 40	0.926605523	0	0	92.66055046	0	0	85.71428571	0	9380.979094	0.917808235	0	0	91.78082192	0	0	85.32110092	0	255.7316817
Epochs 60	0.908256888	25	0	93.33333333	50	0	86.60287081	1099.912342	9380.979094	0.858447492	9.090909091	0	91.66666667	54.54545455	25	84.72906404	71.08989264	255.7316817
Epochs 80	0.885321081	11.11111111	0	92.75362319	33.33333333	50	86.40776699	1129.044206	9380.979094	0.808219194	0	0	90.76923077	55	50	84.53608247	152.493366	255.7316817
Epochs 100	0.876146793	10	0	92.68292683	30	0	85.78431373	994.3285166	9380.979094	0.812785387	0	0	90.81632653	57.89473684	50	84.61538462	152.493366	255.7316817
Epochs 120	0.899082541	16.66666667	25	93.26923077	33.33333333	25	85.99033816	1271.160904	9380.979094	0.844748855	0	0	91.13300493	54.54545455	40	84.65346535	93.50184001	255.7316817
Epochs 140	0.908256888	20	33.33333333	93.33333333	40	33.33333333	86.12440191	1297.560465	9380.979094	0.858447492	0	20	91.66666667	50	60	85.22167488	294.8347882	255.7316817
Epochs 160	0.899082541	20	20	93.26923077	60	40	85.99033816	959.871149	9380.979094	0.858447492	0	25	92.07920792	55.55555556	62.5	85.5721393	266.8056933	255.7316817
Epochs 180	0.899082541	20	20	93.26923077	60	40	85.99033816	959.871149	9380.979094	0.858447492	0	25	92.07920792	55.55555556	62.5	85.5721393	266.8056933	255.7316817
Epochs 200	0.903669715	20	25	93.30143541	60	50	86.05769231	1580.325176	9380.979094	0.858447492	0	16.66666667	91.66666667	44.44444444	50	85.22167488	49.64893071	255.7316817
Fresh Del Monte Produce Inc (small cap) Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.064220183	4.694835681	0	80	34.43396226	0	60	5.320148705	5.320148705	0.09589041	4.830917874	0	91.66666667	45.14563107	0	83.33333333	-65.97131265	-65.97131265
Epochs 40	0.862385333	0	25	91.2195122	44.44444444	50	84.80392157	-68.35507131	5.320148705	0.844748855	6.666666667	33.33333333	91.04477612	73.33333333	66.66666667	83	198.0545224	-65.97131265
Epochs 60	0.655963302	5.263157895	29.41176471	93.75	36.84210526	47.05882353	86.71328671	-32.57664794	5.320148705	0.712328792	10	0	92.63803681	63.26530612	66.66666667	84.66257669	266.297635	-65.97131265
Epochs 80	0.775229335	11.76470588	9.090909091	92.17877095	47.05882353	50	84.83146067	117.8607639	5.320148705	0.748858452	9.090909091	8	93.02325581	50	48	84.79532164	179.8481697	-65.97131265
Epochs 100	0.866972506	0	10	91.26213592	0	20	84.3902439	45.14111586	5.320148705	0.863013685	0	0	90.43062201	75	50	82.21153846	1.299097547	-65.97131265
Epochs 120	0.857798159	0	0	90.77669903	40	0	84.3902439	-6.277066849	5.320148705	0.858447492	0	0	90.38461538	75	42.85714286	82.12560386	1.299097547	-65.97131265
Epochs 140	0.853210986	0	0	90.73170732	40	12.5	84.31372549	-6.277066849	5.320148705	0.858447492	0	0	90.38461538	75	42.85714286	82.12560386	1.299097547	-65.97131265
Epochs 160	0.853210986	0	0	90.73170732	25	22.22222222	83.82352941	1.98736438	5.320148705	0.858447492	0	0	90.38461538	75	42.85714286	82.12560386	1.299097547	-65.97131265
Epochs 180	0.848623872	0	0	90.68627451	25	30	83.74384236	-22.5668555	5.320148705	0.858447492	0	0	90.38461538	75	42.85714286	82.12560386	1.299097547	-65.97131265
Epochs 200	0.844036698	0	0	91.08910891	20	27.27272727	84.07960199	-87.08958391	5.320148705	0.863013685	0	0	90.43062201	66.66666667	42.85714286	82.21153846	1.299097547	-65.97131265

Table 9-2 Results of Experiment for LSTM Model Trained Using Non-Cyclic Stocks, Using Image Representation Input

Singapore Airlines Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.463302761	7.692307692	10.71428571	92.78350515	53.84615385	57.14285714	79.16666667	184.2601223	-64.15459983	0.455813944	7.142857143	12.82051282	94.56521739	42.85714286	61.53846154	86.81318681	-88.79432585	-78.23835547
Epochs 40	0.444954127	9.090909091	11.11111111	94.38202247	59.09090909	55.55555556	86.36363636	-28.5142565	-64.15459983	0.358139545	6.12244898	9.090909091	91.78082192	44.89795918	56.81818182	86.11111111	-93.56942242	-78.23835547
Epochs 60	0.490825683	10	8.888888889	93.2038835	59.42028986	57.77777778	83.49514563	-36.10594795	-64.15459983	0.413953483	5.263157895	9.375	92.04545455	47.36842105	59.375	86.20689655	-97.15972796	-78.23835547
Epochs 80	0.545871556	11.86440678	7.142857143	93.16239316	60.34482759	57.14285714	82.90598291	-12.5575339	-64.15459983	0.488372087	4.87804878	8.695652174	90	47.56097561	56.52173913	84.40366972	-95.28445155	-78.23835547
Epochs 100	0.559633017	9.375	6.666666667	91.93548387	55.55555556	63.33333333	81.4516129	19.77546567	-64.15459983	0.558139563	4.109589041	7.692307692	89.92248062	52.05479452	46.15384615	83.59375	-79.61812193	-78.23835547
Epochs 120	0.646789014	13.04347826	3.703703704	92.4137931	53.33333333	62.96296296	80	-4.06184255	-64.15459983	0.586046517	2.898550725	0	89.85507246	46.37681159	37.5	83.21167883	-85.28097119	-78.23835547
Epochs 140	0.715596318	16.12903226	4	92.59259259	60	60	82.09876543	-58.30215438	-64.15459983	0.693023264	2.127659574	0	90.79754601	46.80851064	40	85.18518519	-92.67804554	-78.23835547
Epochs 160	0.75688076	14.81481481	5.555555556	92.48554913	61.53846154	50	80.34682081	-36.08529079	-64.15459983	0.739534855	0	0	90.85714286	44.44444444	25	85.05747126	-74.90049161	-78.23835547
Epochs 180	0.752293587	16	4.761904762	92.44186047	66.66666667	57.14285714	80.23255814	-41.76004492	-64.15459983	0.758139551	0	0	90.55555556	45.16129032	25	84.91620112	-61.29637526	-78.23835547
Epochs 200	0.779816508	20	5	92.69662921	57.89473684	55	80.8988764	-28.37475927	-64.15459983	0.776744187	3.333333333	0	91.20879121	46.66666667	33.33333333	85.63535912	-67.02670638	-78.23835547
OCBC Bank Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.25688073	6.306306306	6.779661017	93.75	47.74774775	55.93220339	91.4893617	-86.95940203	-55.90202866	0.344186038	6.382978723	10.20408163	87.5	53.19148936	57.14285714	80.28169014	-41.73488998	-24.56291964
Epochs 40	0.30733946	6.756756757	6.25	89.0625	54.05405405	53.75	87.3015873	-98.35173989	-55.90202866	0.386046499	7.317073171	11.11111111	89.87341772	50	56.60377358	86.07594937	2.613796635	-24.56291964
Epochs 60	0.454128444	9.523809524	6.41025641	91.83673469	54.76190476	56.41025641	85.56701031	-95.48822209	-55.90202866	0.483720928	8.620689655	7.843137255	89.62264151	53.44827586	54	84.90566038	-19.24969226	-24.56291964
Epochs 80	0.495412856	12.82051282	6.756756757	93.33333333	53.84615385	54.05405405	88.46153846	-84.80854136	-55.90202866	0.558139563	6.976744186	6.818181818	89.0625	48.8372093	48.8372093	85.15625	-46.14566342	-24.56291964
Epochs 100	0.637614667	10.34482759	6.666666667	92.36111111	55.17241379	57.77777778	86.01398601	-48.51101203	-55.90202866	0.669767439	9.090909091	7.407407407	89.67741935	51.51515152	40.74074074	86.36363636	-28.56629681	-24.56291964
Epochs 120	0.711009145	4.761904762	6.451612903	91.56626506	42.85714286	67.74193548	85.45454545	-57.66180377	-55.90202866	0.725581408	11.11111111	9.523809524	90.41916168	55.55555556	47.61904762	86.74698795	1.470825189	-24.56291964
Epochs 140	0.720183492	0	4	90.69767442	42.85714286	68	84.79532164	-86.20247886	-55.90202866	0.772092998	13.63636364	12.5	90.96045198	59.09090909	56.25	87.5	-10.92426626	-24.56291964
Epochs 160	0.761467874	0	4.761904762	91.16022099	31.25	71.42857143	85.55555556	-65.5489786	-55.90202866	0.813953459	13.33333333	10	90.52631579	60	70	86.24338624	-47.22047382	-24.56291964
Epochs 180	0.770642221	0	0	90.81081081	30.76923077	70	84.7826087	-65.06456996	-55.90202866	0.841860473	23.07692308	12.5	91.2371134	61.53846154	62.5	87.04663212	-55.92700952	-24.56291964
Epochs 200	0.775229335	0	0	90.86021505	25	65	84.86486486	108.8229812	-55.90202866	0.823255837	12.5	14.28571429	90.625	62.5	57.14285714	86.38743455	-56.13416872	-24.56291964
CNOOC Limited Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.317535549	5.555555556	0	89.39393939	43.35664336	0	80.3030303	-64.98048188	-54.68960087	0.211267605	4.347826087	0	84.44444444	39.375	42.85714286	77.77777778	-70.54764821	-84.2898875

Epochs 40	0.407582939	6.666666667	7.462686567	91.66666667	58.33333333	54.54545455	84.52380952	-48.64242201	-54.68960087	0.441314548	6.25	8.771929825	92.39130435	46.875	50	79.34782609	-83.08858325	-84.2898875
Epochs 60	0.521327019	4.545454545	7.547169811	91.22807018	61.36363636	57.69230769	85.0877193	-30.58425234	-54.68960087	0.525821567	7.547169811	8.510638298	92.03539823	50.94339623	45.65217391	81.4159292	-86.27871098	-84.2898875
Epochs 80	0.587677717	3.225806452	6.25	90.90909091	61.29032258	57.44680851	83.33333333	-55.09990713	-54.68960087	0.591549277	8.333333333	8.695652174	90.83969466	41.66666667	44.44444444	80.15267176	-49.09689282	-84.2898875
Epochs 100	0.649289072	4.761904762	6.818181818	91.09589041	66.66666667	60.46511628	82.87671233	126.8780322	-54.68960087	0.64319247	10.71428571	9.302325581	91.54929577	53.57142857	45.23809524	80.28169014	-39.02636059	-84.2898875
Epochs 120	0.687203765	5.555555556	5.405405405	91.02564103	66.66666667	58.33333333	82.69230769	44.08004548	-54.68960087	0.685446024	9.523809524	10.25641026	91.50326797	57.14285714	51.28205128	80.92105263	14.67958409	-84.2898875
Epochs 140	0.739336491	6.25	3.846153846	91.12426036	75	60	82.84023669	43.65140295	-54.68960087	0.713615	16	12.12121212	92.90322581	52	45.45454545	81.81818182	-83.14765776	-84.2898875
Epochs 160	0.77251184	8.333333333	0	91.01123596	75	60	83.14606742	54.12067258	-54.68960087	0.746478856	17.64705882	10	92.1686747	52.94117647	50	81.81818182	-83.42930436	-84.2898875
Epochs 180	0.781990528	8.333333333	0	91.11111111	91.66666667	61.11111111	82.77777778	15.91107028	-54.68960087	0.746478856	12.5	10.71428571	91.12426036	50	57.14285714	80.95238095	-21.79012872	-84.2898875
Epochs 200	0.800947845	10	0	91.30434783	90	56.25	83.15217391	15.91107028	-54.68960087	0.746478856	5.882352941	12	90.64327485	47.05882353	60	80.58823529	-83.08628202	-84.2898875
JP Morgan Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.30733946	12.28070175	4.854368932	94.82758621	56.14035088	47.05882353	91.37931034	9762.236207	1576.179166	0.420091331	10.16949153	8.219178082	91.95402299	45.76271186	57.53424658	82.55813953	35.18264351	-31.90034799
Epochs 40	0.270642191	10.14492754	5	95.91836735	53.62318841	49.49494949	87.75510204	2146.128029	1576.179166	0.333333343	10	9.090909091	92.06349206	48.88888889	54.54545455	77.41935484	-69.82054685	-31.90034799
Epochs 60	0.399082571	10.90909091	4.938271605	93.90243902	54.54545455	50	84.14634146	1440.568528	1576.179166	0.452054799	8.108108108	12.5	89.69072165	50	52.08333333	78.125	-74.911751	-31.90034799
Epochs 80	0.454128444	8.771929825	4.761904762	92.85714286	49.12280702	53.22580645	84.69387755	1701.699439	1576.179166	0.511415541	5.970149254	15.78947368	89.47368421	49.25373134	60.52631579	79.6460177	-56.89538645	-31.90034799
Epochs 100	0.56422019	9.090909091	6.12244898	92.8	43.18181818	51.02040816	83.87096774	4334.326559	1576.179166	0.529680371	4.838709677	12.12121212	87.90322581	46.77419355	57.57575758	80.48780488	-27.69176514	-31.90034799
Epochs 120	0.614678919	12.5	4.255319149	92.08633094	46.875	52.17391304	84.17266187	4633.447592	1576.179166	0.566210032	4.838709677	13.04347826	88.05970149	48.38709677	60.86956522	80.45112782	-6.722960645	-31.90034799
Epochs 140	0.614678919	14.28571429	3.921568627	92.08633094	46.42857143	52.94117647	84.05797101	5818.184533	1576.179166	0.630136967	7.142857143	7.407407407	88.66666667	52.38095238	59.25925926	81.20805369	-29.57231911	-31.90034799
Epochs 160	0.701834857	17.24137931	6.060606061	93.58974359	51.72413793	48.48484848	85.80645161	5033.360325	1576.179166	0.652968049	7.142857143	5	88.53503185	47.61904762	55	80.76923077	-70.01568897	-31.90034799
Epochs 180	0.766055048	22.72727273	7.692307692	94.11764706	54.54545455	57.69230769	86.39053254	6963.355561	1576.179166	0.698630154	6.25	5.555555556	88.75739645	56.25	55.55555556	80.95238095	-58.11701109	-31.90034799
Epochs 200	0.788990855	23.52941176	11.53846154	94.28571429	52.94117647	57.69230769	86.7816092	6562.364489	1576.179166	0.735159814	9.090909091	5	89.26553672	63.63636364	70	81.25	-8.441962122	-31.90034799
American Axle (small cap) Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.426605493	10.25641026	4.494382022	94.44444444	56.41025641	46.06741573	89.88764045	45.2371328	-40.19620025	0.470319629	10.25641026	6.578947368	90.38461538	61.53846154	55.26315789	84.46601942	601.8539654	-32.50977019
Epochs 40	0.32110092	7.142857143	7.777777778	100	44.28571429	49.43820225	93.10344828	-50.44195671	-40.19620025	0.452054799	9.302325581	10	90.625	53.48837209	55	85.26315789	387.0563896	-32.50977019
Epochs 60	0.366972476	6.756756757	9.333333333	98.55072464	41.89189189	50	92.75362319	-86.21758521	-40.19620025	0.484018266	9.259259259	10	90.47619048	57.40740741	58.33333333	85.57692308	362.7421853	-32.50977019
Epochs 80	0.426605493	7.246376812	10.44776119	98.7804878	42.02898551	46.96969697	92.68292683	-87.74493649	-40.19620025	0.515981734	4.761904762	8.771929825	88.33333333	54.76190476	61.40350877	83.19327731	596.1653574	-32.50977019
Epochs 100	0.440366983	4.545454545	9.836065574	95.6043956	40.90909091	43.33333333	89.01098901	-87.82411037	-40.19620025	0.552511394	7.692307692	9.259259259	89.68253968	56.41025641	59.25925926	85.6	1430.552321	-32.50977019

Epochs 120	0.490825683	5	6.12244898	92.66055046	40	39.58333333	86.23853211	-89.37664624	-40.19620025	0.598173499	8.163265306	9.090909091	90.51094891	51.02040816	60.60606061	85.29411765	994.9926928	-32.50977019
Epochs 140	0.550458729	3.846153846	5.128205128	91.33858268	34.61538462	34.21052632	85.03937008	-92.65664019	-40.19620025	0.694063902	9.375	14.28571429	91.19496855	56.25	53.57142857	86.07594937	1228.947038	-32.50977019
Epochs 160	0.591743112	4.166666667	3.225806452	90.64748201	37.5	30	84.89208633	-92.69653356	-40.19620025	0.712328792	6.666666667	9.523809524	90.47619048	50	57.14285714	85.62874251	1265.590709	-32.50977019
Epochs 180	0.642201841	0	4.166666667	90.8496732	36.58536585	30.43478261	84.31372549	-78.18868659	-40.19620025	0.753424644	4.761904762	5.882352941	90.05524862	42.85714286	47.05882353	85.55555556	-43.12700705	-32.50977019
Epochs 200	0.669724762	3.125	3.571428571	91.13924051	40.625	25.92592593	84.81012658	-82.83859801	-40.19620025	0.753424644	6.25	8.695652174	90	50	52.17391304	85.47486034	-37.28722749	-32.50977019

Table 9-3 Results of Experiment for LSTM Model Trained Using Cyclic Stocks, Using Time Series Representation Input

Kweichow Moutai Co., Ltd. Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.454106271	9.375	9.523809524	92.22222222	48.42105263	33.33333333	90	895.6964892	1666.892281	0.495192319	9.411764706	0	94.05940594	43.52941176	54.54545455	87	243.9669332	678.7940879
Epochs 40	0.420289844	14.75409836	10.14492754	92.20779221	57.37704918	51.47058824	85.71428571	3632.489453	1666.892281	0.3125	12.28070175	7.216494845	94.44444444	59.64912281	51.04166667	90.74074074	239.2893998	678.7940879
Epochs 60	0.502415478	10.86956522	11.86440678	90.19607843	56.52173913	53.44827586	84.31372549	2055.095958	1666.892281	0.384615391	10.63829787	6.976744186	92	63.82978723	52.94117647	85.33333333	293.8631808	678.7940879
Epochs 80	0.560386479	10.25641026	10.41666667	89.16666667	58.97435897	55.31914894	84.16666667	3357.131442	1666.892281	0.447115391	12.82051282	6.329113924	92.22222222	66.66666667	51.28205128	86.66666667	367.5883611	678.7940879
Epochs 100	0.608695626	9.677419355	11.36363636	89.39393939	58.06451613	58.13953488	84.84848485	2749.121272	1666.892281	0.543269217	13.88888889	8.064516129	93.63636364	72.22222222	49.18032787	89.09090909	409.6765773	678.7940879
Epochs 120	0.685990334	10	13.51351351	90	65	56.75675676	85.90604027	1632.012378	1666.892281	0.634615362	16.66666667	7.142857143	93.28358209	83.33333333	42.85714286	89.47368421	1435.532481	678.7940879
Epochs 140	0.734299541	8.333333333	15.15151515	90.12345679	75	66.66666667	86.33540373	6118.695505	1666.892281	0.697115362	10	6.818181818	91.55844156	100	45.45454545	87.58169935	182.7064485	678.7940879
Epochs 160	0.777777791	9.090909091	17.39130435	90.1734104	72.72727273	65.2173913	86.62790698	5919.542224	1666.892281	0.769230783	0	6.896551724	90.8045977	100	51.72413793	86.70520231	91.95229238	678.7940879
Epochs 180	0.787439585	0	12.5	88.95027624	70	56.25	84.44444444	2160.264127	1666.892281	0.783653855	0	4	90.5027933	100	44	85.95505618	212.2044714	678.7940879
Epochs 200	0.811594188	0	16.66666667	89.24731183	66.66666667	50	84.86486486	407.6850903	1666.892281	0.802884638	0	4.761904762	90.71038251	100	38.0952381	85.71428571	161.1343543	678.7940879
Midea Group Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.053140096	5.314009662	0	0	45.63106796	0	0	1245.275482	1245.275482	0.033653848	3.365384615	0	0	42.02898551	0	0	468.5733088	468.5733088
Epochs 40	0.053140096	5.314009662	0	0	45.63106796	0	0	1245.275482	1245.275482	0.033653848	3.365384615	0	0	42.02898551	0	0	468.5733088	468.5733088
Epochs 60	0.202898547	6.338028169	11.11111111	100	47.18309859	44.44444444	89.28571429	12313.97718	1245.275482	0.149038464	4.545454545	0	88.88888889	43.79084967	55.55555556	81.48148148	313.9647661	468.5733088
Epochs 80	0.487922698	6.41025641	14.28571429	91.08910891	57.69230769	64.28571429	80	14289.39263	1245.275482	0.519230783	7.8125	2.857142857	93.57798165	50	65.71428571	87.96296296	132.6184208	468.5733088
Epochs 100	0.66183573	9.756097561	13.04347826	90.90909091	65.85365854	56.52173913	80.28169014	4452.520688	1245.275482	0.673076928	5.882352941	3.703703704	93.19727891	55.88235294	62.96296296	84.93150685	-13.17427409	468.5733088
Epochs 120	0.797101438	6.25	16.66666667	90.5027933	62.5	50	79.21348315	262.8661752	1245.275482	0.740384638	7.142857143	5.555555556	93.20987654	53.57142857	50	85.0931677	119.667949	468.5733088
Epochs 140	0.806763291	6.25	20	90.60773481	75	60	80	6079.227356	1245.275482	0.730769217	4	5	92.02453988	60	60	84.56790123	118.1068263	468.5733088
Epochs 160	0.811594188	7.142857143	18.18181818	90.65934066	64.28571429	54.54545455	80.11049724	784.8979298	1245.275482	0.730769217	4	5	92.02453988	56	50	84.56790123	124.8613848	468.5733088

Epochs 180	0.826086938	0	22.22222222	90.37433155	72.72727273	66.66666667	80.10752688	1193.005733	1245.275482	0.730769217	4.166666667	4.761904762	92.02453988	58.33333333	52.38095238	84.56790123	124.8613848	468.5733088
Epochs 200	0.830917895	0	22.22222222	90.42553191	80	66.66666667	80.21390374	1252.45276	1245.275482	0.740384638	4.347826087	5	92.12121212	56.52173913	50	84.75609756	131.4186674	468.5733088
Walmart Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.408256888	7.407407407	8.536585366	95.12195122	50	48.14814815	93.90243902	3324.723282	9380.979094	0.415525109	7.692307692	7.352941176	94.18604651	50.76923077	50	87.05882353	810.6370679	255.7316817
Epochs 40	0.440366983	7.5	7.058823529	93.5483871	52.5	51.76470588	89.13043478	305.6759013	9380.979094	0.534246564	8.888888889	11.47540984	93.80530973	56.81818182	50.81967213	84.95575221	11.49279664	255.7316817
Epochs 60	0.527522922	5.882352941	8.695652174	93.04347826	47.05882353	53.62318841	86.84210526	237.4258609	9380.979094	0.621004581	8.108108108	16	94.6969697	58.33333333	54	87.12121212	49.50033115	255.7316817
Epochs 80	0.591743112	9.375	8.620689655	94.53125	53.125	51.72413793	86.61417323	264.2880109	9380.979094	0.662100434	9.677419355	15.55555556	94.40559441	50	60	86.71328671	56.3089111	255.7316817
Epochs 100	0.651376128	12	8	94.40559441	48	54	85.21126761	279.5787274	9380.979094	0.753424644	14.28571429	20	95.09202454	57.14285714	60	87.03703704	103.3607404	255.7316817
Epochs 120	0.697247684	8.333333333	10.25641026	94.19354839	50	56.41025641	86.36363636	195.0053093	9380.979094	0.808219194	18.75	20.83333333	94.41340782	68.75	58.33333333	87.07865169	152.4047068	255.7316817
Epochs 140	0.720183492	5.263157895	11.11111111	93.25153374	47.36842105	52.77777778	85.18518519	223.5374576	9380.979094	0.83561641	9.090909091	26.31578947	93.65079365	54.54545455	57.89473684	86.17021277	160.3327741	255.7316817
Epochs 160	0.747706413	5	13.79310345	93.49112426	45	51.72413793	85.11904762	248.5077838	9380.979094	0.87214613	12.5	35.71428571	93.90862944	50	71.42857143	86.73469388	157.8428843	255.7316817
Epochs 180	0.793577969	7.692307692	12.5	93.37016575	38.46153846	58.33333333	85.55555556	261.4528423	9380.979094	0.885844767	16.66666667	36.36363636	93.56435644	50	63.63636364	86.56716418	474.9935206	255.7316817
Epochs 200	0.798165143	6.666666667	17.39130435	93.88888889	33.33333333	60.86956522	86.03351955	261.4528423	9380.979094	0.885844767	14.28571429	40	93.56435644	42.85714286	60	86.56716418	305.6051316	255.7316817
Fresh Del Monte Produce Inc (small cap) Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.426605493	11.42857143	11.76470588	96.25	55.71428571	52.23880597	87.5	947.9425232	5.320148705	0.493150681	11.76470588	9.803921569	95	58.82352941	49.01960784	89.8989899	15010.30983	-65.97131265
Epochs 40	0.426605493	14.0625	10.66666667	96.20253165	54.6875	50	84.81012658	4941.423301	5.320148705	0.410958916	9.523809524	7.352941176	89.77272727	60.31746032	51.47058824	85.05747126	179.2575935	-65.97131265
Epochs 60	0.509174287	13.79310345	11.86440678	95.04950495	58.62068966	55.17241379	86.13861386	555.7496147	5.320148705	0.511415541	9.677419355	6.976744186	90.35087719	54.83870968	51.1627907	84.95575221	-6.217608215	-65.97131265
Epochs 80	0.550458729	10.86956522	9.615384615	91.66666667	60.86956522	50.98039216	82.5	27.41502006	5.320148705	0.543379009	9.677419355	5.882352941	90.24390244	53.22580645	55.88235294	85.24590164	-69.46251705	-65.97131265
Epochs 100	0.555045843	9.302325581	4.347826087	89.14728682	60.46511628	48.88888889	80.62015504	-17.02988625	5.320148705	0.607305944	9.803921569	9.677419355	91.24087591	50.98039216	67.74193548	86.02941176	422.3460476	-65.97131265
Epochs 120	0.577981651	9.090909091	5	89.55223881	56.81818182	46.15384615	81.34328358	-42.47660449	5.320148705	0.666666687	9.756097561	8.333333333	90.90909091	48.7804878	70.83333333	83.00653595	110.576154	-65.97131265
Epochs 140	0.637614667	10	6.451612903	90.47619048	60	56.66666667	82.99319728	-31.78747957	5.320148705	0.698630154	10.25641026	5.882352941	90.79754601	48.71794872	58.82352941	83.33333333	216.009857	-65.97131265
Epochs 160	0.715596318	10.71428571	8.333333333	90.96385542	60.71428571	65.2173913	83.73493976	-11.50791172	5.320148705	0.762557089	16	5.882352941	91.52542373	48	70.58823529	83.52272727	308.9384481	-65.97131265
Epochs 180	0.747706413	13.04347826	5	90.85714286	56.52173913	63.15789474	83.42857143	-16.87106062	5.320148705	0.794520557	19.04761905	7.142857143	91.84782609	52.38095238	71.42857143	83.60655738	566.1708151	-65.97131265
Epochs 200	0.752293587	9.523809524	5.263157895	90.4494382	57.14285714	66.66666667	83.14606742	-16.87106062	5.320148705	0.808219194	18.75	7.142857143	91.53439153	43.75	78.57142857	84.04255319	553.8638366	-65.97131265

Table 9-4 Results of Experiment for LSTM Model Trained Using Non-Cyclic Stocks, Using Time Series Representation Input

10 Appendix 5

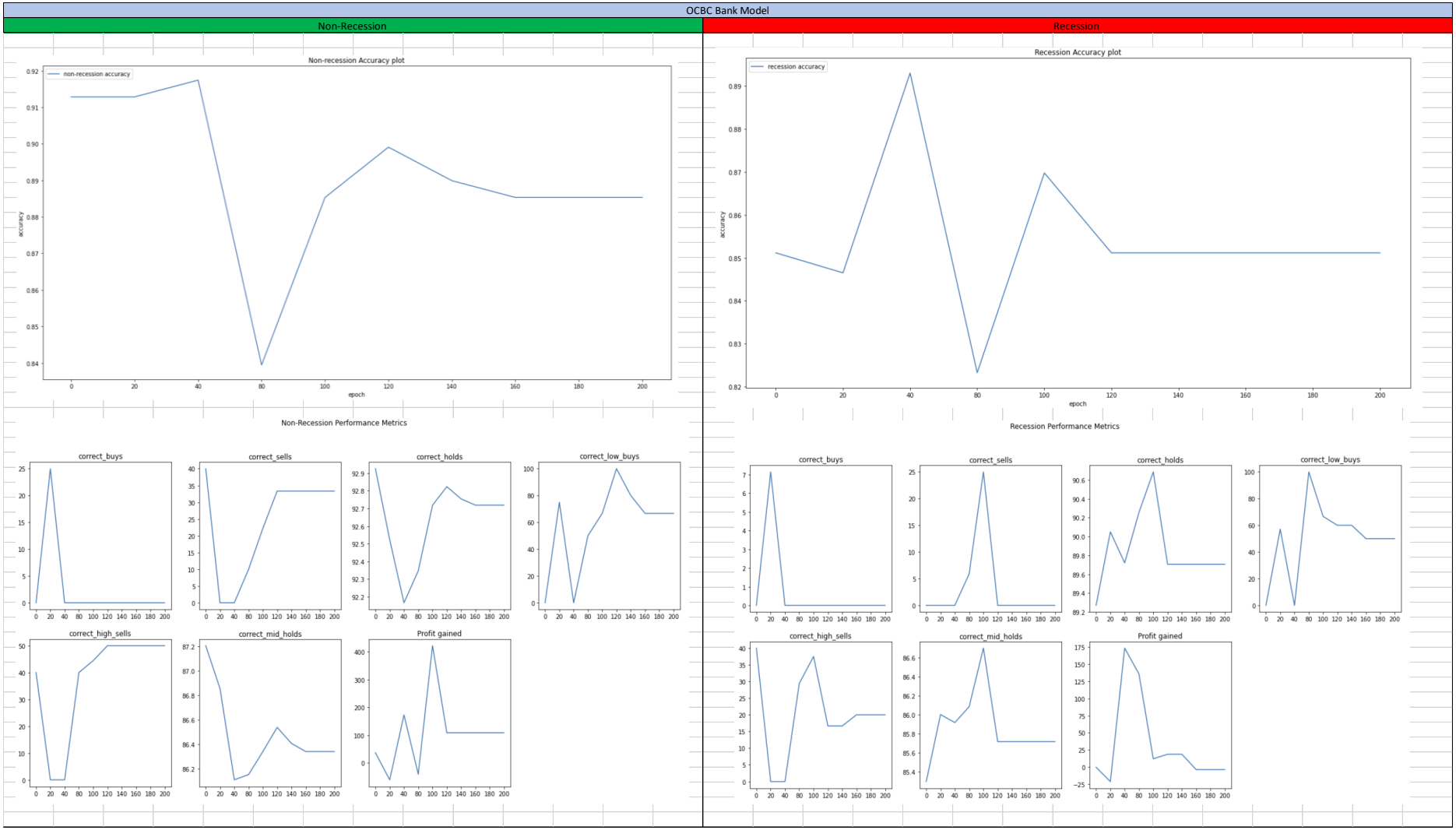


Figure 10-1 Image Representation Models Results

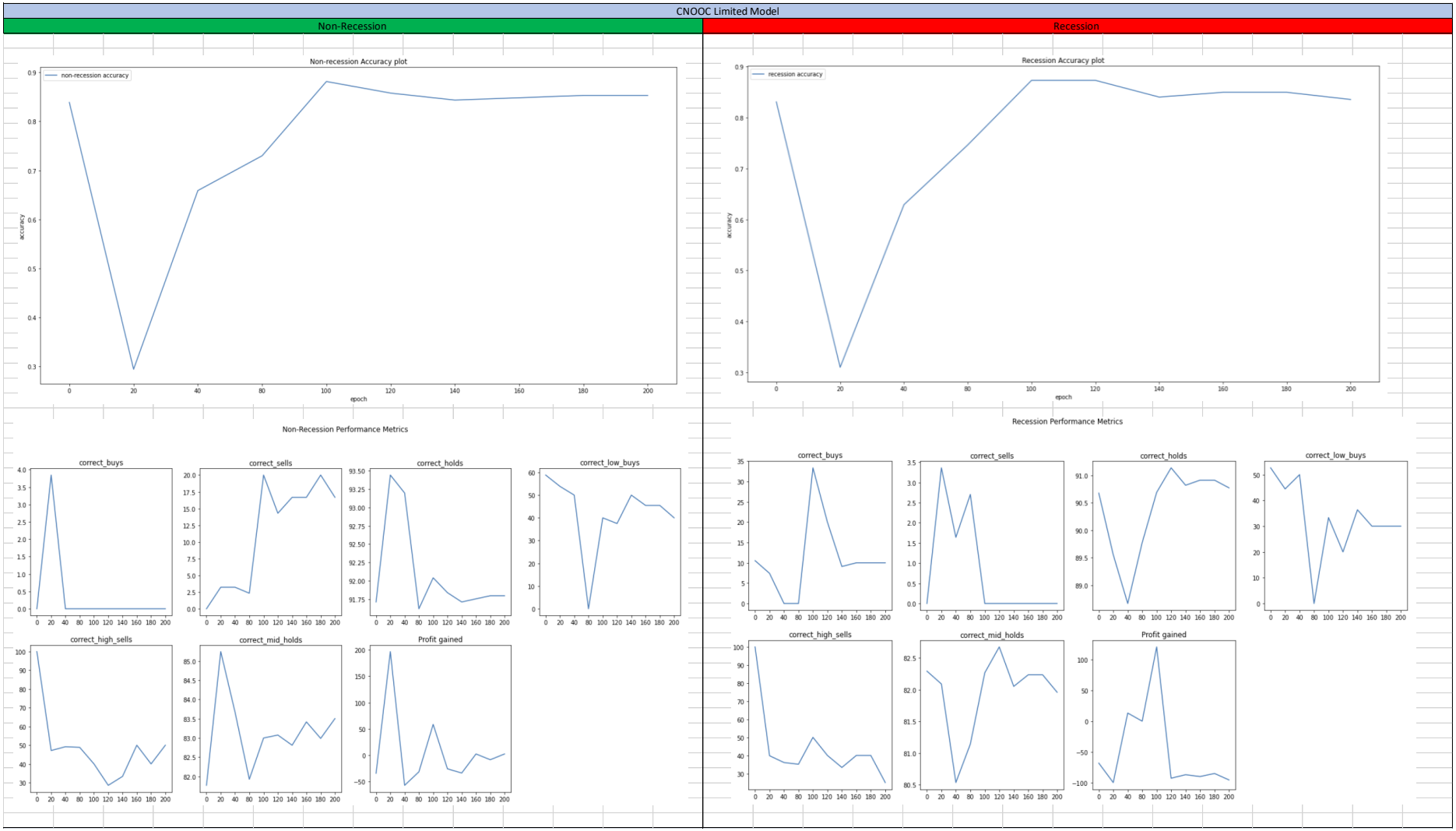


Figure 10-2 Image Representation Models Results

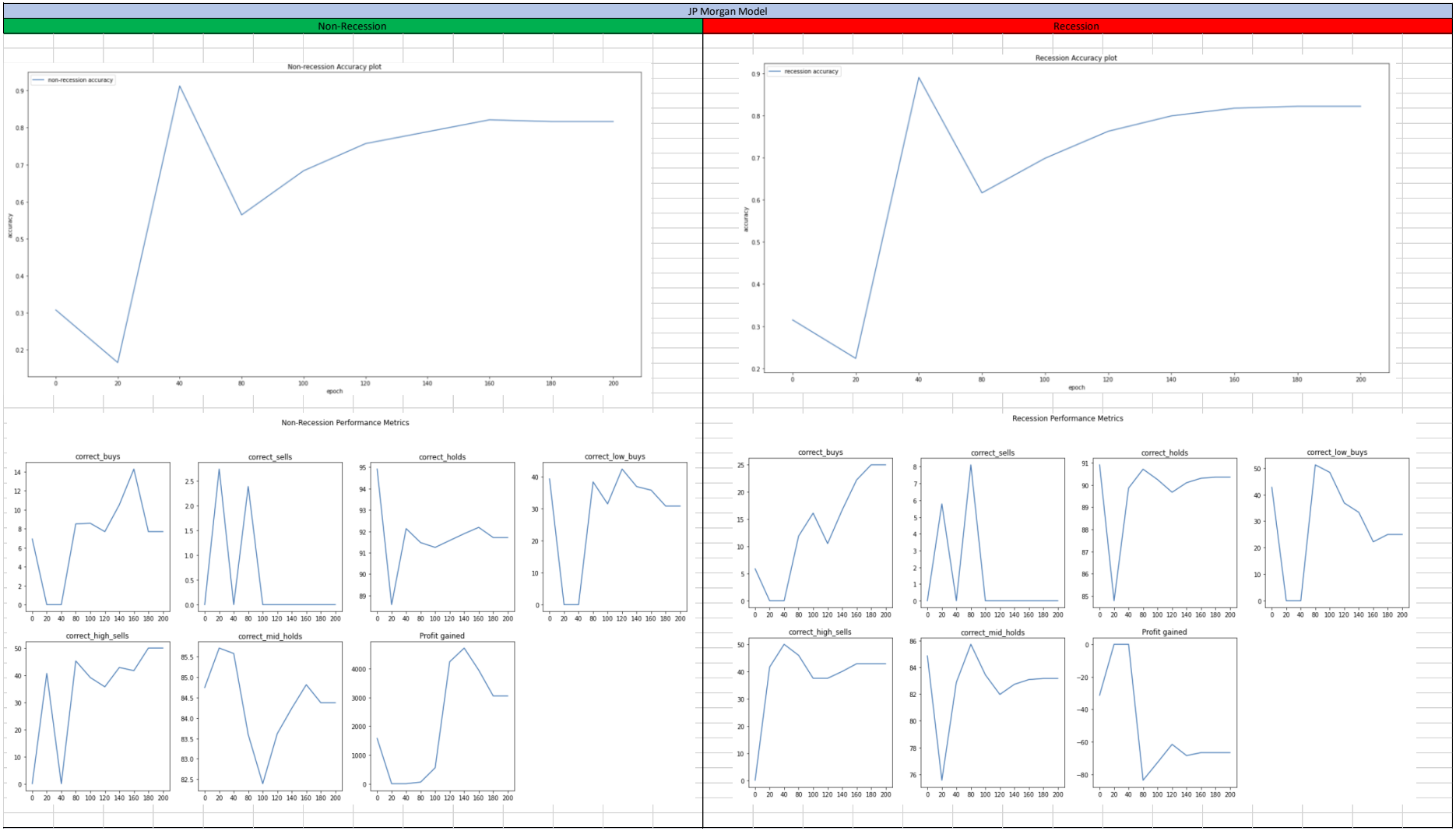


Figure 10-3 Image Representation Models Results

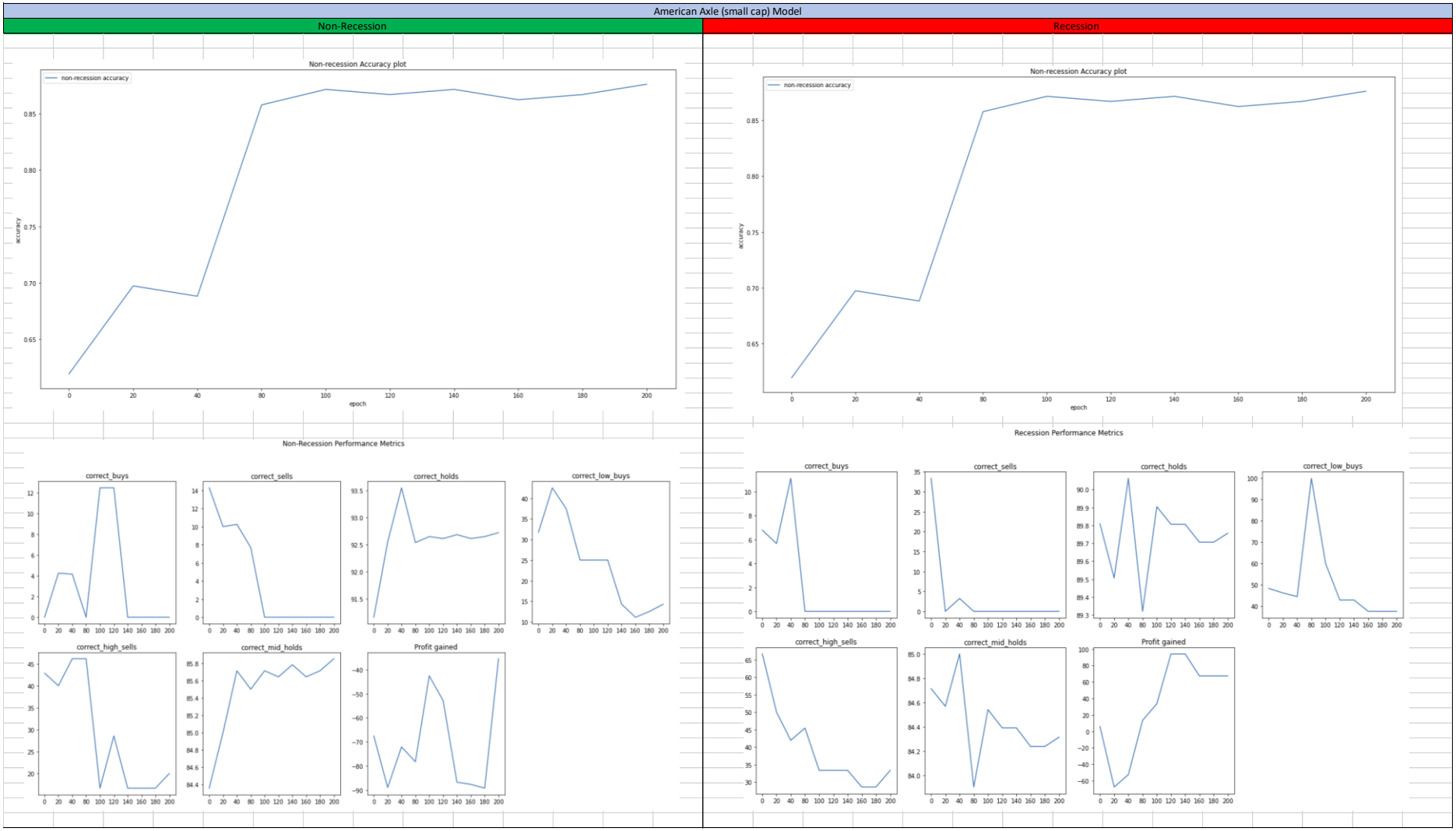


Figure 10-4 Image Representation Models Results

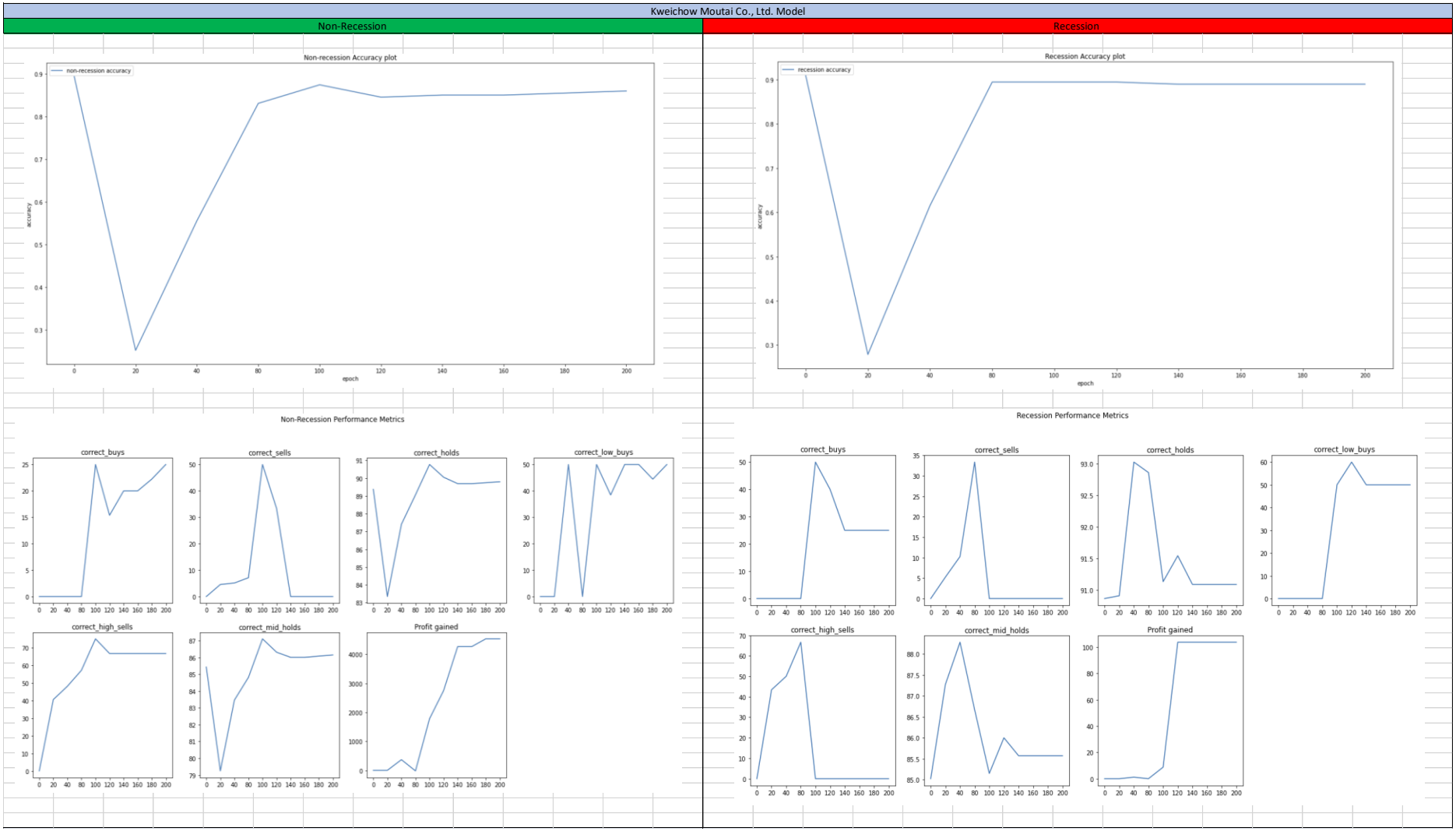


Figure 10-5 Image Representation Models Results

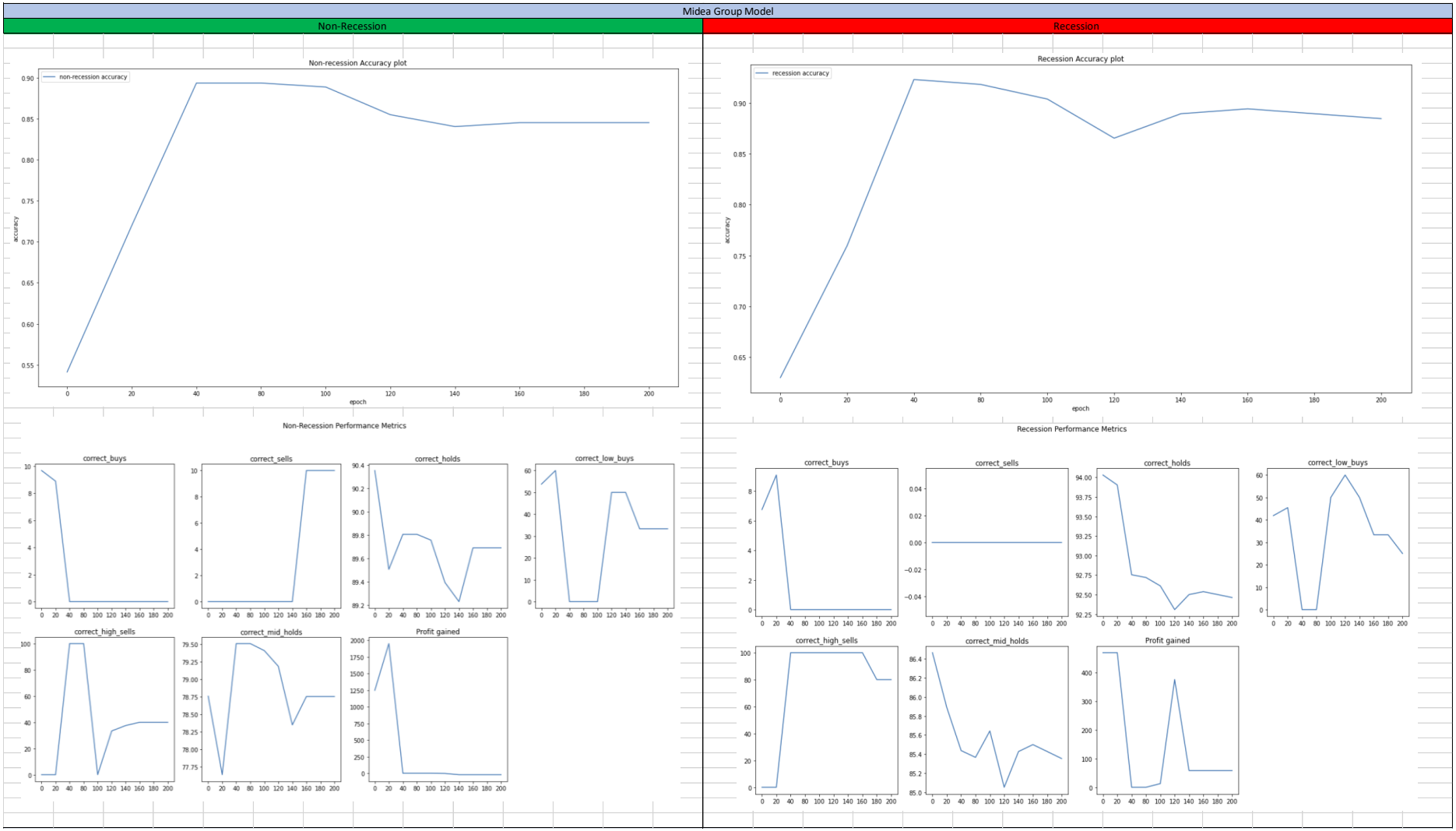


Figure 10-6 Image Representation Models Results

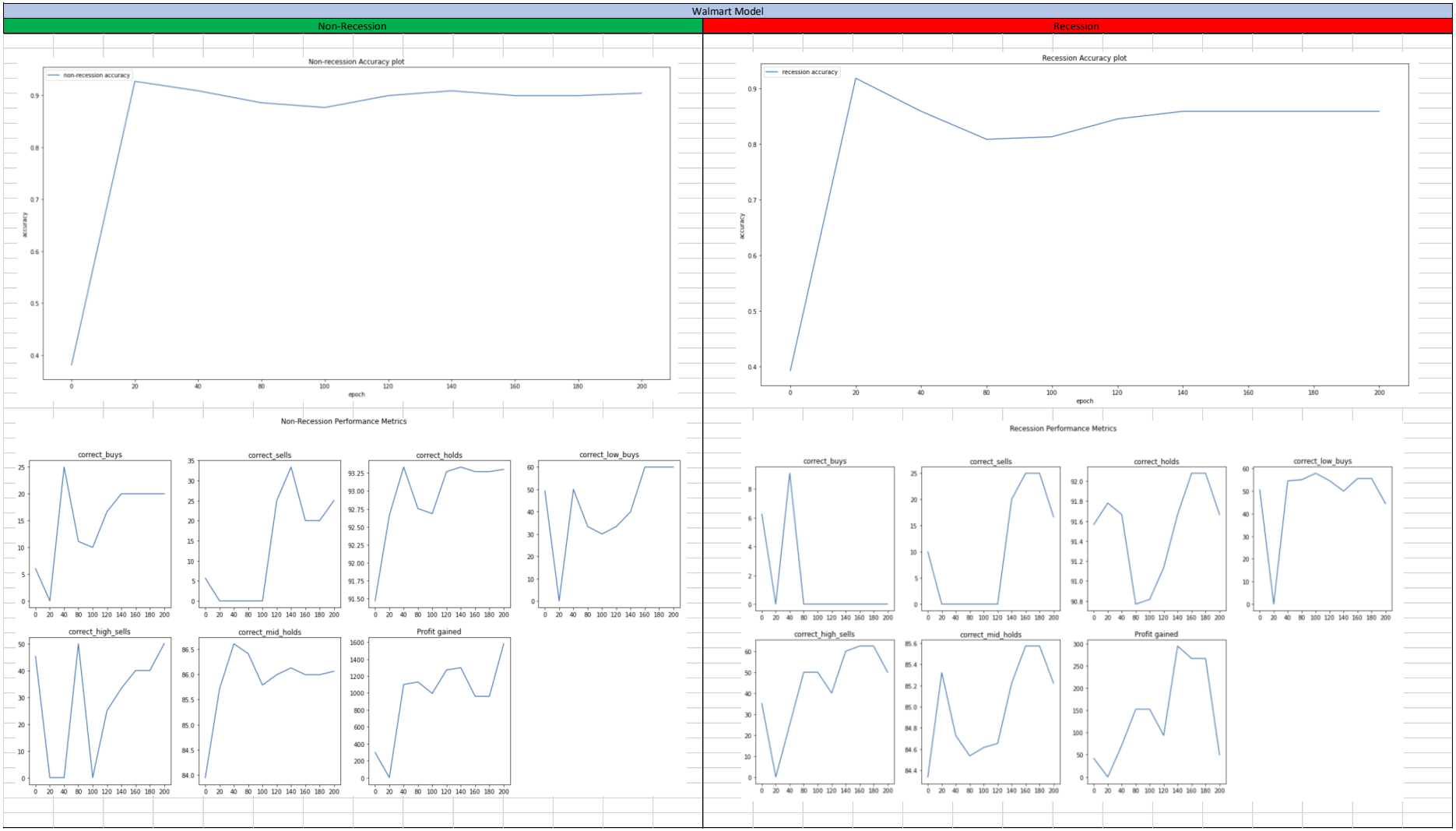


Figure 10-7 Image Representation Models Results

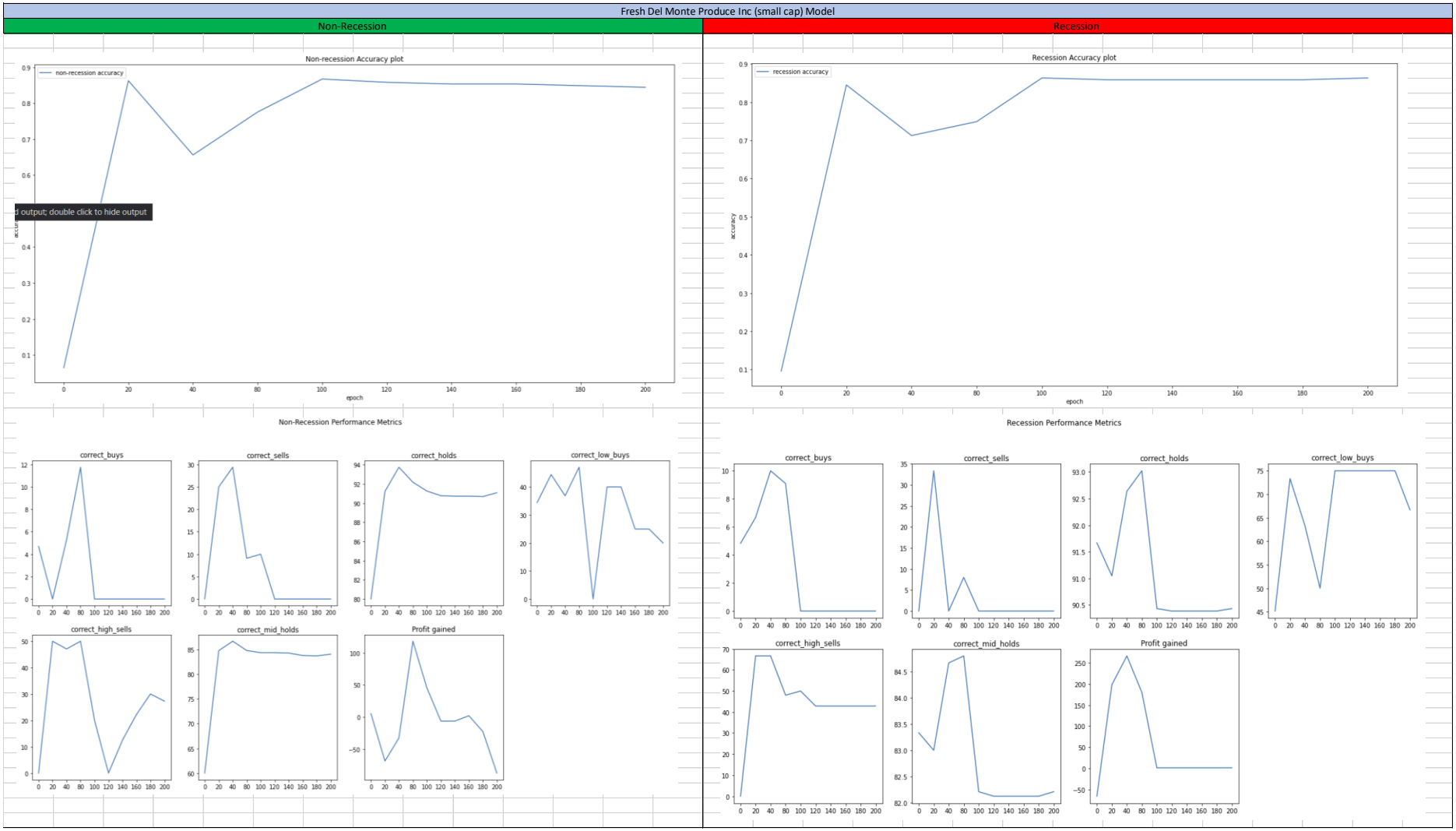


Figure 10-8 Image Representation Models Results

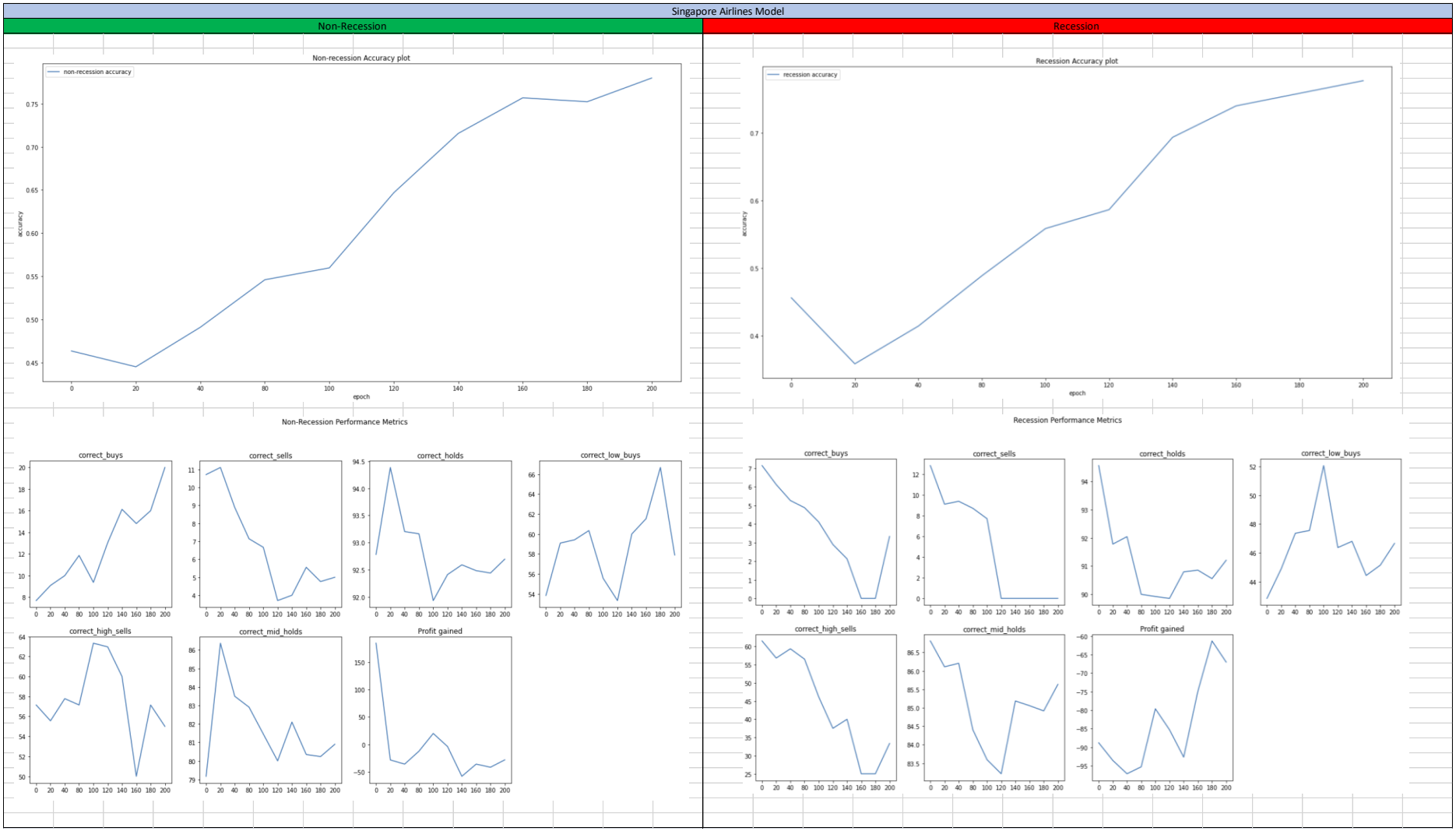


Figure 10-9 Time Series Representation Models Results

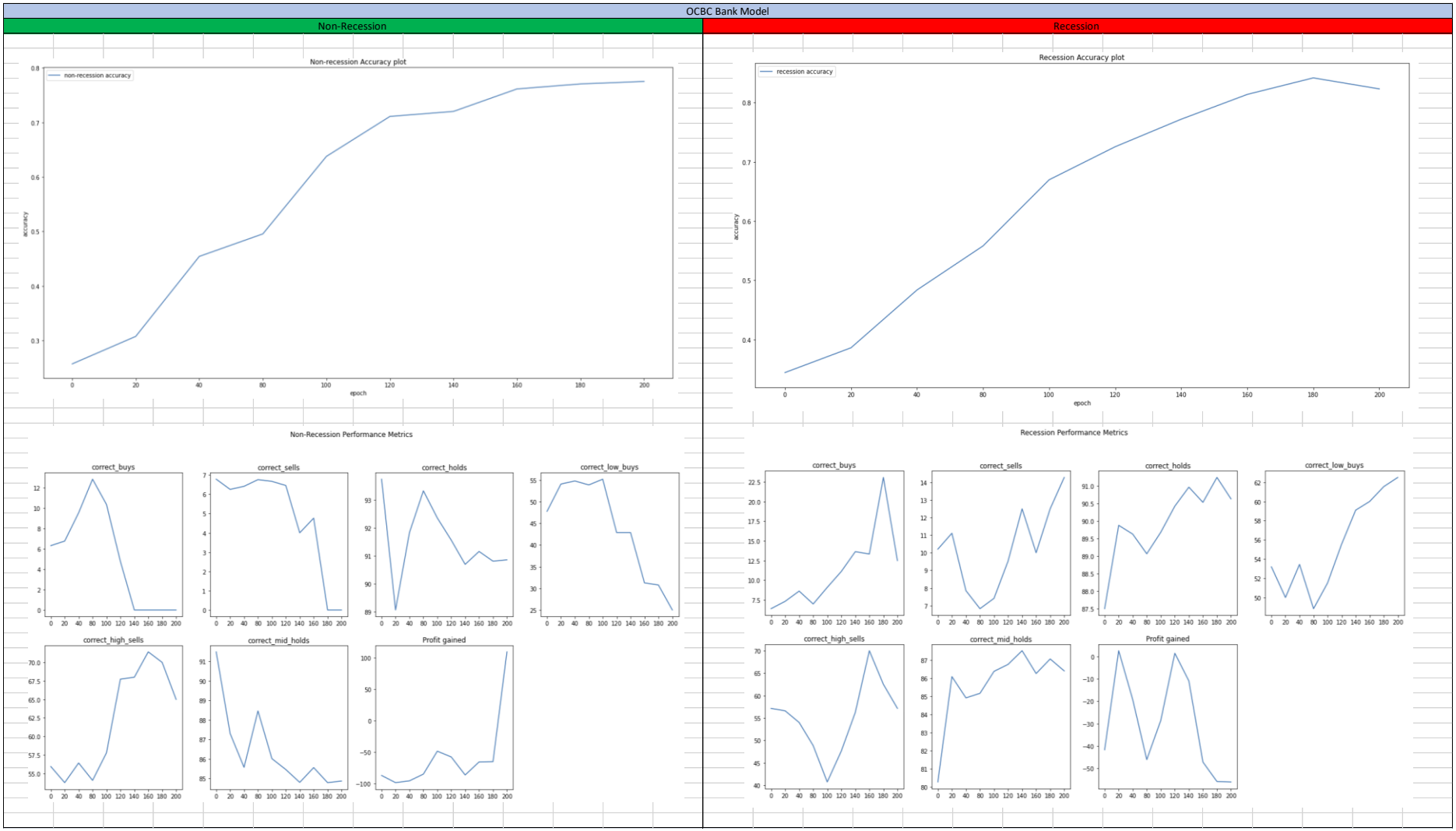


Figure 10-10 Time Series Representation Models Results

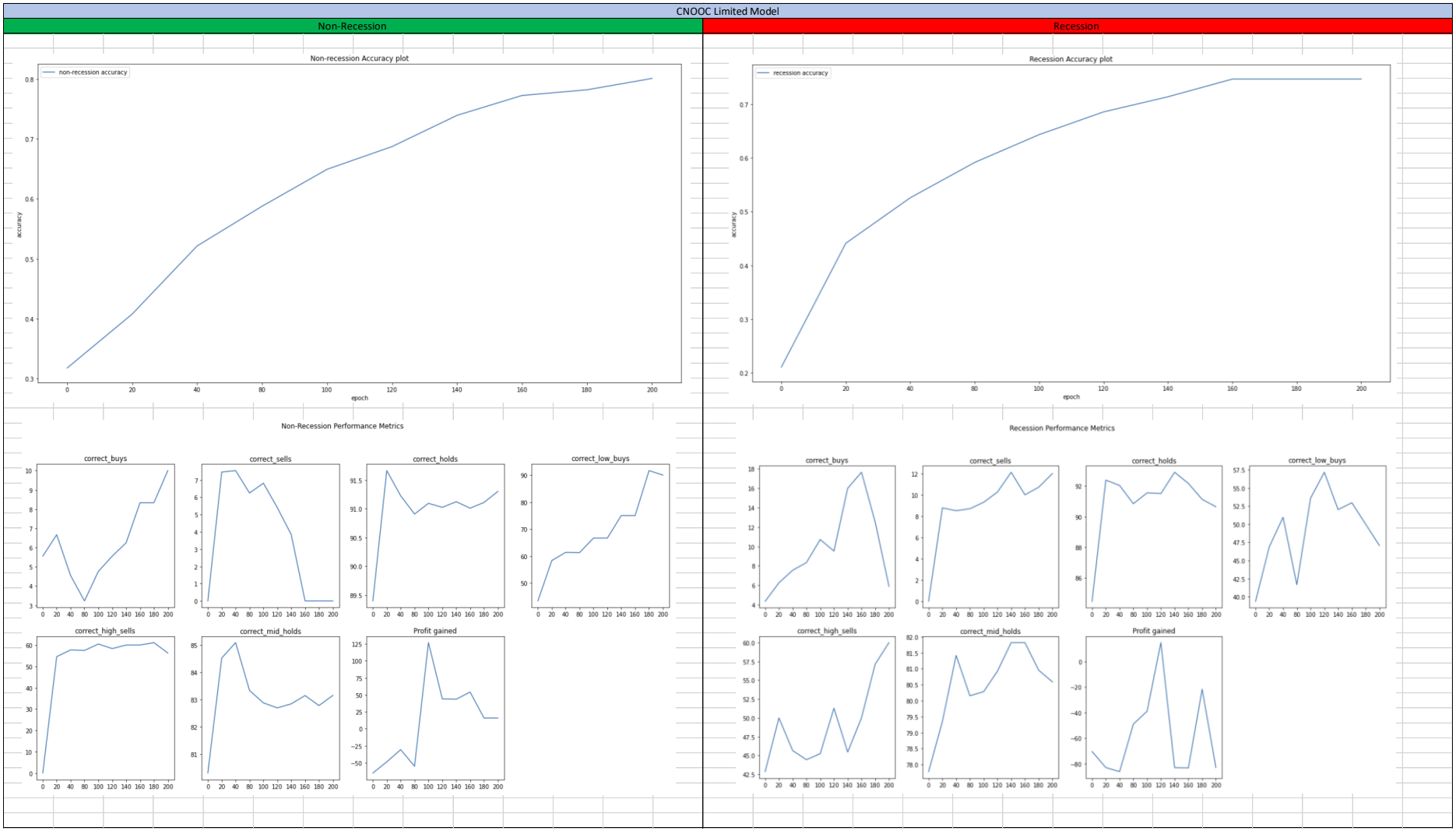


Figure 10-11 Time Series Representation Models Results

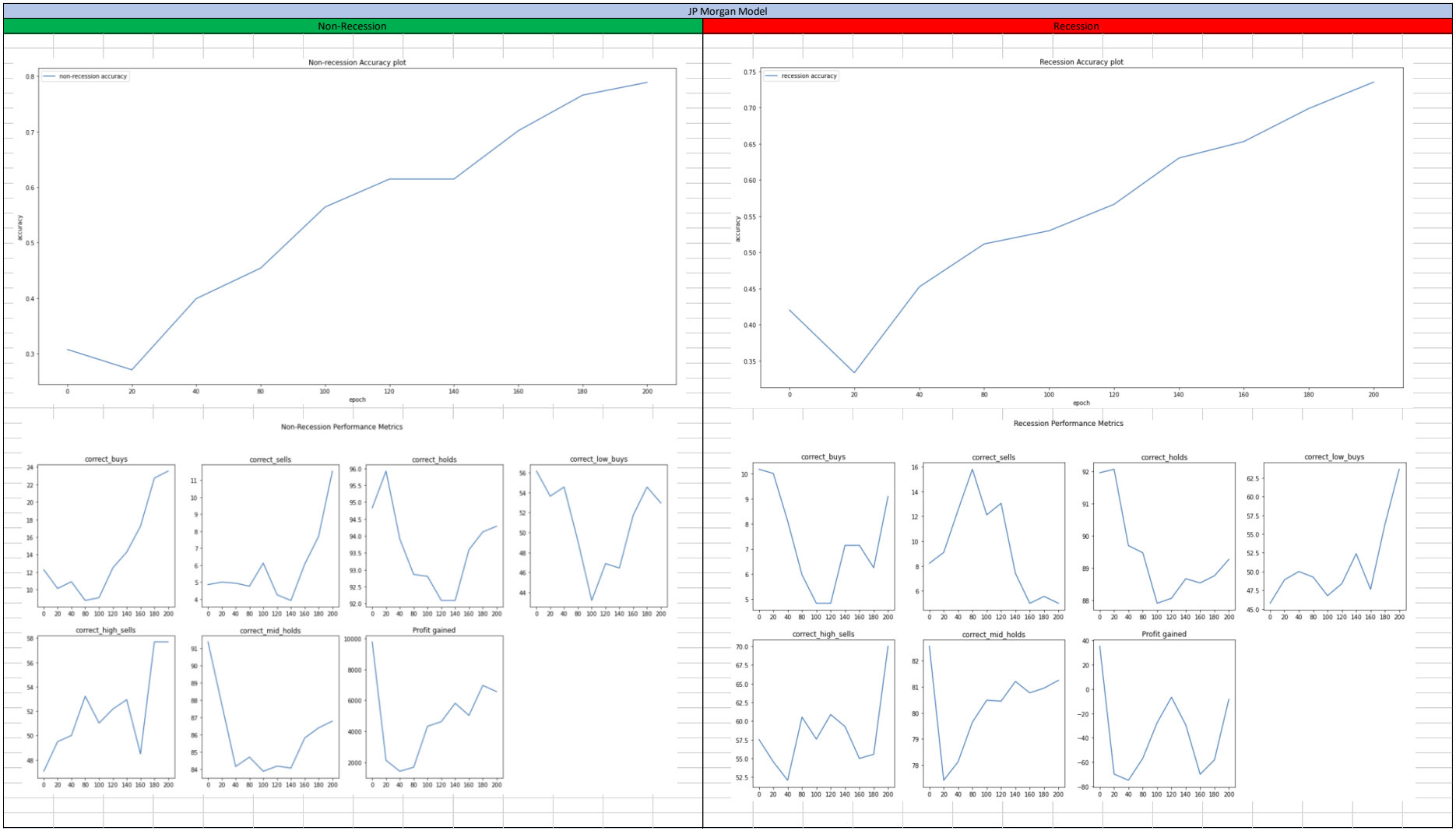


Figure 10-12 Time Series Representation Models Results

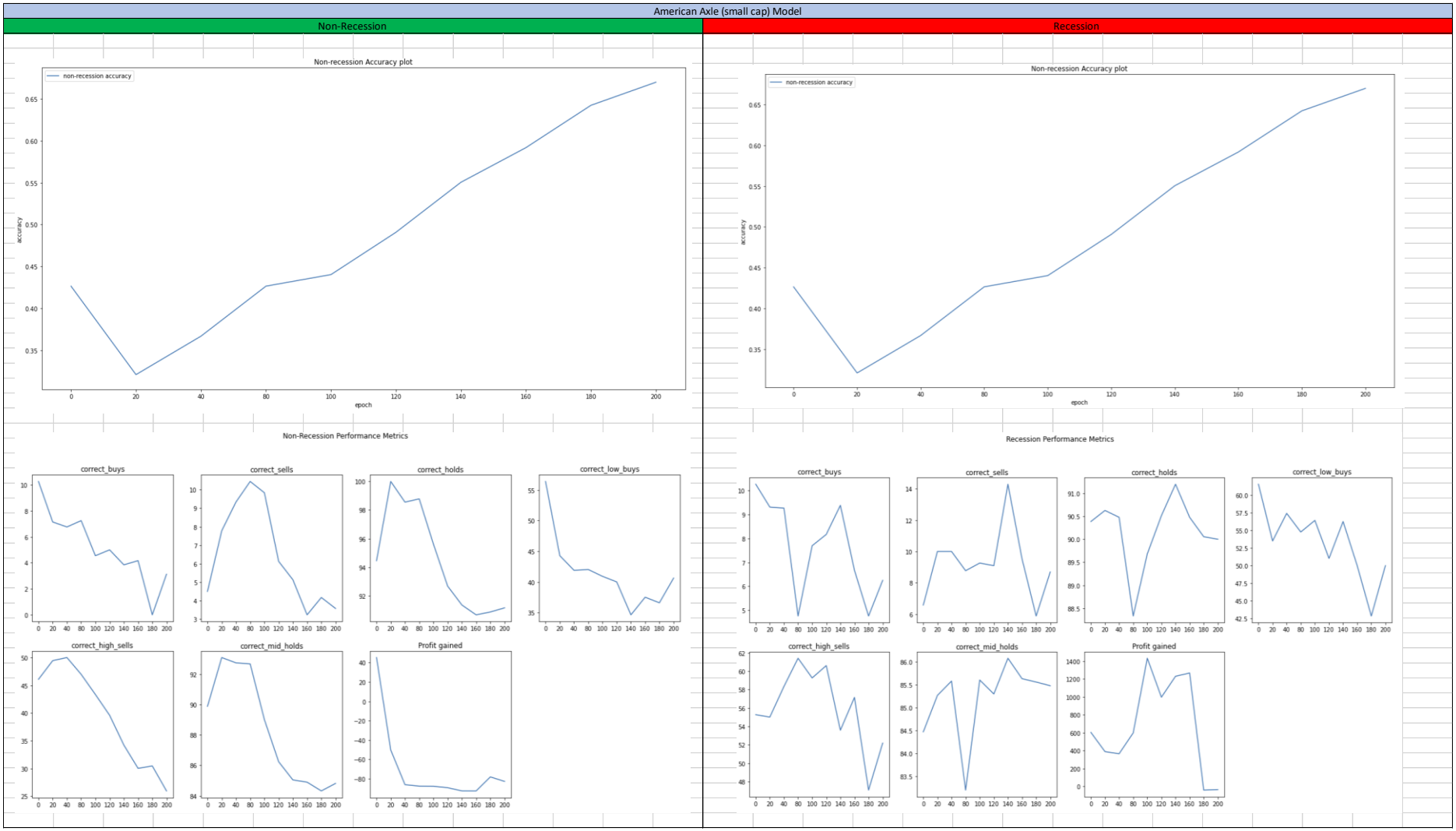


Figure 10-13 Time Series Representation Models Results

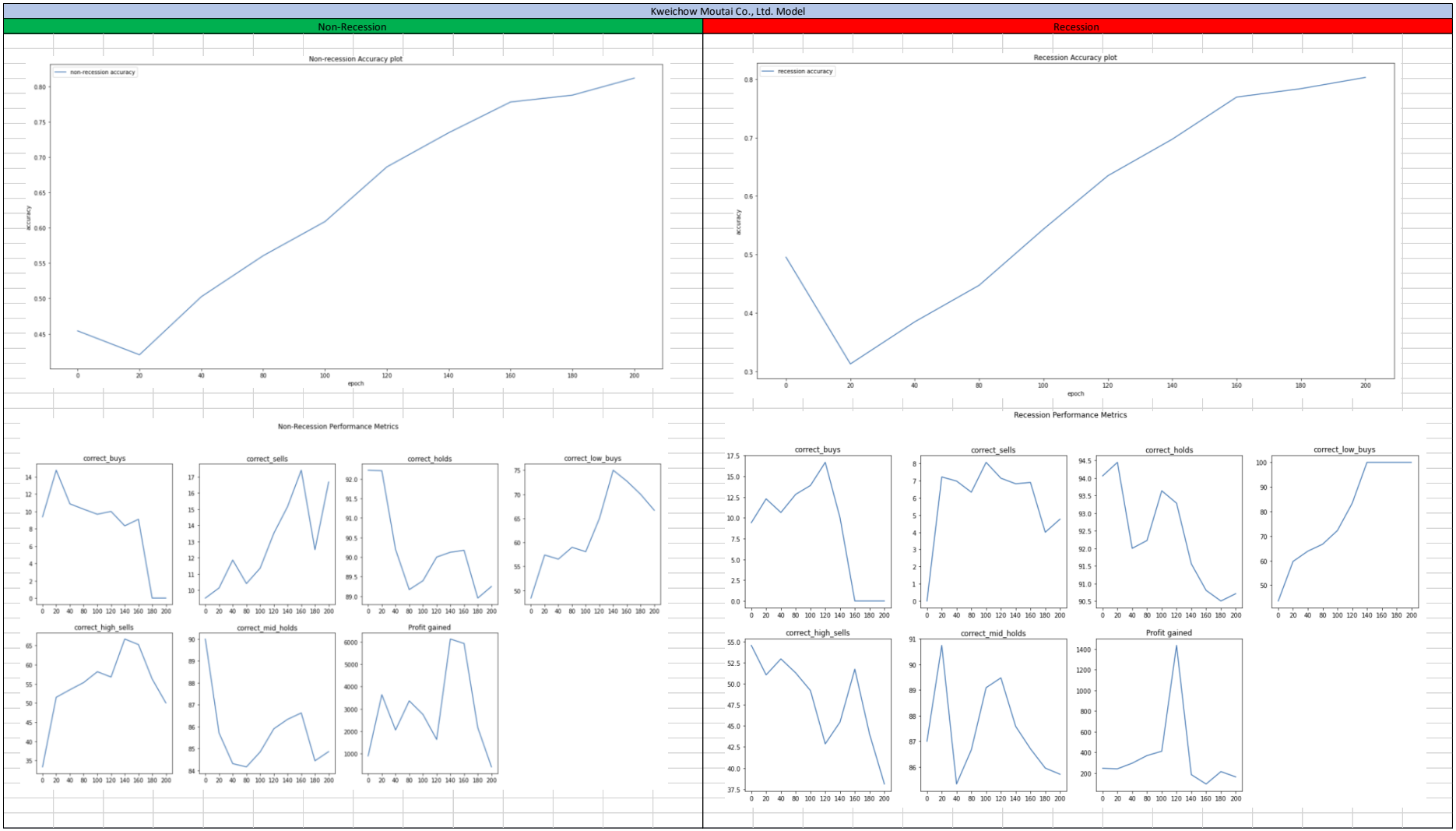


Figure 10-14 Time Series Representation Models Results

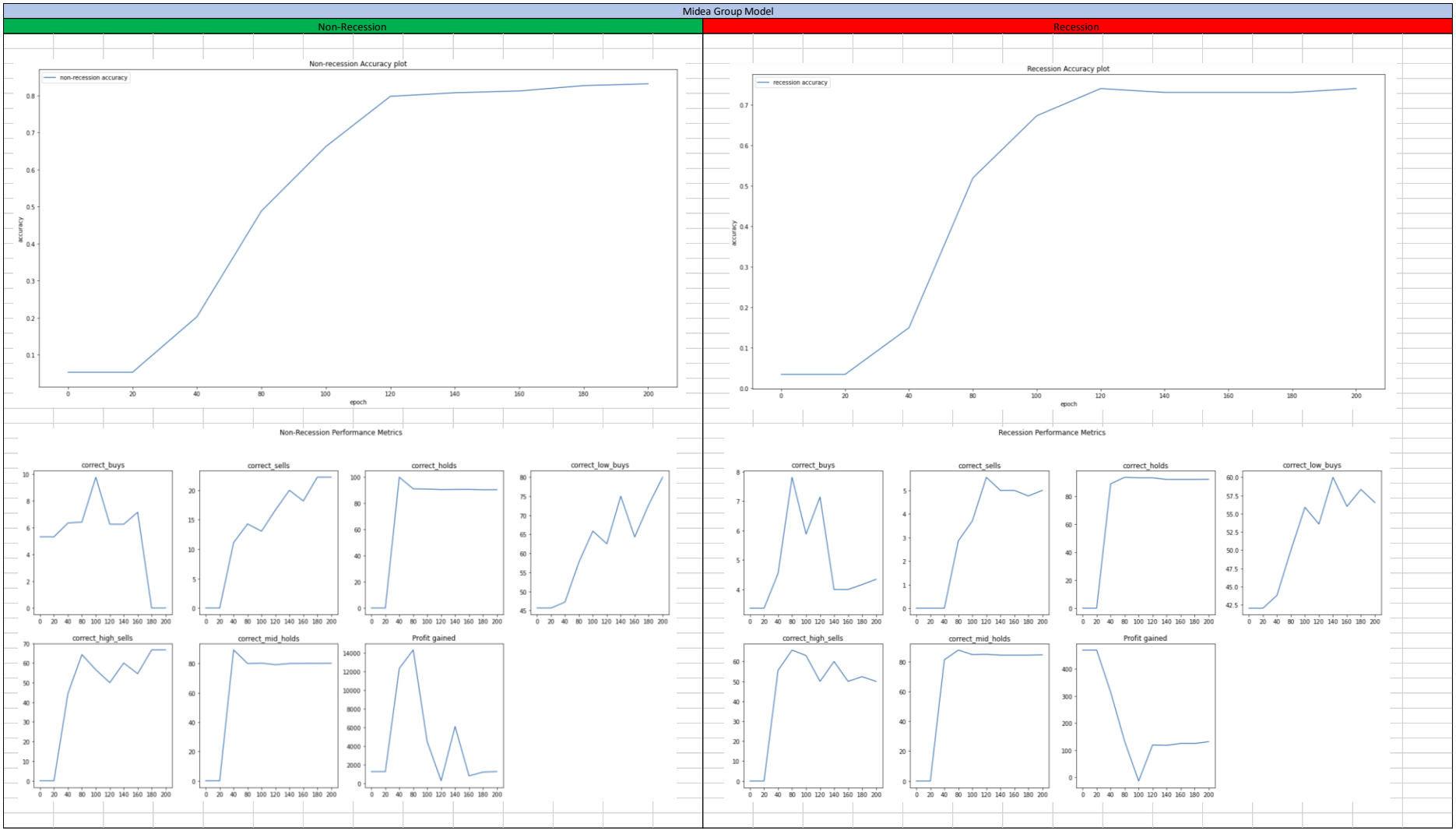


Figure 10-15 Time Series Representation Models Results

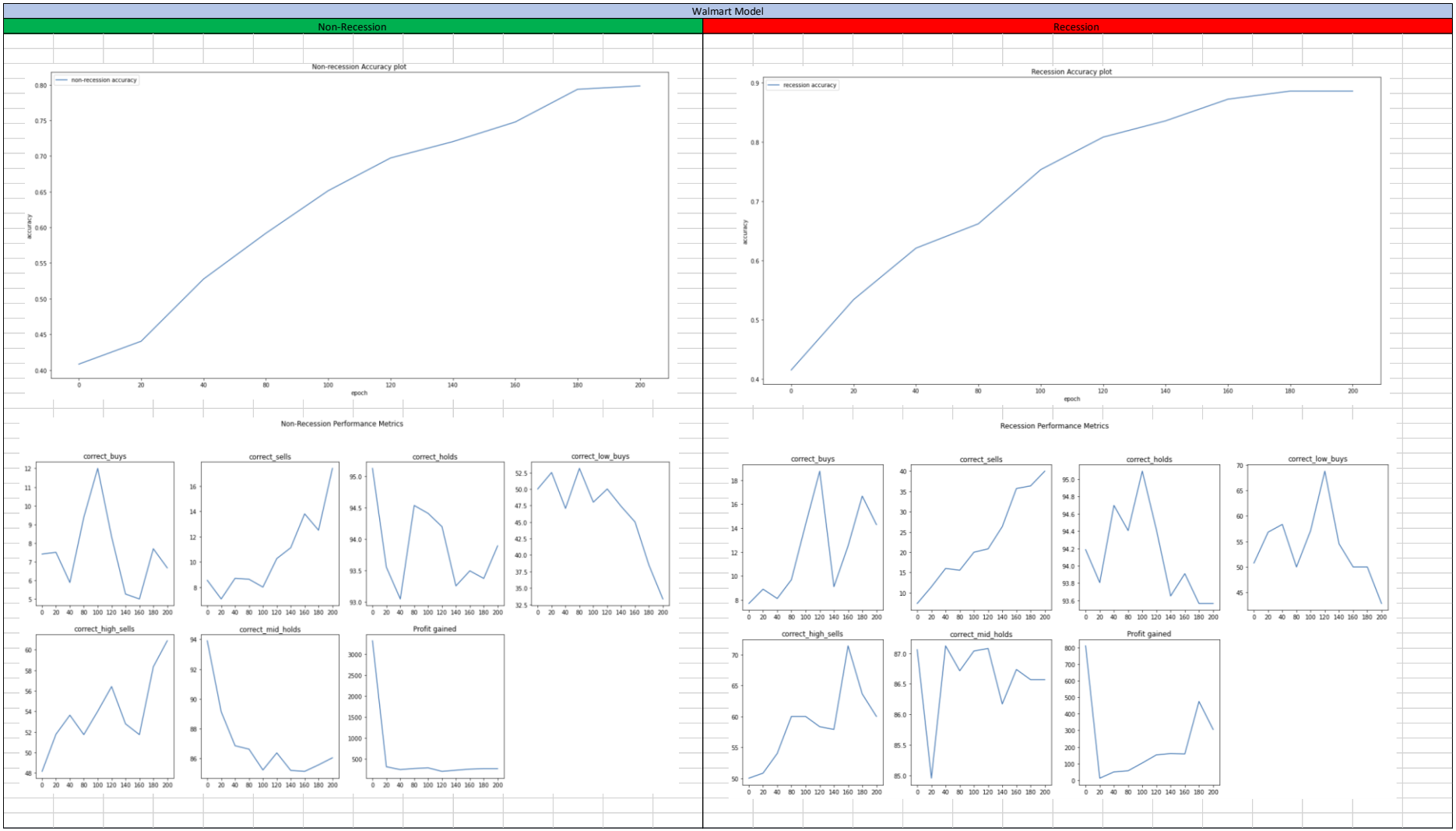


Figure 10-16 Time Series Representation Models Results

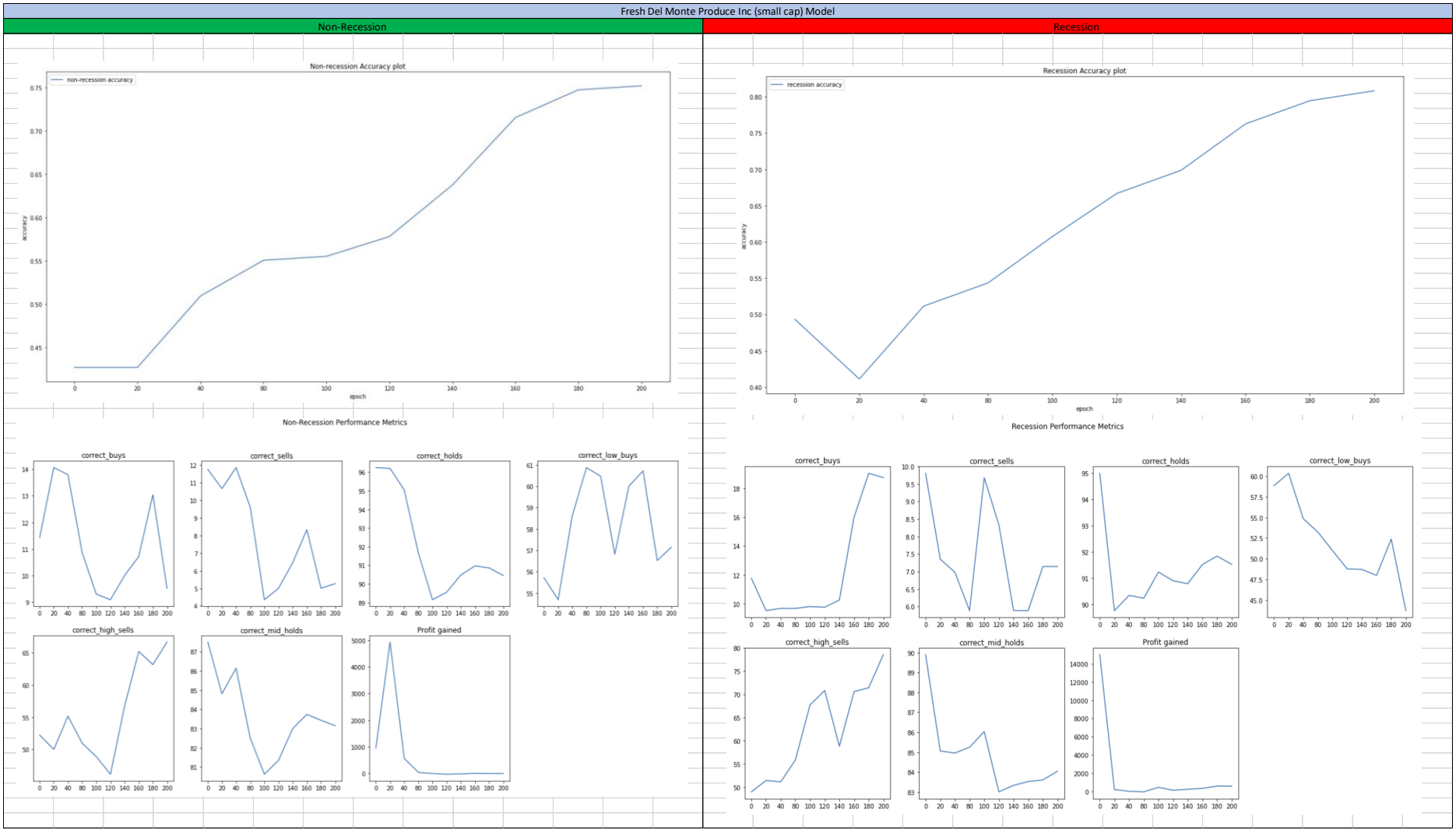


Figure 10-17 Time Series Representation Models Results

11 Appendix 6

Singapore Airlines Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.068807341	6.081081081	8.571428571	0	49.65986395	48.57142857	0	-92.41020507	-64.15459983	0.065116279	5	10.90909091	0	40.625	59.25925926	0	-93.41539595	-78.23835547
Epochs 40	0.096330278	8.411214953	8.333333333	100	54.71698113	48.14814815	100	-84.69858009	-64.15459983	0.079069771	4.918032787	9.89010989	100	45.90163934	58.88888889	100	-93.45213086	-78.23835547
Epochs 60	0.155963302	9.87654321	7.56302521	94.44444444	56.25	47.89915966	77.77777778	-56.35461829	-64.15459983	0.14418605	6.25	8.737864078	100	47.91666667	56.8627451	93.75	-93.47760779	-78.23835547
Epochs 80	0.174311921	9.195402299	7.476635514	91.66666667	55.81395349	45.79439252	75	-64.98657066	-64.15459983	0.19069767	6.315789474	8.695652174	96.42857143	48.42105263	52.74725275	89.28571429	-90.52772501	-78.23835547
Epochs 100	0.211009175	8.823529412	9.195402299	100	54.45544554	50.57471264	82.75862069	57.27793154	-64.15459983	0.200000003	5.454545455	10.52631579	100	49.09090909	54.66666667	82.75862069	-88.01599758	-78.23835547
Epochs 120	0.266055048	6.666666667	8.602150538	90	56.75675676	49.46236559	78	-54.58514404	-64.15459983	0.28372094	5.952380952	9.87654321	96	47.61904762	53.75	88	-86.43551829	-78.23835547
Epochs 140	0.37155962	7.792207792	11.26760563	95.71428571	57.89473684	49.29577465	82.85714286	261.6345306	-64.15459983	0.311627895	5.555555556	8.196721311	89.0625	46.66666667	51.66666667	79.6875	-90.92630418	-78.23835547
Epochs 160	0.472477078	10	12.30769231	95.69892473	59.3220339	49.23076923	83.87096774	393.5747111	-64.15459983	0.432558149	5.555555556	9.803921569	91.30434783	44.44444444	52	82.60869565	-95.7859554	-78.23835547
Epochs 180	0.568807364	5.555555556	13.33333333	93.44262295	61.11111111	48.33333333	76.03305785	-31.96883286	-64.15459983	0.520930231	7.547169811	8.163265306	92.03539823	45.28301887	54.16666667	84.07079646	-93.15470429	-78.23835547
Epochs 200	0.665137589	6.25	12.72727273	93.19727891	56.25	47.27272727	78.08219178	-81.71830784	-64.15459983	0.627906978	5.555555556	10.25641026	92.14285714	36.11111111	55.26315789	83.57142857	-94.00414561	-78.23835547
OCBC Bank Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.486238539	6.930693069	0	90.82568807	54.45544554	62.5	85.18518519	2.194694173	-55.90202866	0.423255801	8.333333333	0	89.01098901	50	75	85.55555556	-28.74310902	-24.56291964
Epochs 40	0.252293587	6.666666667	7.575757576	91.4893617	57.14285714	54.54545455	89.13043478	-39.73207235	-55.90202866	0.227906972	8.196721311	10.52631579	91.66666667	50	69.64285714	86.11111111	-39.99173801	-24.56291964
Epochs 60	0.183486238	7.216494845	6.666666667	87.09677419	56.70103093	56.17977528	83.87096774	-61.33207563	-55.90202866	0.176744193	7.01754386	9.459459459	85.18518519	51.75438596	65.75342466	77.77777778	-30.30721035	-24.56291964
Epochs 80	0.220183492	7	6.41025641	90	56	51.94805195	87.5	-13.18115619	-55.90202866	0.195348844	6.956521739	9.090909091	82.35294118	51.30434783	66.15384615	76.47058824	-19.47397392	-24.56291964
Epochs 100	0.252293587	6.382978723	5.479452055	88.23529412	54.25531915	48.61111111	84.31372549	-43.10006462	-55.90202866	0.260465115	6	8.333333333	81.81818182	52	66.66666667	75.92592593	-20.48672171	-24.56291964
Epochs 120	0.37155962	7.594936709	6.451612903	92.20779221	62.02531646	50.81967213	87.01298701	56.49335893	-55.90202866	0.386046499	5.882352941	11.11111111	85.88235294	54.11764706	68.88888889	80.95238095	30.0029409	-24.56291964
Epochs 140	0.559633017	4.166666667	7.317073171	90.69767442	60.41666667	46.34146341	82.8125	-84.1567612	-55.90202866	0.600000024	7.692307692	14.28571429	89.62962963	59.61538462	75	84.32835821	11.50518888	-24.56291964
Epochs 160	0.623853207	5.128205128	5.714285714	91.66666667	56.41025641	45.71428571	84.61538462	-34.2069979	-55.90202866	0.669767439	7.692307692	16.66666667	90.13157895	58.97435897	79.16666667	85.43046358	15.33777938	-24.56291964
Epochs 180	0.715596318	3.448275862	0	91.17647059	51.72413793	31.57894737	85.20710059	23.88780261	-55.90202866	0.730232537	11.76470588	18.75	90.90909091	64.70588235	75	86.58536585	127.2905612	-24.56291964
Epochs 200	0.733944952	5	7.407407407	91.8128655	65	48.14814815	85.29411765	40.33325348	-55.90202866	0.772092998	17.39130435	16.66666667	91.37931034	73.91304348	72.22222222	87.28323699	139.562669	-24.56291964
CNOOC Limited Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.123222746	5.511811024	7.246376812	93.33333333	52.75590551	63.23529412	73.33333333	-56.62580186	-54.68960087	0.140845075	7.03125	11.11111111	100	43.75	50.70422535	84.61538462	-85.6462992	-84.2898875

Epochs 40	0.109004736	6.363636364	7.608695652	100	53.63636364	62.63736264	88.88888889	-76.23738236	-54.68960087	0.150234744	6.542056075	9.090909091	94.44444444	46.72897196	50.57471264	83.33333333	-80.96262102	-84.2898875
Epochs 60	0.175355449	6.603773585	7.594936709	92.30769231	51.88679245	64.1025641	80.76923077	-75.46713737	-54.68960087	0.192488268	6.542056075	10.25641026	92.85714286	47.6635514	49.35064935	85.71428571	-84.04515358	-84.2898875
Epochs 80	0.251184821	6.52173913	8	93.18181818	55.43478261	70.27027027	88.63636364	310.8385821	-54.68960087	0.300469488	7.865168539	11.11111111	94.23076923	49.43820225	54.92957746	88.46153846	-84.03269629	-84.2898875
Epochs 100	0.260663509	6.25	10.95890411	97.61904762	53.125	68.05555556	88.0952381	431.6912893	-54.68960087	0.314553976	8.333333333	11.29032258	94.54545455	47.91666667	54.09836066	87.27272727	-87.79727977	-84.2898875
Epochs 120	0.412322283	7.692307692	9.433962264	95	57.69230769	69.23076923	87.5	366.7414791	-54.68960087	0.43192488	7.692307692	13.7254902	94.04761905	50	52	85.71428571	-73.44279938	-84.2898875
Epochs 140	0.535545051	9.677419355	5.405405405	93.75	54.83870968	66.66666667	84.82142857	316.3761707	-54.68960087	0.56807512	7.575757576	21.875	94.7826087	48.48484848	54.83870968	86.08695652	-68.24844039	-84.2898875
Epochs 160	0.592417061	9.615384615	6.060606061	93.65079365	55.76923077	68.75	84.12698413	573.014451	-54.68960087	0.615023494	8.928571429	20	94.48818898	44.64285714	48.27586207	86.61417323	-71.50935973	-84.2898875
Epochs 180	0.729857802	14.28571429	4.545454545	92.54658385	60.71428571	66.66666667	82.60869565	6.276774134	-54.68960087	0.723004699	6.451612903	15	91.97530864	45.16129032	42.10526316	83.95061728	-79.81321544	-84.2898875
Epochs 200	0.800947845	15.78947368	7.142857143	92.69662921	57.89473684	57.14285714	81.92090395	-67.07058094	-54.68960087	0.765258193	9.090909091	11.11111111	91.90751445	50	41.17647059	84.39306358	-86.59499941	-84.2898875
JP Morgan Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.073394492	9.821428571	3.80952381	100	48.21428571	47.11538462	100	65.86506803	1576.179166	0.091324203	6.944444444	13.33333333	0	47.55244755	57.33333333	0	84.1152476	-31.90034799
Epochs 40	0.077981651	11.45833333	3.333333333	100	50	47.89915966	100	-21.73657912	1576.179166	0.10958904	8.333333333	10.52631579	100	48.7394958	55.78947368	100	57.48162599	-31.90034799
Epochs 60	0.087155961	10.20408163	3.50877193	83.33333333	51.02040816	46.90265487	66.66666667	-36.02818695	1576.179166	0.118721463	8.403361345	10.75268817	85.71428571	50.84745763	55.91397849	85.71428571	43.57950144	-31.90034799
Epochs 80	0.137614682	10.34482759	3.571428571	89.47368421	51.72413793	45.94594595	78.94736842	-38.06078953	1576.179166	0.178082198	9.174311927	11.11111111	95	52.29357798	55.55555556	94.73684211	106.7189949	-31.90034799
Epochs 100	0.169724777	10.34482759	3.80952381	92.30769231	50.57471264	48.07692308	84.61538462	-30.19223856	1576.179166	0.200913236	9.090909091	11.9047619	96	51.81818182	54.76190476	91.66666667	228.0122155	-31.90034799
Epochs 120	0.238532111	10	4.210526316	93.02325581	50	47.87234043	81.39534884	24.73497068	1576.179166	0.269406378	8.823529412	12.32876712	93.18181818	50.98039216	56.16438356	83.72093023	137.2507467	-31.90034799
Epochs 140	0.403669715	8.474576271	4.166666667	91.95402299	54.23728814	41.66666667	83.72093023	11.69348718	1576.179166	0.415525109	7.792207792	11.11111111	89.77272727	53.24675325	59.25925926	79.31034483	111.2672405	-31.90034799
Epochs 160	0.555045843	9.090909091	3.448275862	91.33858268	48.48484848	41.37931034	82.53968254	209.357763	1576.179166	0.584474862	7.142857143	13.33333333	90.15151515	57.14285714	60	81.67938931	58.89082503	-31.90034799
Epochs 180	0.633027494	8.571428571	0	91.21621622	45.71428571	42.85714286	83.67346939	1842.929469	1576.179166	0.675799072	8.333333333	14.81481481	90.38461538	50	66.66666667	83.22580645	109.5793959	-31.90034799
Epochs 200	0.697247684	13.63636364	0	91.97530864	40.90909091	41.17647059	85.0931677	2936.116601	1576.179166	0.748858452	14.28571429	15.38461538	91.27906977	61.9047619	69.23076923	83.62573099	89.40526711	-31.90034799
American Axle (small cap) Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.146788985	4.651162791	6.481481481	87.5	45.34883721	53.27102804	83.33333333	29.04003992	-40.19620025	0.205479458	10.66666667	8.695652174	93.10344828	58.10810811	58.26086957	82.75862069	203.0937994	-32.50977019
Epochs 40	0.114678897	4.761904762	6.315789474	77.77777778	45.71428571	55.31914894	77.77777778	-30.95499944	-40.19620025	0.150684938	9.615384615	9.803921569	100	58.25242718	62.74509804	100	239.6232258	-32.50977019
Epochs 60	0.123853214	4.716981132	7.368421053	88.23529412	45.28301887	56.38297872	82.35294118	-88.10830625	-40.19620025	0.146118715	9.523809524	9	92.85714286	56.73076923	60	85.71428571	109.049838	-32.50977019
Epochs 80	0.233944952	5.376344086	6.329113924	89.13043478	49.46236559	55.12820513	84.7826087	-80.80686578	-40.19620025	0.260273963	10.71428571	6.976744186	85.71428571	56.62650602	62.79069767	81.63265306	122.3825055	-32.50977019
Epochs 100	0.211009175	5.319148936	6.024096386	87.80487805	48.93617021	56.09756098	85.36585366	-83.61175832	-40.19620025	0.269406378	11.39240506	6.741573034	86.2745098	60.25641026	61.79775281	82.35294118	265.1826081	-32.50977019

Epochs 120	0.311926603	6.172839506	6.666666667	93.5483871	50.61728395	57.33333333	90.16393443	-74.33191924	-40.19620025	0.383561641	13.84615385	7.692307692	90.78947368	61.53846154	65.38461538	85.33333333	165.8749373	-32.50977019
Epochs 140	0.417431206	7.042253521	5.172413793	93.25842697	50.70422535	58.62068966	86.36363636	-83.55992112	-40.19620025	0.452054799	12.90322581	8.064516129	90.52631579	58.06451613	67.74193548	86.17021277	193.639207	-32.50977019
Epochs 160	0.541284382	3.636363636	7.317073171	92.62295082	50.90909091	58.53658537	86.7768595	-85.0042985	-40.19620025	0.579908669	13.04347826	9.090909091	90.69767442	58.69565217	72.72727273	84.375	-0.36145914	-32.50977019
Epochs 180	0.559633017	3.50877193	6.25	91.47286822	52.63157895	59.375	85.9375	-58.16470874	-40.19620025	0.593607306	12.5	10.25641026	90.90909091	62.5	69.23076923	85.49618321	53.52150498	-32.50977019
Epochs 200	0.724770665	3.333333333	5.263157895	92.30769231	40	63.15789474	84.52380952	-73.76260796	-40.19620025	0.735159814	17.24137931	16	92.12121212	58.62068966	72	86.58536585	-2.756708896	-32.50977019

Table 11-1 Results of Experiment for CNN Models Trained Using Cyclic Stock Data, Using 5 Trading Days Lookback Period

Kweichow Moutai Co., Ltd. Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.091787443	11.39240506	7.8125	0	58.2278481	48.03149606	0	1308.73515	1666.892281	0.067307696	7.936507937	6.206896552	0	55.55555556	47.91666667	0	16.18091013	678.7940879
Epochs 40	0.091787443	12.98701299	6.923076923	0	59.74025974	48.0620155	0	1847.531315	1666.892281	0.072115384	9.836065574	6.12244898	0	54.09836066	46.57534247	0	29.70411942	678.7940879
Epochs 60	0.14009662	13.51351351	7.37704918	90.90909091	58.90410959	45.08196721	90.90909091	1509.89417	1666.892281	0.120192304	8.196721311	6.666666667	91.66666667	50.81967213	47.76119403	91.66666667	183.8953787	678.7940879
Epochs 80	0.227053136	12.67605634	8.571428571	93.5483871	55.71428571	46.66666667	93.5483871	1432.364982	1666.892281	0.197115391	8.474576271	7.5	93.10344828	52.54237288	49.57983193	89.65517241	326.2155545	678.7940879
Epochs 100	0.32367149	15.25423729	8.421052632	94.33962264	57.62711864	46.31578947	94.23076923	1893.934083	1666.892281	0.259615391	4	7.476635514	86.2745098	52	51.88679245	82.35294118	311.4246351	678.7940879
Epochs 120	0.33816424	16.07142857	7.52688172	93.10344828	60.71428571	48.38709677	91.22807018	1858.799791	1666.892281	0.274038464	4	6.862745098	85.71428571	52	51.48514851	82.14285714	362.428571	678.7940879
Epochs 140	0.507246375	16.27906977	10.60606061	92.85714286	60.46511628	51.51515152	89.69072165	3499.71297	1666.892281	0.471153855	6.060606061	5.633802817	88.46153846	57.57575758	52.11267606	82.52427184	498.7978313	678.7940879
Epochs 160	0.666666687	9.090909091	12.5	90.34482759	54.54545455	52.5	86.80555556	462.9947918	1666.892281	0.673076928	5.555555556	5.405405405	89.54248366	66.66666667	51.35135135	84.21052632	103.9004002	678.7940879
Epochs 180	0.734299541	5.555555556	12.5	89.6969697	50	50	85.97560976	427.7079273	1666.892281	0.75	6.666666667	8.333333333	90.53254438	60	50	83.33333333	143.0018936	678.7940879
Epochs 200	0.782608688	7.142857143	17.64705882	89.77272727	50	52.94117647	85.71428571	581.0641012	1666.892281	0.817307711	11.11111111	12.5	91.2568306	44.44444444	50	84.61538462	265.641253	678.7940879
Midea Group Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.086956523	12.5	6.299212598	0	69.62025316	48.81889764	0	14455.97874	1245.275482	0.057692308	7.692307692	4.895104895	0	64.0625	51.74825175	0	159.6794561	468.5733088
Epochs 40	0.115942031	8.849557522	9.090909091	100	59.82142857	55.68181818	66.66666667	7647.832245	1245.275482	0.11057692	7.368421053	5.882352941	90.90909091	56.38297872	55.88235294	81.81818182	24.54694137	468.5733088
Epochs 60	0.144927531	11.11111111	8.490566038	100	65.16853933	56.60377358	100	19374.4067	1245.275482	0.100961536	6.493506494	5.737704918	100	62.33766234	54.54545455	77.77777778	-79.40565271	468.5733088
Epochs 80	0.207729474	10.30927835	8.43373494	96.2962963	61.45833333	59.03614458	77.77777778	9649.136303	1245.275482	0.235576928	6.493506494	6.666666667	92.68292683	65.78947368	57.77777778	82.92682927	7.896760362	468.5733088
Epochs 100	0.207729474	12.04819277	8.163265306	96.15384615	67.07317073	58.16326531	80.76923077	39790.45023	1245.275482	0.192307696	7.246376812	5.555555556	93.5483871	67.64705882	55.55555556	80.64516129	65.68492856	468.5733088
Epochs 120	0.251207739	10.63829787	9.210526316	94.59459459	61.29032258	63.15789474	78.37837838	12221.32744	1245.275482	0.22115384	6.25	6.666666667	92.10526316	62.02531646	58.88888889	78.94736842	79.28673448	468.5733088
Epochs 140	0.314009666	12.34567901	9.210526316	96	63.75	63.15789474	82	11116.58625	1245.275482	0.259615391	7.042253521	5.617977528	91.66666667	65.71428571	56.17977528	81.25	-18.63794312	468.5733088
Epochs 160	0.444444448	17.54385965	9.589041096	97.4025974	71.42857143	61.64383562	88.31168831	137935.6872	1245.275482	0.288461536	4.918032787	4.597701149	88.33333333	63.33333333	55.17241379	78.33333333	-15.68494329	468.5733088
Epochs 180	0.405797094	14.70588235	10	97.10144928	65.67164179	62.85714286	86.95652174	20247.39687	1245.275482	0.326923072	4.615384615	5.405405405	88.4057971	64.0625	59.45945946	79.71014493	-4.072704794	468.5733088

Epochs 200	0.623188376	20.58823529	4.761904762	91.60305344	81.81818182	54.76190476	80.91603053	31077.66647	1245.275482	0.581730783	4.87804878	7.317073171	92.06349206	65	58.53658537	85.71428571	156.2054105	468.5733088
Walmart Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.233944952	4.615384615	6.422018349	93.18181818	56.92307692	47.70642202	88.37209302	61.68238085	9380.979094	0.255707771	8.139534884	8.888888889	95.34883721	54.65116279	47.77777778	95.23809524	2334.427263	255.7316817
Epochs 40	0.155963302	6.557377049	5.34351145	88.46153846	58.33333333	46.5648855	76.92307692	185.38334	9380.979094	0.187214613	8.045977011	9.345794393	96	56.97674419	43.92523364	88	9178.025325	255.7316817
Epochs 60	0.169724777	7.575757576	5.555555556	96.15384615	61.53846154	47.61904762	88.46153846	146.3849989	9380.979094	0.205479458	6.818181818	9.183673469	90.90909091	54.02298851	45.91836735	81.81818182	80.57235486	255.7316817
Epochs 80	0.279816508	8.333333333	7.339449541	97.95918367	58.33333333	45.87155963	91.66666667	171.3172817	9380.979094	0.337899536	8	10.97560976	95.16129032	58.10810811	48.7804878	90.32258065	426.1922348	255.7316817
Epochs 100	0.311926603	8.474576271	7.766990291	98.21428571	56.89655172	47.57281553	92.85714286	92.26818722	9380.979094	0.310502291	6.578947368	9.523809524	93.22033898	56	46.42857143	89.83050847	426.1922348	255.7316817
Epochs 120	0.422018349	8.333333333	10.25641026	98.75	57.62711864	43.58974359	93.75	170.8032445	9380.979094	0.410958916	6.41025641	10.71428571	92.94117647	55.84415584	50	88.23529412	460.9984988	255.7316817
Epochs 140	0.651376128	5.405405405	6.451612903	92	51.35135135	38.70967742	86.57718121	54.33448646	9380.979094	0.630136967	9.259259259	14.28571429	94.16058394	66.03773585	46.42857143	89.05109489	597.9915451	255.7316817
Epochs 160	0.678899109	6.666666667	6.25	92.30769231	53.33333333	40.625	86.4516129	32.28767544	9380.979094	0.648401797	2.5	11.11111111	90.78947368	58.97435897	44.44444444	84.86842105	464.7117687	255.7316817
Epochs 180	0.729357779	3.703703704	5	91.8128655	51.85185185	35	86.47058824	77.59208848	9380.979094	0.712328792	3.03030303	11.11111111	91.07142857	57.57575758	50	85.02994012	633.7173724	255.7316817
Epochs 200	0.788990855	7.692307692	0	91.93548387	61.53846154	31.57894737	85.40540541	80.96206912	9380.979094	0.81735158	8.333333333	12.5	92.14659686	66.66666667	37.5	84.73684211	75.82591754	255.7316817
Fresh Del Monte Produce Inc (small cap) Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.334862381	11.53846154	8.737864078	92.06349206	59.61538462	52.94117647	82.53968254	1810.743455	5.320148705	0.315068483	11.32075472	6.481481481	96.55172414	69.23076923	50.92592593	86.20689655	-34.96847577	-65.97131265
Epochs 40	0.275229365	11.49425287	9.195402299	95.45454545	60.91954023	55.81395349	84.09090909	351.5478904	5.320148705	0.269406378	9.333333333	5.494505495	88.67924528	60.81081081	53.84615385	81.13207547	-39.52387423	-65.97131265
Epochs 60	0.211009175	13.23529412	7.5	93.33333333	63.23529412	52.94117647	86.66666667	121.6164686	5.320148705	0.200913236	12.06896552	6.201550388	90.625	59.64912281	51.9379845	81.25	-67.57299176	-65.97131265
Epochs 80	0.201834857	11.36363636	8.653846154	96.15384615	57.95454545	55.33980583	88.46153846	203.3544203	5.320148705	0.168949768	11.36363636	7.142857143	100	63.2183908	56.25	100	112.3954384	-65.97131265
Epochs 100	0.275229365	10.81081081	9.183673469	93.47826087	59.45945946	55.67010309	86.95652174	2308.639029	5.320148705	0.246575341	13.33333333	7.407407407	100	60.81081081	52.77777778	91.66666667	431.8933072	-65.97131265
Epochs 120	0.389908254	9.523809524	9.210526316	91.13924051	55.55555556	53.33333333	83.5443038	938.7294603	5.320148705	0.429223746	14.28571429	8.219178082	95.18072289	59.67741935	50.68493151	86.74698795	134.7760526	-65.97131265
Epochs 140	0.504587173	9.090909091	8.064516129	90.17857143	52.27272727	53.22580645	81.98198198	211.7346679	5.320148705	0.579908669	13.95348837	6.25	92.1875	57.14285714	50	83.59375	333.9324709	-65.97131265
Epochs 160	0.490825683	10.41666667	7.936507937	90.65420561	52.08333333	49.20634921	83.01886792	887.3756547	5.320148705	0.589041114	15.55555556	4.545454545	92.30769231	59.09090909	50	83.07692308	224.9232772	-65.97131265
Epochs 180	0.610091746	10.25641026	2.702702703	90.14084507	53.84615385	37.83783784	82.9787234	-63.82550167	5.320148705	0.694063902	13.51351351	4.347826087	91.82389937	58.33333333	47.82608696	83.64779874	593.0859471	-65.97131265
Epochs 200	0.591743112	12.5	2.083333333	89.85507246	53.125	43.75	81.75182482	84.17265327	5.320148705	0.726027369	14.28571429	3.703703704	90.64327485	70	51.85185185	83.04093567	481.5345765	-65.97131265

Table 11-2 Results of Experiment for CNN Models Trained Using Non-Cyclic Stock Data, Using 5 Trading Days Lookback Period

Singapore Airlines Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.215596333	9.756097561	6.930693069	91.42857143	53.65853659	45.54455446	85.29411765	125.4695634	-64.15459983	0.241860464	7.777777778	8.139534884	97.43589744	46.66666667	56.47058824	87.17948718	-76.65774776	-78.23835547
Epochs 40	0.128440365	8.333333333	7.407407407	85.71428571	51.04166667	45.37037037	84.61538462	-84.78913922	-64.15459983	0.106976748	5.93220339	7.954545455	100	43.22033898	52.87356322	100	-84.67246505	-78.23835547
Epochs 60	0.183486238	10.66666667	7.56302521	95.83333333	54.66666667	43.69747899	95.65217391	-77.51354333	-64.15459983	0.162790701	6.930693069	8.602150538	95.23809524	43.56435644	53.26086957	76.19047619	-90.29994583	-78.23835547
Epochs 80	0.192660555	11.84210526	7.627118644	100	50.66666667	43.22033898	95.83333333	202.1819872	-64.15459983	0.186046511	6.382978723	8.510638298	96.2962963	45.74468085	54.83870968	85.18518519	-38.97601582	-78.23835547
Epochs 100	0.252293587	10.95890411	8.490566038	97.43589744	48.61111111	44.33962264	92.30769231	-70.46672343	-64.15459983	0.237209305	5.681818182	9.195402299	95	43.18181818	53.48837209	85	-58.35078434	-78.23835547
Epochs 120	0.311926603	10.66666667	4.938271605	90.32258065	51.35135135	45.67901235	82.25806452	-80.73847863	-64.15459983	0.320930243	6.024096386	9.722222222	95	45.78313253	56.33802817	86.66666667	-50.81117877	-78.23835547
Epochs 140	0.545871556	16.21621622	4.838709677	92.43697479	44.44444444	48.38709677	80.67226891	-66.73959167	-64.15459983	0.497674406	6.52173913	8.064516129	92.52336449	50	59.01639344	87.85046729	-38.93652569	-78.23835547
Epochs 160	0.610091746	13.63636364	5.128205128	92.59259259	44.18604651	43.58974359	80	-86.84918974	-64.15459983	0.600000024	6.12244898	13.51351351	93.79844961	48.97959184	61.11111111	89.14728682	581.0844788	-78.23835547
Epochs 180	0.669724762	16.66666667	5.263157895	92.66666667	44.82758621	42.10526316	80	-75.9177974	-64.15459983	0.651162803	5.555555556	13.88888889	93.00699301	52.77777778	60	88.81118881	261.8068958	-78.23835547
Epochs 200	0.720183492	9.523809524	3.571428571	91.12426036	42.85714286	42.85714286	79.16666667	-81.84327957	-64.15459983	0.734883726	9.090909091	10.71428571	92.72727273	63.63636364	59.25925926	87.87878788	16.67861159	-78.23835547
OCBC Bank Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.206422016	6.060606061	7.142857143	94.28571429	48.48484848	51.80722892	88.57142857	-95.94396365	-55.90202866	0.241860464	7.75862069	14.51612903	91.89189189	49.13793103	59.01639344	83.78378378	-19.22068642	-24.56291964
Epochs 40	0.087155961	6.481481481	6.666666667	100	51.85185185	50.96153846	100	-95.47321033	-55.90202866	0.111627907	7.936507937	10.71428571	100	48.41269841	51.80722892	100	-12.74297439	-24.56291964
Epochs 60	0.165137619	8.24742268	7	100	55.67010309	52.52525253	90.47619048	-82.94345341	-55.90202866	0.176744193	6.306306306	11.53846154	84.61538462	49.54954955	57.14285714	76.92307692	-26.00039031	-24.56291964
Epochs 80	0.211009175	8.333333333	7.777777778	96.875	55.20833333	52.80898876	90.625	-8.42871766	-55.90202866	0.186046511	5.504587156	11.84210526	83.33333333	48.62385321	56	76.66666667	-41.98559812	-24.56291964
Epochs 100	0.394495428	7.462686567	7.352941176	91.56626506	56.71641791	58.82352941	87.80487805	-38.40325037	-55.90202866	0.38139534	5.747126437	12.5	88.75	50.57471264	47.91666667	84.81012658	-50.82503896	-24.56291964
Epochs 120	0.5	8.196721311	6.382978723	91.81818182	57.37704918	55.31914894	87.1559633	-74.16231614	-55.90202866	0.465116292	7.407407407	13.88888889	90.81632653	54.32098765	44.44444444	86.59793814	-46.14506923	-24.56291964
Epochs 140	0.573394477	6.818181818	6.818181818	91.53846154	54.54545455	50	86.82170543	-77.86140076	-55.90202866	0.609302342	6.666666667	14.70588235	90.44117647	57.77777778	44.11764706	86.66666667	-62.90970573	-24.56291964
Epochs 160	0.674311936	8.333333333	10	92.76315789	58.33333333	53.33333333	88.0794702	-36.7499611	-55.90202866	0.697674394	6.25	10	89.57055215	56.25	40	85.80246914	-51.99052901	-24.56291964
Epochs 180	0.747706413	7.142857143	11.11111111	92.44186047	60.71428571	50	87.71929825	-19.29915184	-55.90202866	0.758139551	9.090909091	0	88.95027624	50	33.33333333	85.55555556	-54.50318628	-24.56291964
Epochs 200	0.770642221	4	14.28571429	92.17877095	56	57.14285714	87.07865169	179.381934	-55.90202866	0.790697694	10	0	89.36170213	50	57.14285714	86.09625668	-59.98277539	-24.56291964
CNOOC Limited Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.061611373	4.347826087	6.779661017	100	50	52.13675214	100	57.08618491	-54.68960087	0.084507041	7.142857143	7.96460177	100	45.91836735	49.10714286	50	-34.02595255	-84.2898875
Epochs 40	0.137440756	3.703703704	6.422018349	90.47619048	51.85185185	52.77777778	80.95238095	93.77408677	-54.68960087	0.183098584	7.894736842	8.035714286	96	44.73684211	54.05405405	84	-80.36348198	-84.2898875
Epochs 60	0.094786733	4.597701149	5.405405405	76.92307692	55.17241379	53.63636364	76.92307692	303.5743578	-54.68960087	0.14553991	7.228915663	8.035714286	88.88888889	45.78313253	54.05405405	72.22222222	-84.52667586	-84.2898875
Epochs 80	0.189573467	4.87804878	6.315789474	88.23529412	54.87804878	53.19148936	82.35294118	207.3582858	-54.68960087	0.244131461	9.756097561	9.375	100	50	57.89473684	91.42857143	-44.95231919	-84.2898875

Epochs 100	0.265402853	5.714285714	4.597701149	88.88888889	57.14285714	51.1627907	77.77777778	243.732553	-54.68960087	0.333333343	10.29411765	10.22727273	96.49122807	54.41176471	60.91954023	91.22807018	-46.79861118	-84.2898875
Epochs 120	0.331753552	5.479452055	5.714285714	91.17647059	56.16438356	53.62318841	80.88235294	390.8202694	-54.68960087	0.384976536	10.95890411	10	95.71428571	56.16438356	59.42028986	90	-28.7804697	-84.2898875
Epochs 140	0.459715635	6.349206349	7.692307692	92.70833333	57.14285714	54.90196078	81.25	590.481555	-54.68960087	0.507042229	10.52631579	12.5	95	54.38596491	54.54545455	88	-41.80579224	-84.2898875
Epochs 160	0.578199029	3.921568627	11.76470588	92.06349206	60.78431373	60.60606061	82.53968254	173.388692	-54.68960087	0.591549277	13.63636364	10.86956522	93.49593496	61.36363636	55.55555556	87.80487805	-13.69806145	-84.2898875
Epochs 180	0.71563983	3.125	19.04761905	92.40506329	62.5	65	82.91139241	27.24361	-54.68960087	0.699530542	8.823529412	16.66666667	91.61290323	55.88235294	60.86956522	85.16129032	-74.70408728	-84.2898875
Epochs 200	0.791469216	0	17.64705882	92.13483146	50	68.75	82.58426966	-81.84934484	-54.68960087	0.788732409	15.78947368	19.04761905	93.06358382	52.63157895	70	86.70520231	93.09851503	-84.2898875
JP Morgan Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.068807341	9.782608696	4.761904762	0	46.73913043	46.4	0	1969.343306	1576.179166	0.08219178	7.75862069	8.737864078	0	46.95652174	47.57281553	0	94.31893951	-31.90034799
Epochs 40	0.068807341	10.52631579	4.06504065	0	47.36842105	47.54098361	0	2276.412203	1576.179166	0.09589041	8.771929825	9.615384615	100	48.67256637	49.03846154	100	-6.69291111	-31.90034799
Epochs 60	0.087155961	9.574468085	4.237288136	83.33333333	48.93617021	47.86324786	83.33333333	3008.064012	1576.179166	0.118721463	8.928571429	9.090909091	87.5	47.74774775	49.49494949	87.5	53.88723524	-31.90034799
Epochs 80	0.183486238	11.26760563	4.237288136	93.10344828	56.33802817	48.71794872	89.65517241	3560.585854	1576.179166	0.196347028	10.46511628	9.345794393	92.30769231	51.76470588	47.6635514	80.76923077	128.520739	-31.90034799
Epochs 100	0.32110092	11.42857143	4.597701149	95.08196721	55.71428571	46.51162791	90.16393443	6607.926763	1576.179166	0.388127863	10	12.12121212	94.52054795	51.25	57.57575758	90.27777778	47.11988197	-31.90034799
Epochs 120	0.440366983	12.5	5.479452055	95.50561798	57.14285714	43.83561644	88.63636364	3561.475367	1576.179166	0.465753436	9.85915493	12.96296296	93.61702128	50.70422535	55.55555556	87.09677419	59.63221023	-31.90034799
Epochs 140	0.536697268	12.5	6.896551724	95.53571429	54.16666667	44.82758621	88.28828829	4319.423525	1576.179166	0.570776284	12.28070175	15.55555556	94.87179487	50.87719298	55.55555556	86.20689655	56.1732789	-31.90034799
Epochs 160	0.600917459	10.52631579	6.382978723	93.23308271	52.63157895	44.68085106	84.84848485	3191.950179	1576.179166	0.643835604	13.04347826	14.70588235	93.52517986	50	61.76470588	85.50724638	79.20568807	-31.90034799
Epochs 180	0.688073397	4.347826087	10.25641026	92.94871795	52.17391304	48.71794872	85.80645161	5807.992429	1576.179166	0.712328792	13.79310345	15.625	93.03797468	58.62068966	56.25	85.98726115	124.0664579	-31.90034799
Epochs 200	0.80733943	7.142857143	6.666666667	92.06349206	64.28571429	60	85.10638298	1452.625486	1576.179166	0.803652942	18.75	0	90.57591623	50	50	83.68421053	26.75737856	-31.90034799
American Axle (small cap) Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.119266056	4.794520548	10.16949153	100	42.06896552	49.15254237	100	88.13063211	-40.19620025	0.1369863	7.913669065	6.25	93.75	46.37681159	57.8125	87.5	192.979527	-32.50977019
Epochs 40	0.119266056	4.379562044	9.090909091	93.33333333	43.06569343	51.51515152	85.71428571	-57.73975605	-40.19620025	0.132420093	7.8125	5.405405405	88.23529412	49.60629921	63.51351351	82.35294118	134.3558161	-32.50977019
Epochs 60	0.220183492	4.62962963	8.450704225	94.87179487	44.44444444	50.70422535	89.47368421	-10.04556592	-40.19620025	0.287671238	10	5.970149254	94.23076923	48.48484848	64.17910448	88.46153846	201.0985802	-32.50977019
Epochs 80	0.293577969	3.703703704	9.803921569	93.22033898	44.44444444	47.05882353	91.37931034	-22.81535692	-40.19620025	0.347031951	9.523809524	6.52173913	92.64705882	51.92307692	69.56521739	86.76470588	135.0755741	-32.50977019
Epochs 100	0.426605493	3.448275862	10.81081081	91.4893617	43.67816092	48.64864865	83.87096774	-88.3521848	-40.19620025	0.497716904	11.25	8.333333333	94.17475728	54.43037975	72.22222222	87.37864078	61.47317379	-32.50977019
Epochs 120	0.587155938	3.389830508	8.333333333	91.85185185	42.37288136	50	83.58208955	-22.50133414	-40.19620025	0.652968049	13.20754717	9.523809524	92.4137931	55.76923077	71.42857143	86.89655172	8.55558546	-32.50977019
Epochs 140	0.752293587	3.703703704	6.666666667	92.04545455	37.03703704	60	84	-66.49094726	-40.19620025	0.748858452	9.677419355	14.28571429	91.37931034	53.33333333	71.42857143	86.20689655	-68.39170787	-32.50977019
Epochs 160	0.669724762	5.769230769	11.76470588	94.63087248	38.46153846	64.70588235	87.16216216	-28.74235483	-40.19620025	0.716894984	11.36363636	16.66666667	92.02453988	53.48837209	66.66666667	85.88957055	-66.01754092	-32.50977019
Epochs 180	0.798165143	4.347826087	9.090909091	93.47826087	34.7826087	63.63636364	85.79234973	-80.51386432	-40.19620025	0.789954364	12.5	10	91.35135135	54.16666667	60	85.86956522	-27.98678405	-32.50977019
Epochs 200	0.848623872	7.142857143	12.5	93.36734694	28.57142857	62.5	85.64102564	-72.42130804	-40.19620025	0.79908675	5.882352941	0	89.69072165	47.05882353	62.5	84.45595855	-29.78407333	-32.50977019

Table 11-3 Results of Experiment for CNN Models Trained Using Cyclic Stock Data, Using 10 Trading Days Lookback Period

Kweichow Moutai Co., Ltd. Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.106280193	9.649122807	10.86956522	100	51.32743363	51.08695652	100	5659.133601	1666.892281	0.072115384	8.411214953	5.940594059	0	41.12149533	49	0	188.2403993	678.7940879
Epochs 40	0.188405797	11.49425287	9.278350515	86.95652174	58.13953488	50.51546392	82.60869565	2735.178611	1666.892281	0.134615391	10.81081081	4.273504274	88.23529412	45.94594595	47.4137931	76.47058824	248.9366184	678.7940879
Epochs 60	0.159420297	11.11111111	9.090909091	87.5	60	51.81818182	81.25	5072.083712	1666.892281	0.129807696	12.6984127	5.970149254	100	53.96825397	47.36842105	90.90909091	281.5986686	678.7940879
Epochs 80	0.30917874	11.84210526	10.97560976	93.87755102	60	54.87804878	91.83673469	4302.736726	1666.892281	0.259615391	10.71428571	4.807692308	89.58333333	53.57142857	51.45631068	83.33333333	203.192356	678.7940879
Epochs 100	0.449275374	11.76470588	12.72727273	92.85714286	58.20895522	61.81818182	89.28571429	3745.760782	1666.892281	0.451923072	8.695652174	5.970149254	90.52631579	58.69565217	49.25373134	86.17021277	172.3313512	678.7940879
Epochs 120	0.526570022	12.06896552	14.89361702	93.1372549	55.17241379	63.82978723	89.10891089	11637.20831	1666.892281	0.504807711	7.894736842	6.557377049	89.90825688	60.52631579	52.45901639	86.11111111	193.6205582	678.7940879
Epochs 140	0.623188376	13.95348837	15.78947368	92.85714286	58.13953488	65.78947368	88.8	19510.33936	1666.892281	0.552884638	9.677419355	5.263157895	90.83333333	61.29032258	54.38596491	86.55462185	232.7271577	678.7940879
Epochs 160	0.666666687	11.9047619	14.28571429	90.27777778	57.14285714	76.19047619	86.71328671	17861.14433	1666.892281	0.668269217	11.11111111	3.125	90.60402685	59.25925926	46.875	85.13513514	43.98778282	678.7940879
Epochs 180	0.748792291	16.66666667	14.28571429	90.79754601	60	71.42857143	87.03703704	15551.47354	1666.892281	0.778846145	11.11111111	6.666666667	90.85714286	50	60	85.05747126	134.8587794	678.7940879
Epochs 200	0.777777791	19.23076923	21.42857143	91.61676647	61.53846154	71.42857143	87.95180723	13712.38794	1666.892281	0.783653855	7.142857143	5.882352941	90.96045198	42.85714286	52.94117647	84.65909091	165.7482247	678.7940879
Midea Group Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.526570022	9	0	93.45794393	48.48484848	0	81.30841121	1245.275482	1245.275482	0.615384638	7.407407407	0	96.06299213	44.44444444	0	89.68253968	468.5733088	468.5733088
Epochs 40	0.898550749	0	0	89.85507246	0	0	79.61165049	0	1245.275482	0.927884638	0	0	93.23671498	0	0	85.9223301	191.0979817	468.5733088
Epochs 60	0.183574885	6.315789474	8.333333333	89.28571429	60	53.01204819	78.57142857	6243.513565	1245.275482	0.15865384	6.329113924	2.941176471	92.59259259	50.63291139	43.56435644	81.48148148	-19.19522169	468.5733088
Epochs 80	0.241545901	8.064516129	6.796116505	90.47619048	54.83870968	46.07843137	80.95238095	13263.6585	1245.275482	0.25	8.510638298	5.882352941	97.61904762	61.70212766	48.30508475	90.47619048	-84.69908661	468.5733088
Epochs 100	0.198067635	10	7.5	92.59259259	60.60606061	55	81.48148148	68707.68646	1245.275482	0.168269232	6.25	4.705882353	92.59259259	53.125	54.76190476	77.77777778	134.368397	468.5733088
Epochs 120	0.256038636	11.26760563	9.090909091	97.2972973	60	54.54545455	86.48648649	26470.27181	1245.275482	0.278846145	8.474576271	5.102040816	94.11764706	64.40677966	52.57731959	84.31372549	6.846448546	468.5733088
Epochs 140	0.299516916	10.95890411	9.411764706	93.87755102	59.72222222	55.29411765	81.63265306	22588.89845	1245.275482	0.346153855	7.8125	5.128205128	95.45454545	60.9375	54.54545455	86.36363636	32.05392983	468.5733088
Epochs 160	0.400966197	12.06896552	10.38961039	94.44444444	62.06896552	58.44155844	77.46478873	33876.45361	1245.275482	0.418269217	8.333333333	5.333333333	92.94117647	66.66666667	55.40540541	83.52941176	8.278860147	468.5733088
Epochs 180	0.521739125	13.33333333	10.16949153	93.2038835	60	57.62711864	79.41176471	33894.34007	1245.275482	0.567307711	11.11111111	7.142857143	94.82758621	75	51.78571429	85.2173913	-31.56268899	468.5733088
Epochs 200	0.473429948	11.62790698	8.695652174	91.57894737	60.46511628	60.86956522	76.59574468	45471.75853	1245.275482	0.519230783	8.823529412	6.060606061	93.51851852	70.58823529	49.23076923	83.33333333	-5.835055857	468.5733088
Walmart Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.064220183	5.084745763	7.142857143	50	48.30508475	47.42268041	50	136.028061	9380.979094	0.077625573	5.384615385	9.195402299	100	51.9379845	50.57471264	50	71.71103075	255.7316817
Epochs 40	0.096330278	5.504587156	6.930693069	100	48.62385321	46	87.5	44.80134221	9380.979094	0.086757988	4.724409449	9.302325581	83.33333333	49.20634921	45.34883721	66.66666667	76.28531825	255.7316817

Epochs 60	0.119266056	5.263157895	6.481481481	93.33333333	48.42105263	44.85981308	80	75.19590777	9380.979094	0.10958904	5.405405405	8.24742268	90.90909091	51.35135135	44.79166667	81.81818182	-92.77833706	255.7316817
Epochs 80	0.174311921	5.376344086	7.291666667	89.65517241	47.31182796	44.79166667	82.14285714	157.1565241	9380.979094	0.168949768	5.405405405	8.536585366	92.30769231	53.15315315	45.67901235	92.30769231	-90.61000683	255.7316817
Epochs 100	0.284403682	5.882352941	6.666666667	89.65517241	45.88235294	45.33333333	75.43859649	176.4063782	9380.979094	0.296803653	5.940594059	11.29032258	92.85714286	51.48514851	48.38709677	87.27272727	182.7349851	255.7316817
Epochs 120	0.490825683	6.976744186	6.060606061	91.74311927	51.1627907	45.45454545	82.40740741	131.4537275	9380.979094	0.447488576	6.451612903	11.11111111	92.55319149	53.22580645	51.61290323	84.04255319	153.486589	255.7316817
Epochs 140	0.522935808	9.090909091	6.666666667	92.98245614	52.27272727	48.33333333	83.18584071	197.9772623	9380.979094	0.557077646	9.090909091	14.58333333	94.82758621	52.72727273	54.16666667	86.95652174	294.891895	255.7316817
Epochs 160	0.5	7.462686567	5	91.89189189	47.76119403	47.5	82.72727273	388.1326999	9380.979094	0.538812757	8.219178082	15.15151515	94.69026549	52.05479452	57.57575758	86.60714286	114.2546366	255.7316817
Epochs 180	0.729357779	13.33333333	5.555555556	92.81437126	40	47.22222222	84.93975904	-0.245338592	9380.979094	0.748858452	9.090909091	14.81481481	92.94117647	54.54545455	55.55555556	85.79881657	346.7329928	255.7316817
Epochs 200	0.793577969	20	4	92.89617486	50	44	85.16483516	-9.044734712	9380.979094	0.780821919	6.25	5.555555556	91.35135135	50	44.44444444	83.69565217	32.26291353	255.7316817
Fresh Del Monte Produce Inc (small cap) Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.133027524	8.474576271	10	100	47.00854701	48.88888889	100	721.4519474	5.320148705	0.12328767	4.504504505	6.666666667	88.88888889	48.18181818	46.66666667	77.77777778	-60.13177915	-65.97131265
Epochs 40	0.119266056	8.620689655	8.510638298	100	47.4137931	47.31182796	87.5	-25.24370664	5.320148705	0.16438356	7.207207207	8.139534884	95.45454545	51.81818182	50	90.90909091	-39.87897135	-65.97131265
Epochs 60	0.128440365	8.771929825	8.695652174	83.33333333	47.36842105	46.73913043	81.81818182	96.54870205	5.320148705	0.1369863	6.956521739	7.954545455	93.75	54.38596491	52.27272727	87.5	37.78581005	-65.97131265
Epochs 80	0.30733946	11.11111111	9.333333333	94.33962264	51.11111111	50.66666667	82.69230769	163.0278757	5.320148705	0.273972601	7.777777778	7.792207792	90.38461538	53.93258427	53.24675325	86.53846154	25.14240902	-65.97131265
Epochs 100	0.339449555	10.84337349	8.450704225	92.1875	48.19277108	50.70422535	80.95238095	902.5367301	5.320148705	0.328767121	8.536585366	8.219178082	92.1875	55.55555556	56.16438356	87.5	45.90852535	-65.97131265
Epochs 120	0.412844032	9.722222222	9.677419355	91.66666667	47.22222222	51.61290323	80.72289157	950.8657696	5.320148705	0.420091331	8.955223881	7.8125	92.04545455	56.06060606	56.25	86.36363636	110.6895815	-65.97131265
Epochs 140	0.610091746	9.756097561	5.555555556	90.07092199	46.34146341	50	82.14285714	163.104754	5.320148705	0.621004581	8.333333333	7.317073171	91.54929577	60	56.09756098	84.50704225	73.34119491	-65.97131265
Epochs 160	0.711009145	10.71428571	4.347826087	90.41916168	57.14285714	56.52173913	83.73493976	35.03236	5.320148705	0.689497709	6.896551724	3.703703704	90.79754601	53.57142857	55.55555556	82.82208589	83.60524117	-65.97131265
Epochs 180	0.724770665	4.347826087	4.761904762	89.65517241	56.52173913	47.61904762	83.23699422	457.5566317	5.320148705	0.716894984	4	4.347826087	90.64327485	58.33333333	60.86956522	82.45614035	580.7288734	-65.97131265
Epochs 200	0.747706413	0	0	89.07103825	58.82352941	50	81.86813187	632.2755977	5.320148705	0.753424644	6.25	4.545454545	90.05524862	73.33333333	59.09090909	81.7679558	1995.857984	-65.97131265

Table 11-4 Results of Experiment for CNN Models Trained Using Non-Cyclic Stock Data, Using 10 Trading Days Lookback Period

Singapore Airlines Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.279816508	6.382978723	6.944444444	96.15384615	53.19148936	43.66197183	86.53846154	-89.65604542	-64.15459983	0.172093019	4.424778761	4.47761194	82.85714286	39.28571429	53.73134328	71.42857143	-77.56809485	-78.23835547
Epochs 40	0.463302761	5.813953488	9.677419355	92.07920792	51.1627907	48.38709677	81	-94.01026605	-64.15459983	0.42790699	5	12	93.33333333	41.41414141	56	82.22222222	-75.49380554	-78.23835547
Epochs 60	0.068807341	8.256880734	5.504587156	0	49.07407407	38.53211009	0	-76.91447249	-64.15459983	0.055813953	4.511278195	6.172839506	100	40.15151515	49.38271605	100	-86.50465452	-78.23835547
Epochs 80	0.105504587	6.896551724	4.545454545	78.57142857	50.43478261	40.90909091	71.42857143	-71.99888779	-64.15459983	0.106976748	4.054054054	5.769230769	93.33333333	38.7755102	48.07692308	80	-93.21819447	-78.23835547
Epochs 100	0.261467904	8.641975309	5.681818182	91.83673469	53.75	39.77272727	73.46938776	-74.55110811	-64.15459983	0.306976736	4.672897196	6.666666667	92.06349206	39.25233645	51.11111111	80.64516129	-83.85475454	-78.23835547
Epochs 120	0.463302761	6	7.575757576	91.17647059	52	45.45454545	77.22772277	-67.19230647	-64.15459983	0.488372087	4.285714286	7.894736842	92.52336449	41.42857143	50	84.90566038	-91.32249152	-78.23835547

Epochs 140	0.56422019	8.108108108	7.272727273	92.06349206	45.94594595	40	78.4	-69.23286316	-64.15459983	0.613953471	5.769230769	10.34482759	94.02985075	42.30769231	48.27586207	85.71428571	-91.08927767	-78.23835547
Epochs 160	0.651376128	6.25	3.03030303	90.8496732	43.75	30.3030303	77.63157895	-81.73271741	-64.15459983	0.688372076	4.651162791	11.76470588	92.90322581	37.20930233	52.94117647	84.41558442	-86.81551015	-78.23835547
Epochs 180	0.711009145	8.333333333	3.703703704	91.01796407	45.83333333	25.92592593	78.31325301	-86.49874238	-64.15459983	0.786046505	7.692307692	18.18181818	92.69662921	53.84615385	63.63636364	85.31073446	-65.32504883	-78.23835547
Epochs 200	0.752293587	5.555555556	4.545454545	91.01123596	38.88888889	31.81818182	76.83615819	-84.26262479	-64.15459983	0.841860473	11.76470588	25	93.15789474	52.94117647	62.5	86.24338624	-71.80648638	-78.23835547
OCBC Bank Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.055045873	5.063291139	5.755395683	0	50.63291139	45.65217391	0	-95.22767609	-55.90202866	0.065116279	7.692307692	5.839416058	0	43.58974359	45.58823529	0	2059.278196	-24.56291964
Epochs 40	0.064220183	6.315789474	6.504065041	0	47.36842105	46.72131148	0	-90.2862613	-55.90202866	0.08372093	9.615384615	7.207207207	0	49.03846154	49.09090909	0	82.75595317	-24.56291964
Epochs 60	0.087155961	6.306306306	7	71.42857143	50.45045045	50.50505051	71.42857143	-94.56798028	-55.90202866	0.088372096	8	6.896551724	100	47.58064516	47.12643678	100	-32.2503735	-24.56291964
Epochs 80	0.133027524	7.216494845	7.547169811	93.33333333	50.51546392	49.52380952	86.66666667	-98.04103902	-55.90202866	0.134883717	8.333333333	5.617977528	83.33333333	47.22222222	47.19101124	82.35294118	15.07583192	-24.56291964
Epochs 100	0.183486238	6.896551724	6.060606061	87.5	47.12643678	47.95918367	81.25	-98.42157735	-55.90202866	0.176744193	8.490566038	5	86.20689655	45.28301887	45	85.71428571	-20.1309369	-24.56291964
Epochs 120	0.279816508	5.194805195	6.024096386	89.65517241	46.75324675	46.34146341	84.48275862	-99.24022704	-55.90202866	0.293023258	9.183673469	4.918032787	91.07142857	44.89795918	42.62295082	87.27272727	-23.93281352	-24.56291964
Epochs 140	0.449541271	6.12244898	7.042253521	91.83673469	53.06122449	40.84507042	87.62886598	-97.7785653	-55.90202866	0.441860467	3.225806452	6	87.37864078	43.5483871	46	84.31372549	-17.8364871	-24.56291964
Epochs 160	0.582568824	6.896551724	8.333333333	93.02325581	51.72413793	46.66666667	88.28125	-98.23416995	-55.90202866	0.637209296	6.451612903	7.894736842	90.4109589	58.06451613	52.63157895	88.27586207	-39.66217287	-24.56291964
Epochs 180	0.697247684	6.666666667	6.976744186	92.5	53.33333333	48.8372093	87.42138365	-98.35188186	-55.90202866	0.697674394	0	3.571428571	88.69047619	47.36842105	50	85.62874251	25.49424596	-24.56291964
Epochs 200	0.74311924	11.76470588	3.571428571	91.90751445	58.82352941	60.71428571	87.20930233	-82.10367008	-55.90202866	0.76279068	0	7.142857143	89.07103825	44.44444444	64.28571429	86.26373626	-37.75909954	-24.56291964
CNOOC Limited Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.037914693	0	4.081632653	0	26.66666667	41.53846154	0	-44.21867025	-54.68960087	0.046948358	0	4.975124378	0	33.33333333	40	0	-63.350102	-84.2898875
Epochs 40	0.0521327	4.651162791	7.692307692	0	45.93023256	52.63157895	0	-59.81142472	-54.68960087	0.046948358	5.113636364	2.702702703	0	40.57142857	54.05405405	0	-53.99125962	-84.2898875
Epochs 60	0.04265403	3.669724771	4.901960784	0	51.37614679	53.46534653	0	46.71912895	-54.68960087	0.070422538	6.422018349	6.796116505	100	41.28440367	48.03921569	100	-56.10447311	-84.2898875
Epochs 80	0.151658773	3.409090909	6.12244898	92	54.54545455	53.60824742	84	332.571984	-54.68960087	0.17840375	7.954545455	7.070707071	92.30769231	45.45454545	48.97959184	80.76923077	-53.08058455	-84.2898875
Epochs 100	0.222748816	4.109589041	6.315789474	88.37209302	53.42465753	54.25531915	79.06976744	321.7653143	-54.68960087	0.206572771	7.142857143	8.24742268	93.75	46.42857143	50	84.375	-46.35304291	-84.2898875
Epochs 120	0.298578203	5.172413793	6.382978723	91.52542373	50	53.76344086	84.74576271	312.72586	-54.68960087	0.28169015	6.25	7.446808511	89.09090909	40.625	50.53763441	76.36363636	-50.6093405	-84.2898875
Epochs 140	0.450236976	6.12244898	7.246376812	93.5483871	48.97959184	52.94117647	82.79569892	10.35078479	-54.68960087	0.422535211	5.454545455	6.153846154	89.24731183	41.81818182	50	79.56989247	-45.53269482	-84.2898875
Epochs 160	0.516587675	7.894736842	7.575757576	94.39252336	47.36842105	52.30769231	84.11214953	45.32453168	-54.68960087	0.460093886	4.545454545	6.060606061	89.32038835	38.63636364	47.69230769	78.6407767	-46.35540363	-84.2898875
Epochs 180	0.606635094	7.407407407	7.407407407	93.84615385	44.44444444	54.71698113	83.07692308	54.54301079	-54.68960087	0.549295783	5.405405405	7.407407407	90.98360656	35.13513514	48.14814815	80.99173554	-61.34962327	-84.2898875
Epochs 200	0.720379174	6.666666667	14.81481481	94.80519481	43.33333333	66.66666667	84.31372549	-45.7620447	-54.68960087	0.615023494	5	3.333333333	89.51048951	35	46.66666667	80.98591549	-49.74634533	-84.2898875
JP Morgan Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit

Epochs 20	0.298165143	33.33333333	3.267973856	95.16129032	66.66666667	40.13157895	91.93548387	29.71222765	1576.179166	0.388127863	0	6.766917293	91.56626506	33.33333333	39.84962406	85.36585366	-76.90789579	-31.90034799
Epochs 40	0.087155961	11.94029851	4.137931034	83.33333333	55.2238806	46.52777778	83.33333333	2313.976787	1576.179166	0.155251145	9.375	8.759124088	88.88888889	44.44444444	48.17518248	88.88888889	-49.35102512	-31.90034799
Epochs 60	0.082568809	12.12121212	3.448275862	71.42857143	56.06060606	46.52777778	71.42857143	838.5964149	1576.179166	0.118721463	10	8.510638298	87.5	52.17391304	47.5177305	87.5	-42.42930982	-31.90034799
Epochs 80	0.110091746	13.55932203	2.777777778	80	59.3220339	46.85314685	80	634.7126073	1576.179166	0.273972601	11.62790698	8.59375	91.66666667	51.1627907	46.45669291	85.41666667	-11.79959078	-31.90034799
Epochs 100	0.192660555	10.44776119	3.47826087	86.11111111	50.74626866	44.73684211	86.11111111	1946.767901	1576.179166	0.360730588	9.615384615	10.89108911	95.45454545	51.92307692	49.5049505	86.15384615	-9.014484147	-31.90034799
Epochs 120	0.316513747	11.11111111	4.081632653	89.39393939	51.85185185	46.39175258	87.87878788	1992.395511	1576.179166	0.470319629	10.52631579	8.75	91.08910891	50	47.5	83	60.50318063	-31.90034799
Epochs 140	0.467889905	9.756097561	5.405405405	91.26213592	53.65853659	45.20547945	88.34951456	2859.781618	1576.179166	0.639269412	9.090909091	8.510638298	89.33333333	59.09090909	53.19148936	82.55033557	41.02540597	-31.90034799
Epochs 160	0.619266033	12.90322581	4.255319149	92.14285714	58.06451613	50	87.85714286	3334.146984	1576.179166	0.735159814	11.11111111	10.71428571	90.1734104	61.11111111	50	82.55813953	13.09290504	-31.90034799
Epochs 180	0.651376128	16.66666667	4.255319149	92.5170068	62.5	50	87.75510204	6052.437244	1576.179166	0.748858452	14.28571429	7.407407407	89.88764045	50	51.85185185	82.48587571	33.72506661	-31.90034799
Epochs 200	0.766055048	15.78947368	4.347826087	92.61363636	63.15789474	52.17391304	86.85714286	4307.007783	1576.179166	0.794520557	16.66666667	0	89.58333333	41.66666667	46.66666667	82.19895288	14.73128435	-31.90034799
American Axle (small cap) Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.050458714	4.807692308	5.263157895	0	43.26923077	44.24778761	0	-65.40433303	-40.19620025	0.073059358	7.843137255	6.837606838	0	40.59405941	44.44444444	0	7154.068951	-32.50977019
Epochs 40	0.128440365	4.958677686	6.25	100	42.97520661	46.83544304	94.11764706	-90.3902093	-40.19620025	0.16438356	8.547008547	7.594936709	86.95652174	46.55172414	54.43037975	82.60869565	472.7329705	-32.50977019
Epochs 60	0.183486238	2.5	4.901960784	91.66666667	40	45.54455446	83.33333333	-4.043056907	-40.19620025	0.214611873	8.536585366	8	86.48648649	53.08641975	56	83.78378378	948.5029515	-32.50977019
Epochs 80	0.188073397	2.247191011	5.494505495	89.47368421	41.57303371	50	84.21052632	65.37296492	-40.19620025	0.196347028	5.882352941	6.315789474	82.05128205	50.58823529	52.63157895	76.31578947	266.0144609	-32.50977019
Epochs 100	0.293577969	2.272727273	7.352941176	91.93548387	42.04545455	53.73134328	83.87096774	-60.01935258	-40.19620025	0.283105016	6.097560976	7.594936709	87.93103448	51.2195122	55.69620253	80.70175439	521.3301731	-32.50977019
Epochs 120	0.403669715	2.564102564	9.259259259	94.18604651	44.87179487	51.85185185	84.70588235	-51.10808885	-40.19620025	0.397260278	7.462686567	7.575757576	89.53488372	53.73134328	57.57575758	81.17647059	135.0505326	-32.50977019
Epochs 140	0.555045843	1.639344262	12.5	92.8	44.26229508	53.125	85.48387097	-19.42659372	-40.19620025	0.616438329	6.52173913	7.407407407	89.04109589	50	55.55555556	83.44827586	-43.67431941	-32.50977019
Epochs 160	0.733944952	2.857142857	7.692307692	92.94117647	40	61.53846154	85.79881657	53.97538773	-40.19620025	0.753424644	4.166666667	13.33333333	90	45.83333333	80	84.91620112	-51.24319387	-32.50977019
Epochs 180	0.747706413	3.125	7.692307692	93.06358382	43.75	53.84615385	86.04651163	13.60005988	-40.19620025	0.780821919	5.555555556	14.28571429	89.83957219	50	64.28571429	84.40860215	-66.84577959	-32.50977019
Epochs 200	0.798165143	4.761904762	0	93.01075269	42.85714286	54.54545455	85.94594595	-16.26975789	-40.19620025	0.808219194	7.692307692	15.38461538	90.15544041	46.15384615	69.23076923	84.89583333	-61.02639705	-32.50977019

Table 11-5 Results of Experiment for CNN Models Trained Using Cyclic Stock Data, Using 20 Trading Days Lookback Period

Kweichow Moutai Co., Ltd. Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.053140096	0	5.314009662	0	0	38.34951456	0	0	1666.892281	0.048076924	0	4.807692308	0	0	41.06280193	0	0	678.7940879
Epochs 40	0.111111112	6.993006993	1.960784314	92.30769231	43.35664336	40	92.30769231	4894.795998	1666.892281	0.096153848	6.666666667	6.060606061	100	42.22222222	47.69230769	100	901.0859789	678.7940879
Epochs 60	0.086956523	8.270676692	8.219178082	100	47.36842105	44.44444444	100	2826.071188	1666.892281	0.067307696	7.438016529	5.747126437	0	42.97520661	47.6744186	0	361.6127504	678.7940879
Epochs 80	0.111111112	10.28037383	7.368421053	100	50.46728972	47.87234043	100	1356.160424	1666.892281	0.086538464	7.368421053	6.422018349	100	44.21052632	46.2962963	100	554.799268	678.7940879

Epochs 100	0.236714974	10.46511628	8.235294118	91.66666667	51.1627907	50	86.11111111	1753.788164	1666.892281	0.22115384	8.571428571	6.862745098	91.66666667	51.42857143	49.5049505	86.11111111	529.9270567	678.7940879
Epochs 120	0.29468599	10.25641026	8.860759494	92	51.28205128	51.28205128	84	1752.412003	1666.892281	0.326923072	8.196721311	7.142857143	90.47619048	55.73770492	49.39759036	85.71428571	425.6482214	678.7940879
Epochs 140	0.386473417	10.44776119	10.29411765	91.66666667	50.74626866	50.74626866	86.11111111	1313.970041	1666.892281	0.427884609	9.803921569	8.219178082	92.85714286	56.8627451	54.79452055	87.95180723	1471.976187	678.7940879
Epochs 160	0.492753625	11.86440678	12	90.81632653	54.23728814	51.02040816	85.71428571	15753.63586	1666.892281	0.572115362	10.25641026	10.20408163	91.66666667	64.1025641	55.10204082	88.23529412	2837.522064	678.7940879
Epochs 180	0.574879229	11.36363636	11.9047619	90.08264463	63.63636364	53.65853659	85.95041322	6472.233	1666.892281	0.653846145	11.11111111	10	91.4893617	59.25925926	60	87.14285714	6950.172453	678.7940879
Epochs 200	0.63285023	12.5	14.70588235	90.97744361	62.5	58.82352941	85.60606061	8366.950274	1666.892281	0.677884638	8.695652174	6.060606061	90.13157895	60.86956522	60.60606061	86.09271523	221.5671949	678.7940879
Midea Group Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.053140096	5.314009662	0	0	45.63106796	0	0	1245.275482	1245.275482	0.033653848	3.365384615	0	0	42.02898551	0	0	468.5733088	468.5733088
Epochs 40	0.067632847	6.024096386	9.756097561	0	47.27272727	51.2195122	0	4301.201136	1245.275482	0.03846154	3.95480226	3.225806452	0	42.04545455	51.61290323	0	130.6283604	468.5733088
Epochs 60	0.067632847	6.349206349	7.407407407	0	50	51.25	0	6741.892943	1245.275482	0.043269232	4.964539007	2.985074627	0	45.39007092	51.51515152	0	192.0559373	468.5733088
Epochs 80	0.241545901	5.263157895	25	90.69767442	46.35761589	75	86.04651163	1021.46203	1245.275482	0.197115391	3.184713376	0	87.80487805	41.02564103	40	78.04878049	272.6989002	468.5733088
Epochs 100	0.077294685	7.751937984	7.692307692	0	50	48.71794872	0	18673.77867	1245.275482	0.043269232	4.827586207	3.174603175	0	46.20689655	48.38709677	0	146.7066676	468.5733088
Epochs 120	0.082125604	7.638888889	9.523809524	0	51.04895105	55.55555556	0	4549.622349	1245.275482	0.043269232	4.761904762	3.278688525	0	46.57534247	50.81967213	0	175.8119661	468.5733088
Epochs 140	0.173913047	7.692307692	9.090909091	80.76923077	49.51456311	51.94805195	76.92307692	3040.043129	1245.275482	0.144230768	6.086956522	2.816901408	95.45454545	49.56521739	54.28571429	81.81818182	188.5488609	468.5733088
Epochs 160	0.12560387	6.956521739	10	83.33333333	49.12280702	52.5	83.33333333	3032.829786	1245.275482	0.067307696	5.833333333	2.409638554	100	48.33333333	50	100	142.8213759	468.5733088
Epochs 180	0.38164252	4.545454545	10	86.41975309	56.92307692	60	77.77777778	44347.58481	1245.275482	0.408653855	7.594936709	4.166666667	95.0617284	50.63291139	56.25	86.25	172.1532982	468.5733088
Epochs 200	0.454106271	7.142857143	10.52631579	89.36170213	60	57.89473684	79.78723404	218213.0276	1245.275482	0.490384609	7.936507937	4.444444444	95	55.55555556	57.77777778	84.84848485	401.1282325	468.5733088
Walmart Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.454128444	0	6.611570248	94.79166667	100	42.14876033	89.47368421	8.005731861	9380.979094	0.525114179	0	8	91.45299145	100	44	87.06896552	19.60292601	255.7316817
Epochs 40	0.114678897	6	6.666666667	92.30769231	47	43.26923077	84.61538462	384.3944551	9380.979094	0.105022833	5.511811024	9.523809524	100	51.58730159	51.19047619	87.5	10577.62683	255.7316817
Epochs 60	0.252293587	6.097560976	6.896551724	89.79591837	50	45.97701149	85.41666667	400.2134209	9380.979094	0.205479458	5.714285714	8.860759494	91.42857143	53.33333333	53.16455696	79.41176471	191.7662904	255.7316817
Epochs 80	0.288990825	8.196721311	5.940594059	92.85714286	54.09836066	46.53465347	90.90909091	534.5656284	9380.979094	0.292237431	7.594936709	9.195402299	94.33962264	56.96202532	47.12643678	84.61538462	1058.50568	255.7316817
Epochs 100	0.380733937	8.888888889	5.376344086	92.5	55.55555556	47.31182796	87.34177215	645.2102247	9380.979094	0.383561641	3.448275862	8.974358974	90.36144578	62.06896552	48.71794872	82.92682927	1506.416215	255.7316817
Epochs 120	0.463302761	8.888888889	6.756756757	92.92929293	57.77777778	43.24324324	85.71428571	681.1668756	9380.979094	0.433789968	3.50877193	9.230769231	89.69072165	61.40350877	52.30769231	83.33333333	1630.9348	255.7316817
Epochs 140	0.651376128	10.71428571	8.695652174	93.75	60.71428571	45.65217391	86.71328671	824.3146332	9380.979094	0.675799072	5.128205128	9.090909091	91.13924051	64.1025641	63.63636364	85.35031847	1353.113907	255.7316817
Epochs 160	0.688073397	16.66666667	6.52173913	93.50649351	72.22222222	45.65217391	86.2745098	1073.694184	9380.979094	0.703196347	4	10	91.46341463	56	53.33333333	84.66257669	316.6878424	255.7316817
Epochs 180	0.752293587	18.75	8.823529412	94.04761905	68.75	41.17647059	87.4251497	999.3960313	9380.979094	0.744292259	0	4.761904762	90.5027933	63.15789474	57.14285714	83.70786517	573.0667142	255.7316817
Epochs 200	0.821100891	20	11.11111111	94.05405405	66.66666667	50	87.5	262.6072101	9380.979094	0.789954364	0	0	90.57591623	66.66666667	70	83.68421053	338.3200833	255.7316817

Fresh Del Monte Produce Inc (small cap) Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.876146793	0	0	90.52132701	50	0	83.33333333	-30.48024424	5.320148705	0.90867579	0	0	90.86757991	0	0	82.56880734	0	-65.97131265
Epochs 40	0.25688073	5.494505495	9.090909091	88	38.46153846	48.68421053	82	17.49799314	5.320148705	0.310502291	7.692307692	4.545454545	93.5483871	50	45.45454545	88.70967742	320.241971	-65.97131265
Epochs 60	0.279816508	7.291666667	4.6875	87.93103448	41.66666667	42.1875	80.70175439	377.1592076	5.320148705	0.378995448	7.920792079	6.976744186	96	52	44.18604651	84	-8.391124506	-65.97131265
Epochs 80	0.284403682	10.34482759	8.333333333	97.87234043	44.82758621	48.80952381	93.47826087	127.1574499	5.320148705	0.319634706	8.080808081	8.196721311	96.61016949	54.08163265	50.81967213	88.13559322	156.2103414	-65.97131265
Epochs 100	0.389908254	9.090909091	7.692307692	93.58974359	45.45454545	48.07692308	88.31168831	229.1907022	5.320148705	0.365296811	7.619047619	9.523809524	94.44444444	54.80769231	50	80.55555556	229.7510025	-65.97131265
Epochs 120	0.5	6.451612903	8.888888889	90.99099099	41.93548387	46.66666667	82.72727273	82.92965662	5.320148705	0.520547926	9.589041096	10.52631579	95.37037037	58.90410959	52.63157895	84.11214953	251.5807948	-65.97131265
Epochs 140	0.619266033	6.52173913	3.703703704	90.34482759	39.13043478	48.14814815	82.63888889	813.4178985	5.320148705	0.666666687	10	13.04347826	94.52054795	60	52.17391304	83.44827586	1072.26147	-65.97131265
Epochs 160	0.683486223	3.125	4.347826087	90.18404908	37.5	47.82608696	83.33333333	-6.948077223	5.320148705	0.757990897	16	13.04347826	92.98245614	72	52.17391304	83.52941176	2741.52274	-65.97131265
Epochs 180	0.75688076	4.166666667	6.666666667	91.06145251	41.66666667	53.33333333	83.14606742	-68.99127465	5.320148705	0.83561641	14.28571429	20	91.79487179	71.42857143	70	82.98969072	1515.69194	-65.97131265
Epochs 200	0.775229335	4.347826087	8.333333333	91.2568306	39.13043478	50	83.51648352	-77.43867538	5.320148705	0.826484025	13.33333333	18.18181818	91.70984456	73.33333333	63.63636364	82.8125	454.9986974	-65.97131265

Table 11-6 Results of Experiment for CNN Models Trained Using Non-Cyclic Stock Data, Using 20 Trading Days Lookback Period

Singapore Airlines Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.059633028	5.113636364	9.523809524	0	46.28571429	47.61904762	0	-67.12243677	-64.15459983	0.060465116	5.031446541	8.928571429	0	42.40506329	57.14285714	0	70.32604111	-78.23835547
Epochs 40	0.105504587	7.258064516	5.882352941	100	47.96747967	42.35294118	77.77777778	-82.98493156	-64.15459983	0.079069771	6.611570248	5.555555556	100	42.5	50	75	12.84786655	-78.23835547
Epochs 60	0.059633028	7.692307692	4.385964912	0	50.48543689	40.35087719	0	-39.61876354	-64.15459983	0.060465116	6.422018349	5.660377358	0	42.59259259	49.05660377	0	-71.23028799	-78.23835547
Epochs 80	0.082568809	8	5.357142857	66.66666667	48.48484848	41.07142857	66.66666667	-66.89508226	-64.15459983	0.074418604	5.263157895	5.263157895	83.33333333	42.47787611	50.52631579	50	-82.03282784	-78.23835547
Epochs 100	0.192660555	7	5.952380952	88.23529412	48.48484848	39.28571429	73.52941176	-90.62985122	-64.15459983	0.195348844	5.217391304	7.462686567	93.93939394	41.22807018	52.23880597	87.87878788	-93.10645731	-78.23835547
Epochs 120	0.477064222	7.272727273	8.474576271	91.34615385	51.85185185	42.37288136	78.84615385	-74.31915094	-64.15459983	0.38139534	4.938271605	7.407407407	92.5	41.25	55.55555556	86.25	-66.18395925	-78.23835547
Epochs 140	0.614678919	7.692307692	15.15151515	93.98496241	45.09803922	42.42424242	78.19548872	-50.94214084	-64.15459983	0.493023247	2.857142857	3.225806452	90.35087719	44.92753623	51.61290323	85.0877193	-76.56569213	-78.23835547
Epochs 160	0.706422031	7.692307692	21.73913043	93.58974359	44.73684211	43.47826087	78.84615385	12.99716807	-64.15459983	0.595348835	0	4.545454545	90.71428571	44.23076923	59.09090909	85	-49.16578956	-78.23835547
Epochs 180	0.788990855	9.523809524	17.64705882	92.77777778	50	47.05882353	79.44444444	-28.18044827	-64.15459983	0.688372076	0	6.666666667	90.74074074	59.45945946	60	84.56790123	-55.79340896	-78.23835547
Epochs 200	0.821100891	6.25	18.18181818	92.14659686	56.25	45.45454545	78.42105263	-57.24193481	-64.15459983	0.748837233	0	0	90.96045198	64.28571429	66.66666667	84.74576271	-12.71608278	-78.23835547
OCBC Bank Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.059633028	5.737704918	5.263157895	100	45.08196721	47.87234043	100	-90.64099011	-55.90202866	0.08372093	7.8125	5.952380952	100	49.60629921	47.61904762	100	-3.427225814	-24.56291964
Epochs 40	0.238532111	5.882352941	5.769230769	91.30434783	44.11764706	46.60194175	84.7826087	-92.69610222	-55.90202866	0.232558146	5.479452055	7.142857143	88.63636364	52.05479452	47.42268041	84.09090909	-21.49736988	-24.56291964

Epochs 60	0.238532111	6.382978723	5.263157895	87.5	45.74468085	44	83.33333333	-69.40258496	-55.90202866	0.260465115	9	5.970149254	89.58333333	50	50.74626866	80.85106383	1759.470202	-24.56291964
Epochs 80	0.298165143	4.651162791	4.545454545	87.87878788	43.02325581	41.53846154	81.81818182	-98.97684755	-55.90202866	0.353488386	7.777777778	5.660377358	91.66666667	48.88888889	47.16981132	84.50704225	-37.11904699	-24.56291964
Epochs 100	0.412844032	3.076923077	5.263157895	88.54166667	44.61538462	41.07142857	82.29166667	-95.81938101	-55.90202866	0.502325594	7.8125	7.142857143	91.74311927	56.25	47.61904762	87.03703704	-96.91610378	-24.56291964
Epochs 120	0.633027494	3.448275862	5	90.60402685	44.82758621	35.8974359	83.89261745	-97.66281675	-55.90202866	0.641860485	3.03030303	6.666666667	88.81578947	57.57575758	46.66666667	84.76821192	-94.58756681	-24.56291964
Epochs 140	0.784403682	6.666666667	5.263157895	91.84782609	46.66666667	31.57894737	85.24590164	-81.95933667	-55.90202866	0.748837233	0	11.11111111	89.3258427	57.89473684	44.44444444	85.87570621	-92.30194543	-24.56291964
Epochs 160	0.784403682	6.666666667	5.263157895	91.84782609	46.66666667	31.57894737	85.24590164	-87.85961734	-55.90202866	0.776744187	0	13.33333333	89.67391304	62.5	33.33333333	86.33879781	-92.06538463	-24.56291964
Epochs 180	0.87155962	0	0	91.78743961	75	28.57142857	85.9223301	113.4481478	-55.90202866	0.851162791	0	16.66666667	89.65517241	66.66666667	50	86.63366337	43.20339418	-24.56291964
Epochs 200	0.862385333	0	0	91.70731707	60	25	85.78431373	303.2236117	-55.90202866	0.846511602	0	16.66666667	89.6039604	71.42857143	50	86.56716418	54.19440997	-24.56291964
CNOOC Limited Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.037914693	3.902439024	0	0	43.62745098	66.66666667	0	-63.91889498	-54.68960087	0.046948358	4.784688995	0	0	39.90384615	100	0	-84.39348225	-84.2898875
Epochs 40	0.04265403	2.702702703	4.597701149	0	48.64864865	42.19653179	0	-43.37718194	-54.68960087	0.056338027	6.451612903	5.494505495	0	48.38709677	40.8839779	0	-72.27513115	-84.2898875
Epochs 60	0.04265403	3.738317757	4.807692308	0	45.79439252	48.54368932	0	-13.68694755	-54.68960087	0.065727696	6.930693069	6.25	0	38.61386139	46.84684685	0	-90.55202228	-84.2898875
Epochs 80	0.09952607	3.448275862	6.25	91.66666667	50.57471264	50.45045045	91.66666667	57.722145	-54.68960087	0.14553991	7.446808511	6.930693069	94.44444444	41.4893617	48	88.88888889	-88.6333063	-84.2898875
Epochs 100	0.165876776	2.352941176	7.142857143	92.85714286	50.58823529	54.63917526	89.28571429	164.4027854	-54.68960087	0.169014081	7.291666667	7.446808511	95.65217391	38.54166667	50.53763441	86.95652174	-89.4247294	-84.2898875
Epochs 120	0.303317547	2.777777778	7.692307692	91.80327869	55.55555556	54.54545455	88.52459016	285.1988608	-54.68960087	0.28169015	8.43373494	5.333333333	89.09090909	38.55421687	48	83.33333333	-73.60690488	-84.2898875
Epochs 140	0.369668245	3.174603175	8.219178082	93.33333333	57.14285714	56.94444444	85.33333333	164.192166	-54.68960087	0.338028163	6.944444444	5.714285714	88.73239437	40.27777778	48.57142857	84.28571429	-74.10600019	-84.2898875
Epochs 160	0.497630328	3.389830508	6.976744186	91.74311927	54.23728814	58.13953488	84.25925926	9.707259889	-54.68960087	0.483568072	7.692307692	7.317073171	88.78504673	41.53846154	58.53658537	84.90566038	-36.57938507	-84.2898875
Epochs 180	0.691943109	6.451612903	10.34482759	93.37748344	61.29032258	62.06896552	84.66666667	254.0089511	-54.68960087	0.629107952	10	9.090909091	90.71428571	32.5	54.54545455	85.61151079	1001.786413	-84.2898875
Epochs 200	0.805687189	7.142857143	15.78947368	93.25842697	64.28571429	52.63157895	83.61581921	119.1518267	-54.68960087	0.741784036	8.333333333	5.882352941	90.11627907	29.16666667	64.70588235	84.21052632	-68.05767344	-84.2898875
JP Morgan Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.027522936	0	3.015075377	0	36.84210526	41.41414141	0	312.2013688	1576.179166	0.059360731	5.263157895	6	0	31.57894737	40.70351759	0	-15.76327717	-31.90034799
Epochs 40	0.100917429	7.142857143	4.819277108	100	39.68253968	41.46341463	77.77777778	1777.710414	1576.179166	0.150684938	6.976744186	11.11111111	88.88888889	43.75	48.61111111	77.77777778	69.07795345	-31.90034799
Epochs 60	0.105504587	8.035714286	5.154639175	100	41.07142857	43.75	88.88888889	1273.473393	1576.179166	0.127853885	7.086614173	10.97560976	100	45.23809524	48.7804878	80	146.4903809	-31.90034799
Epochs 80	0.201834857	9.375	5.434782609	100	45.83333333	41.75824176	90	817.8645874	1576.179166	0.260273963	8.411214953	11.5942029	93.02325581	50	49.27536232	83.72093023	164.4042239	-31.90034799
Epochs 100	0.316513747	6.578947368	5.333333333	89.55223881	46.05263158	48.64864865	85.07462687	829.4666791	1576.179166	0.401826471	8.139534884	11.76470588	91.46341463	48.23529412	50.98039216	81.70731707	52.47582028	-31.90034799
Epochs 120	0.527522922	5.172413793	7.5	90.83333333	43.10344828	38.46153846	85	652.3640034	1576.179166	0.602739751	7.272727273	8.333333333	90	50	50	81.42857143	-44.5816373	-31.90034799
Epochs 140	0.798165143	14.28571429	7.142857143	92.89617486	52.38095238	50	87.91208791	11186.89105	1576.179166	0.771689475	11.53846154	0	90.2173913	52	55.55555556	82.60869565	-21.0281704	-31.90034799
Epochs 160	0.816513777	7.142857143	7.692307692	92.14659686	57.14285714	53.84615385	87.36842105	7807.70088	1576.179166	0.780821919	5.263157895	0	89.47368421	50	50	82.10526316	-31.04573301	-31.90034799

Epochs 180	0.880733967	11.11111111	25	92.68292683	55.55555556	75	85.78431373	11105.74588	1576.179166	0.821917832	0	0	89.10891089	50	57.14285714	81.5920398	-25.3674353	-31.90034799
Epochs 200	0.880733967	11.11111111	25	92.68292683	44.44444444	50	86.76470588	11873.64315	1576.179166	0.840182662	0	0	89.32038835	60	0	82.03883495	-4.941510679	-31.90034799
American Axle (small cap) Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.055045873	0	3.738317757	100	0	39.43661972	100	0	-40.19620025	0.06849315	0	5.164319249	80	0	43.86792453	80	-5.129074735	-32.50977019
Epochs 40	0.532110095	0	5.050505051	93.27731092	0	41.41414141	84.74576271	0	-40.19620025	0.579908669	0	6.172839506	90.37037037	0	51.85185185	82.08955224	-36.69466729	-32.50977019
Epochs 60	0.211009175	1.515151515	3.80952381	87.23404255	40.90909091	43.80952381	78.26086957	-93.11941535	-40.19620025	0.287671238	7.042253521	7.865168539	86.44067797	48.57142857	55.05617978	79.66101695	268.3621826	-32.50977019
Epochs 80	0.188073397	3.636363636	5.34351145	100	38.18181818	45.38461538	90.625	-83.7241725	-40.19620025	0.200913236	6.25	6.896551724	82.05128205	44.44444444	54.31034483	79.48717949	1451.324567	-32.50977019
Epochs 100	0.399082571	4.545454545	4.545454545	94.18604651	38.63636364	48.86363636	84.70588235	-85.46366398	-40.19620025	0.374429226	8	5.882352941	86.9047619	46.93877551	60	80.95238095	4255.448437	-32.50977019
Epochs 120	0.527522922	2.631578947	3.448275862	91.80327869	39.47368421	48.27586207	82.6446281	-90.20083666	-40.19620025	0.525114179	5.714285714	8.064516129	88.52459016	51.42857143	62.90322581	81.81818182	717.5490229	-32.50977019
Epochs 140	0.573394477	4.347826087	2.564102564	91.72932331	45.65217391	51.28205128	84.09090909	-41.58060614	-40.19620025	0.598173499	7.692307692	9.302325581	90.51094891	51.28205128	58.13953488	83.82352941	638.7210464	-32.50977019
Epochs 160	0.665137589	0	2.777777778	91.71974522	28	50	83.97435897	-43.2960044	-40.19620025	0.662100434	7.142857143	8.571428571	89.74358974	53.57142857	57.14285714	83.87096774	1472.554372	-32.50977019
Epochs 180	0.729357779	0	0	91.37931034	37.5	53.57142857	84.39306358	35.52072099	-40.19620025	0.785388112	10	15.38461538	90.32258065	60	76.92307692	84.32432432	2648.948579	-32.50977019
Epochs 200	0.75688076	0	0	91.66666667	30.76923077	52	84.91620112	-78.56924691	-40.19620025	0.821917832	9.090909091	10	89.8989899	63.63636364	80	84.26395939	2793.197128	-32.50977019

Table 11-7 Results of Experiment for CNN Models Trained Using Cyclic Stock Data, Using 25 Trading Days Lookback Period

Kweichow Moutai Co., Ltd. Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.347826093	16.66666667	3.361344538	86.84210526	41.66666667	38.98305085	81.57894737	458.8795784	1666.892281	0.259615391	12.5	5.298013245	91.83673469	62.5	44.66666667	85.71428571	62.68965525	678.7940879
Epochs 40	0.067632847	11.11111111	6.111111111	0	62.96296296	40.22346369	0	181.5485647	1666.892281	0.052884616	9.523809524	4.812834225	0	61.9047619	44.08602151	0	1625.65852	678.7940879
Epochs 60	0.072463766	7.75862069	6.593406593	0	50	46.66666667	0	19750.29765	1666.892281	0.0625	6.481481481	6	0	39.81481481	43.43434343	0	235.3596755	678.7940879
Epochs 80	0.164251208	9.708737864	5	83.33333333	52.42718447	46.25	78.26086957	18928.12642	1666.892281	0.192307696	6.896551724	6.593406593	93.33333333	40.22988506	43.33333333	90	174.519604	678.7940879
Epochs 100	0.265700489	12.5	3.797468354	87.5	56.25	48.10126582	78.72340426	12341.23756	1666.892281	0.3125	8.196721311	6.666666667	94.73684211	44.26229508	41.11111111	87.5	181.9633924	678.7940879
Epochs 120	0.33816424	12.5	5.128205128	89.23076923	56.25	47.43589744	84.375	2533.209732	1666.892281	0.384615391	6.818181818	6.976744186	91.02564103	43.18181818	40.69767442	87.01298701	81.63303492	678.7940879
Epochs 140	0.468599021	13.33333333	4.761904762	88.88888889	55.55555556	47.61904762	85.71428571	3969.997347	1666.892281	0.524038434	3.333333333	6.349206349	90.43478261	40	41.26984127	85.96491228	-17.75901081	678.7940879
Epochs 160	0.599033833	10	6.666666667	89.39393939	53.33333333	53.33333333	85.49618321	3127.344389	1666.892281	0.701923072	7.142857143	7.692307692	91.61290323	57.14285714	46.15384615	87.01298701	-31.63275454	678.7940879
Epochs 180	0.710144937	16.66666667	3.448275862	89.375	55.55555556	48.27586207	86.16352201	754.7797067	1666.892281	0.740384638	8.333333333	9.090909091	92.02453988	66.66666667	39.39393939	87.03703704	325.3311852	678.7940879
Epochs 200	0.772946835	21.42857143	5	90.1734104	64.28571429	45	86.04651163	732.8034594	1666.892281	0.783653855	11.11111111	8.333333333	91.42857143	66.66666667	37.5	86.20689655	305.1236578	678.7940879
Midea Group Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit

Epochs 20	0.048309177	0	4.830917874	0	0	42.23300971	0	0	1245.275482	0.03846154	0	3.846153846	0	0	42.51207729	0	0	468.5733088
Epochs 40	0.048309177	0	4.830917874	0	0	42.23300971	0	0	1245.275482	0.03846154	0	3.8647343	0	100	42.7184466	0	15.4983699	468.5733088
Epochs 60	0.072463766	7.692307692	6.666666667	0	52.99145299	50.56179775	0	731.4615416	1245.275482	0.03846154	4.47761194	2.702702703	0	41.79104478	43.83561644	0	-10.0645678	468.5733088
Epochs 80	0.198067635	4.054054054	6.382978723	82.05128205	51.35135135	52.68817204	76.92307692	10110.35147	1245.275482	0.211538464	5.952380952	2.409638554	90.24390244	47.61904762	46.34146341	80.48780488	30.9893488	468.5733088
Epochs 100	0.077294685	8.080808081	7.407407407	0	54.54545455	52.3364486	0	31842.25756	1245.275482	0.052884616	6.25	3.157894737	100	41.96428571	42.55319149	100	35.13404781	468.5733088
Epochs 120	0.149758458	6.896551724	7.142857143	85.71428571	53.04347826	52.85714286	85.71428571	56978.97385	1245.275482	0.139423072	5.6	4.6875	100	43.2	47.61904762	100	102.5403397	468.5733088
Epochs 140	0.106280193	5.940594059	7.291666667	90	53	50	90	10497.15586	1245.275482	0.168269232	7.070707071	3.571428571	100	43.43434343	46.98795181	96	-17.17125747	468.5733088
Epochs 160	0.357487917	8.988764045	6.382978723	88.73239437	53.40909091	46.80851064	77.46478873	24860.04694	1245.275482	0.427884609	7.317073171	4.761904762	96.42857143	48.7804878	48.7804878	90.47619048	103.7902543	468.5733088
Epochs 180	0.207729474	7.75862069	8.474576271	90.625	53.04347826	47.45762712	81.25	12840.90302	1245.275482	0.240384609	5.982905983	4.081632653	97.61904762	47.00854701	47.91666667	95.23809524	125.5975101	468.5733088
Epochs 200	0.222222224	7.317073171	4.651162791	85.36585366	50.81967213	46.51162791	73.17073171	16329.07893	1245.275482	0.302884609	5.737704918	3.448275862	96.49122807	46.72131148	50	91.22807018	266.1648221	468.5733088
Walmart Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.458715588	10.16949153	3.278688525	93.87755102	50.84745763	43.33333333	87.75510204	298.2929494	9380.979094	0.456620991	5	3.773584906	89.62264151	54.23728814	39.62264151	83.01886792	-85.68326109	255.7316817
Epochs 40	0.417431206	10.71428571	6.666666667	95.29411765	53.57142857	40	90.47619048	94.78778656	9380.979094	0.438356161	6.451612903	4.494382022	90.90909091	46.66666667	42.69662921	88.88888889	-6.676214281	255.7316817
Epochs 60	0.316513747	5.882352941	5.833333333	93.75	50	39.16666667	88.88888889	48.91571404	9380.979094	0.342465758	5.769230769	6.382978723	90.4109589	46.15384615	42.55319149	86.11111111	34.07431346	255.7316817
Epochs 80	0.37155962	5.263157895	5.882352941	93.58974359	50	40.19607843	87.01298701	196.6194377	9380.979094	0.461187214	10	5.714285714	92.92929293	54	48.57142857	85.71428571	808.9190759	255.7316817
Epochs 100	0.596330285	9.090909091	4.838709677	93.28358209	45.45454545	32.25806452	87.21804511	235.075781	9380.979094	0.643835604	7.894736842	6.060606061	91.89189189	55.26315789	51.51515152	86.39455782	410.7127707	255.7316817
Epochs 120	0.655963302	5	4.255319149	92.71523179	35	29.78723404	86.66666667	697.4573989	9380.979094	0.712328792	9.677419355	4.347826087	92.12121212	58.06451613	52.17391304	86.58536585	155.7849183	255.7316817
Epochs 140	0.715596318	5.882352941	5.555555556	92.72727273	35.29411765	36.11111111	85.97560976	761.6878832	9380.979094	0.748858452	3.571428571	7.692307692	91.01123596	50	38.46153846	85.31073446	176.4962069	255.7316817
Epochs 160	0.770642221	0	8.333333333	92.73743017	26.66666667	45.83333333	85.39325843	501.8342577	9380.979094	0.794520557	4	16.66666667	91.4893617	60	50	85.56149733	333.7245774	255.7316817
Epochs 180	0.788990855	0	7.692307692	92.89617486	33.33333333	42.30769231	85.71428571	131.9911798	9380.979094	0.821917832	0	11.11111111	91.32653061	57.14285714	44.44444444	85.12820513	40.34908655	255.7316817
Epochs 200	0.811926603	0	5.555555556	92.63157895	40	38.88888889	85.71428571	219.7236465	9380.979094	0.840182662	0	20	91.5	57.14285714	40	85.42713568	196.9657116	255.7316817
Fresh Del Monte Produce Inc (small cap) Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.316513747	4.032258065	4	91.30434783	31.70731707	44	85.50724638	-66.33044498	5.320148705	0.315068483	3.731343284	7.692307692	87.5	41.04477612	69.23076923	77.46478873	-31.44182121	-65.97131265
Epochs 40	0.068807341	7.5	6.52173913	0	45	45.25547445	0	747.0824299	5.320148705	0.059360731	7.317073171	4.444444444	50	55.55555556	45.18518519	50	51.89582372	-65.97131265
Epochs 60	0.087155961	7.954545455	4.918032787	75	44.31818182	46.28099174	75	721.1037907	5.320148705	0.086757988	8.080808081	4.385964912	100	52.04081633	44.73684211	100	468.958967	-65.97131265
Epochs 80	0.151376143	7.692307692	5.22875817	84.61538462	46.15384615	42.76315789	84.61538462	562.5834702	5.320148705	0.16438356	9.803921569	4.964539007	88.88888889	58.82352941	43.97163121	84.61538462	44.71366397	-65.97131265
Epochs 100	0.155963302	8.333333333	5	95.45454545	44.21052632	42	95.45454545	-73.38825582	5.320148705	0.12328767	7.766990291	4.95049505	93.33333333	50.98039216	46.53465347	86.66666667	10.61161842	-65.97131265

Epochs 120	0.25688073	6.315789474	4.225352113	90.38461538	42.55319149	40.84507042	86.53846154	-47.19005965	5.320148705	0.315068483	7.368421053	7.936507937	93.44262295	50	52.38095238	88.52459016	-5.270592978	-65.97131265
Epochs 140	0.431192666	5.882352941	5.128205128	92.55319149	45.23809524	35.8974359	84.04255319	-35.90712409	5.320148705	0.474885851	9.89010989	13.88888889	97.82608696	53.33333333	52.77777778	92.39130435	-63.00917525	-65.97131265
Epochs 160	0.555045843	5.263157895	5.882352941	91.33858268	46.42857143	41.17647059	83.46456693	-56.67884273	5.320148705	0.589041114	11.11111111	12.90322581	94.4	53.22580645	48.38709677	86.4	-51.83517823	-65.97131265
Epochs 180	0.683486223	2.777777778	5.263157895	90.18404908	47.22222222	42.10526316	82.71604938	2.106866569	5.320148705	0.707762539	13.95348837	11.11111111	93.03797468	61.9047619	50	84.81012658	5.93993614	-65.97131265
Epochs 200	0.729357779	3.448275862	6.666666667	90.22988506	51.72413793	46.66666667	82.65895954	-43.34549532	5.320148705	0.739726007	15.15151515	10.52631579	92.81437126	59.375	47.36842105	84.43113772	-49.47537264	-65.97131265

Table 11-8 Results of Experiment for CNN Models Trained Using Non-Cyclic Stock Data, Using 25 Trading Days Lookback Period

12 Appendix 7

Singapore Airlines Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.32110092	8.43373494	8.219178082	91.93548387	54.21686747	52.05479452	83.60655738	-50.1692073	-64.15459983	0.302325577	6.25	10.9375	94.54545455	46.875	58.73015873	83.63636364	-72.9662583	-78.23835547
Epochs 40	0.376146793	10.84337349	6.451612903	94.52054795	54.87804878	48.38709677	82.19178082	-64.4607141	-64.15459983	0.33488372	6	10.20408163	92.42424242	46	55.10204082	80	-98.0338153	-78.23835547
Epochs 60	0.463302761	8.695652174	8	91.91919192	56.52173913	48	79.59183673	-62.2123131	-64.15459983	0.451162785	7.5	9.756097561	92.55319149	52.5	56.09756098	81.72043011	-94.0283156	-78.23835547
Epochs 80	0.555045843	8.620689655	8.108108108	91.8699187	53.44827586	51.35135135	80.32786885	-58.9967269	-64.15459983	0.553488374	7.352941176	7.692307692	92.56198347	54.41176471	65.38461538	84.16666667	-15.2637169	-78.23835547
Epochs 100	0.642201841	10.20408163	8	92.36111111	51.02040816	60	80.41958042	-67.9267964	-64.15459983	0.623255789	6.896551724	10.52631579	92.75362319	51.72413793	63.15789474	84.67153285	-26.4476196	-78.23835547
Epochs 120	0.674311936	11.62790698	8.333333333	92.71523179	48.8372093	58.33333333	80.66666667	-66.0992054	-64.15459983	0.646511614	4.255319149	10	91.21621622	55.31914894	55	83.67346939	-23.291021	-78.23835547
Epochs 140	0.720183492	12.5	8.695652174	92.63803681	43.75	60.86956522	80.24691358	-53.2986308	-64.15459983	0.693023264	5.555555556	9.523809524	91.7721519	52.77777778	57.14285714	84.07643312	-14.8313891	-78.23835547
Epochs 160	0.738532126	10.71428571	5.263157895	91.8128655	35.71428571	57.89473684	79.41176471	-55.2848448	-64.15459983	0.706976771	5.714285714	10.52631579	91.92546584	51.42857143	57.89473684	84.375	-54.048349	-78.23835547
Epochs 180	0.738532126	10.71428571	5.263157895	91.8128655	35.71428571	57.89473684	79.41176471	-55.2848448	-64.15459983	0.706976771	5.405405405	11.76470588	91.92546584	51.35135135	58.82352941	84.375	-40.0558434	-78.23835547
Epochs 200	0.766055048	13.04347826	5.555555556	92.09039548	39.13043478	55.55555556	78.97727273	-55.2848448	-64.15459983	0.76279068	7.407407407	13.33333333	92.48554913	59.25925926	66.66666667	85.46511628	-9.21076376	-78.23835547
OCBC Bank Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.486238539	5.454545455	8.928571429	91.58878505	56.36363636	58.92857143	83.96226415	-2.48526867	-55.90202866	0.534883738	13.33333333	11.36363636	91.89189189	51.66666667	60.46511628	85.58558559	-4.88088341	-24.56291964
Epochs 40	0.353211015	2.985074627	7.042253521	87.5	58.20895522	57.14285714	82.5	-69.8478294	-55.90202866	0.42790699	6.849315068	11.76470588	89.01098901	49.31506849	64.70588235	83.33333333	-51.276403	-24.56291964
Epochs 60	0.440366983	3.636363636	7.8125	89.8989899	56.36363636	56.25	84.69387755	-43.5720237	-55.90202866	0.544186056	9.803921569	11.11111111	89.91596639	52.94117647	60	84.74576271	-29.5816493	-24.56291964
Epochs 80	0.513761461	0	10.52631579	90.5982906	50	54.38596491	85.34482759	-43.5786493	-55.90202866	0.641860485	13.51351351	13.15789474	91.42857143	54.05405405	65.78947368	87.05035971	-30.102984	-24.56291964
Epochs 100	0.596330285	0	4.545454545	89.51048951	51.61290323	45.45454545	85.21126761	-50.3511033	-55.90202866	0.688372076	16.12903226	12.5	91.44736842	48.38709677	65.625	86.75496689	-48.0754589	-24.56291964
Epochs 120	0.600917459	0	4.87804878	89.58333333	54.54545455	46.34146341	84.61538462	-68.4277782	-55.90202866	0.720930219	18.51851852	8	90.79754601	51.85185185	60	86.41975309	-39.1949564	-24.56291964
Epochs 140	0.633027494	0	3.225806452	89.54248366	50	41.93548387	84.21052632	-77.2542621	-55.90202866	0.744186044	18.51851852	10	91.07142857	55.55555556	60	86.82634731	-35.0111195	-24.56291964
Epochs 160	0.688073397	0	0	89.82035928	44.44444444	41.66666667	84.93975904	-84.6712357	-55.90202866	0.744186044	16	0	89.65517241	48	50	85.54913295	-40.017375	-24.56291964
Epochs 180	0.729357779	0	0	90.34090909	38.46153846	37.5	84.57142857	-87.7088189	-55.90202866	0.744186044	14.81481481	0	89.65517241	51.85185185	64.28571429	85.54913295	-35.6976915	-24.56291964
Epochs 200	0.738532126	0	5.882352941	90.90909091	44	41.17647059	84.57142857	-90.2983146	-55.90202866	0.772092998	13.04347826	0	89.56043956	52.17391304	80	85.63535912	91.88083507	-24.56291964
CNOOC Limited Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.184834123	3.846153846	0	82.5	46.15384615	71.42857143	80	-79.6115063	-54.68960087	0.21596244	5.844155844	0	88.0952381	42.20779221	58.82352941	73.17073171	-81.9318566	-84.2898875

Epochs 40	0.51184833	9.523809524	9.090909091	94.23076923	58.73015873	60.46511628	84.61538462	237.6688552	-54.68960087	0.49765259	8.219178082	15.38461538	93.06930693	54.79452055	52.63157895	81.18811881	-82.7758038	-84.2898875
Epochs 60	0.530805707	7.692307692	8.510638298	92.85714286	55.76923077	65.2173913	82.14285714	249.0680536	-54.68960087	0.521126747	7.692307692	13.15789474	91.81818182	58.46153846	59.45945946	80.90909091	-80.9289145	-84.2898875
Epochs 80	0.60189575	7.5	9.756097561	92.30769231	55	67.5	82.30769231	-76.7300612	-54.68960087	0.605633795	9.433962264	13.33333333	92.30769231	58.49056604	58.62068966	83.07692308	-76.1951673	-84.2898875
Epochs 100	0.663507104	6.060606061	12.12121212	92.4137931	57.57575758	65.625	81.37931034	-89.0827522	-54.68960087	0.64319247	10.86956522	13.79310345	92.75362319	58.69565217	57.14285714	83.33333333	-41.4373753	-84.2898875
Epochs 120	0.687203765	6.896551724	12.5	92.66666667	55.17241379	67.74193548	82	-87.5203952	-54.68960087	0.661971807	11.9047619	13.79310345	92.95774648	59.52380952	60.71428571	84.50704225	-37.7072614	-84.2898875
Epochs 140	0.710900486	3.846153846	11.53846154	91.82389937	61.53846154	68	81.13207547	-78.8052411	-54.68960087	0.713615	15.15151515	12	92.90322581	57.57575758	54.16666667	84.51612903	-40.5509986	-84.2898875
Epochs 160	0.734597147	7.692307692	13.04347826	92.59259259	61.53846154	63.63636364	82.09876543	-79.6648704	-54.68960087	0.718309879	15.15151515	12.5	92.94871795	60.60606061	52.17391304	84.61538462	-30.9391101	-84.2898875
Epochs 180	0.781990528	5.555555556	15.78947368	92.52873563	61.11111111	66.66666667	82.18390805	-84.0242872	-54.68960087	0.732394338	15.625	13.63636364	93.08176101	53.125	52.38095238	83.64779874	-38.8703861	-84.2898875
Epochs 200	0.791469216	10	17.64705882	93.10344828	65	62.5	82.75862069	-82.4649963	-54.68960087	0.718309879	13.51351351	11.11111111	92.40506329	56.75675676	52.94117647	84.17721519	-26.6866823	-84.2898875
JP Morgan Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.339449555	8.333333333	3.773584906	92.75362319	50	43.39622642	80.88235294	2494.734819	1576.179166	0.315068483	6.837606838	14.63414634	90.16393443	45.68965517	63.41463415	81.96721311	24.91339355	-31.90034799
Epochs 40	0.463302761	10.90909091	6.060606061	93.81443299	50.90909091	47.69230769	86.59793814	730.731207	1576.179166	0.424657524	10.29411765	8.196721311	90	52.23880597	49.18032787	82.22222222	-57.8760131	-31.90034799
Epochs 60	0.532110095	11.76470588	5.660377358	93.85964912	45.09803922	48.07692308	87.71929825	2512.761977	1576.179166	0.534246564	10.41666667	9.433962264	90.6779661	59.57446809	50.94339623	81.3559322	-52.776996	-31.90034799
Epochs 80	0.623853207	12.19512195	5.128205128	93.47826087	46.34146341	46.15384615	86.86131387	2430.819812	1576.179166	0.589041114	12.19512195	8.888888889	90.22556391	67.5	53.33333333	81.95488722	-20.7290171	-31.90034799
Epochs 100	0.674311936	10.34482759	3.03030303	91.66666667	44.82758621	42.42424242	85.80645161	161.0365578	1576.179166	0.625570774	13.88888889	9.523809524	90.78014184	65.71428571	50	82.9787234	-21.350985	-31.90034799
Epochs 120	0.701834857	5.263157895	3.03030303	90.96385542	47.36842105	48.48484848	84.84848485	137.1187561	1576.179166	0.666666687	11.53846154	10.25641026	90.25974026	57.69230769	53.84615385	83.00653595	99.09989952	-31.90034799
Epochs 140	0.729357779	0	3.571428571	90.8045977	50	46.42857143	85.54913295	187.1925403	1576.179166	0.694063902	4.545454545	9.677419355	89.15662651	54.54545455	60	81.92771084	130.0793527	-31.90034799
Epochs 160	0.747706413	0	3.571428571	91.01123596	50	46.42857143	85.31073446	209.2202052	1576.179166	0.712328792	8.695652174	10.71428571	89.88095238	56.52173913	57.14285714	82.03592814	127.1120363	-31.90034799
Epochs 180	0.766055048	0	4.347826087	91.20879121	46.15384615	47.82608696	85.08287293	198.5350165	1576.179166	0.767123282	9.523809524	16.66666667	90.55555556	52.38095238	66.66666667	83.24022346	147.5747709	-31.90034799
Epochs 200	0.752293587	0	0	90.60773481	46.66666667	45.45454545	84.44444444	198.5350165	1576.179166	0.762557089	8.695652174	17.64705882	90.5027933	56.52173913	64.70588235	83.14606742	53.48207241	-31.90034799
American Axle (small cap) Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.275229365	5.681818182	6.578947368	92.59259259	42.52873563	52.63157895	83.33333333	-91.4906339	-40.19620025	0.315068483	11.42857143	7.777777778	91.52542373	53.62318841	60	84.74576271	43.59550362	-32.50977019
Epochs 40	0.412844032	6.849315068	6.779661017	94.18604651	46.57534247	55.93220339	88.23529412	-72.6344817	-40.19620025	0.420091331	13.84615385	9.589041096	93.82716049	60	67.12328767	88.75	-24.2076247	-32.50977019
Epochs 60	0.449541271	7.692307692	6.779661017	94.68085106	46.15384615	54.23728814	87.09677419	-72.5100831	-40.19620025	0.465753436	12.28070175	10.44776119	92.63157895	56.14035088	70.14925373	88.29787234	-39.3199453	-32.50977019
Epochs 80	0.463302761	8.064516129	3.703703704	92.15686275	48.38709677	51.85185185	84.15841584	-75.5653006	-40.19620025	0.515981734	12.24489796	11.29032258	92.59259259	61.2244898	72.58064516	88.78504673	-32.0773301	-32.50977019
Epochs 100	0.545871556	9.615384615	4.444444444	92.56198347	44.23076923	53.33333333	84.16666667	-77.3692386	-40.19620025	0.602739751	17.14285714	12.28070175	93.7007874	71.42857143	68.42105263	89.68253968	5.202788123	-32.50977019
Epochs 120	0.619266033	9.756097561	2.777777778	92.19858156	43.90243902	55.55555556	83.57142857	-80.9271164	-40.19620025	0.634703219	17.64705882	13.7254902	94.02985075	67.64705882	68.62745098	90.22556391	-22.882594	-32.50977019
Epochs 140	0.665137589	8.333333333	3.448275862	92.15686275	47.22222222	55.17241379	84.21052632	-77.5197824	-40.19620025	0.694063902	23.07692308	11.9047619	93.37748344	65.38461538	71.42857143	89.33333333	-47.1350803	-32.50977019

Epochs 160	0.701834857	10.34482759	3.571428571	92.54658385	55.17241379	57.14285714	85	-82.9912016	-40.19620025	0.675799072	21.73913043	8.888888889	92.05298013	69.56521739	66.66666667	88	-45.7908678	-32.50977019
Epochs 180	0.738532126	11.53846154	4.347826087	92.89940828	53.84615385	56.52173913	85.71428571	-73.5692344	-40.19620025	0.707762539	21.73913043	8.333333333	91.875	69.56521739	66.66666667	87.42138365	-44.8133786	-32.50977019
Epochs 200	0.770642221	13.04347826	5.263157895	93.18181818	56.52173913	47.36842105	86.28571429	-69.3652945	-40.19620025	0.79908675	30.76923077	13.04347826	91.80327869	76.92307692	73.91304348	87.36263736	8112.486543	-32.50977019

Table 12-1 Results of Experiment for LSTM Models Trained Using Cyclic Stock Data, Using 5 Trading Days Lookback Period

Kweichow Moutai Co., Ltd. Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.671497583	6.818181818	0	88.31168831	34.09090909	33.33333333	83.66013072	1994.294156	1666.892281	0.75	15.15151515	0	92.07317073	54.54545455	54.54545455	85.88957055	3112.293787	678.7940879
Epochs 40	0.492753625	17.77777778	8.955223881	92.63157895	64.44444444	41.79104478	87.23404255	1151.812782	1666.892281	0.528846145	14.28571429	10.52631579	94.23076923	60.71428571	60.52631579	86.40776699	235.1248833	678.7940879
Epochs 60	0.516908228	17.5	7.936507937	91.34615385	67.5	46.03174603	85.4368932	1181.688328	1666.892281	0.557692289	13.33333333	11.76470588	94.54545455	56.66666667	57.35294118	88.0733945	223.8965425	678.7940879
Epochs 80	0.550724626	13.51351351	9.090909091	90.43478261	64.86486486	45.45454545	85.96491228	993.4482737	1666.892281	0.605769217	16.12903226	12.5	94.21487603	61.29032258	64.28571429	88.33333333	800.8475412	678.7940879
Epochs 100	0.637681186	17.85714286	10.86956522	91.72932331	71.42857143	47.82608696	87.87878788	10185.98769	1666.892281	0.639423072	14.81481481	10.63829787	92.53731343	66.66666667	63.82978723	86.46616541	884.9394455	678.7940879
Epochs 120	0.681159437	18.18181818	10.25641026	91.09589041	77.27272727	43.58974359	86.89655172	14816.20273	1666.892281	0.697115362	18.18181818	10.52631579	92.56756757	77.27272727	65.78947368	85.71428571	951.6092649	678.7940879
Epochs 140	0.729468584	23.07692308	9.090909091	90.0621118	84.61538462	39.39393939	85	3900.923545	1666.892281	0.740384638	0	9.090909091	90.41916168	87.5	63.63636364	84.3373494	1437.525878	678.7940879
Epochs 160	0.758454084	27.27272727	7.407407407	89.9408284	81.81818182	33.33333333	85.11904762	5053.487783	1666.892281	0.769230783	0	10.34482759	90.75144509	100	65.51724138	84.88372093	1136.056533	678.7940879
Epochs 180	0.801932395	37.5	9.523809524	90.4494382	87.5	42.85714286	85.87570621	5540.877059	1666.892281	0.783653855	0	8	90.4494382	100	72	84.18079096	1136.056533	678.7940879
Epochs 200	0.816425145	42.85714286	10.52631579	90.60773481	85.71428571	47.36842105	86.11111111	2299.162585	1666.892281	0.798076928	0	8.695652174	90.60773481	100	73.91304348	84.44444444	1075.49792	678.7940879
Midea Group Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.096618354	5.555555556	0	100	44.16243655	0	55.55555556	1245.275482	1245.275482	0.03846154	3.381642512	0	100	41.74757282	0	100	468.5733088	468.5733088
Epochs 40	0.584541082	6.578947368	0	88.54961832	55.26315789	0	76.92307692	8714.060909	1245.275482	0.586538434	4.938271605	0	92.91338583	44.44444444	0	85.71428571	380.5435845	468.5733088
Epochs 60	0.782608688	7.692307692	25	89.83050847	50	75	78.40909091	591.4479656	1245.275482	0.860576928	0	0	92.26804124	46.15384615	100	84.97409326	673.6076444	468.5733088
Epochs 80	0.652173936	11.76470588	9.090909091	91.42857143	58.82352941	54.54545455	79.13669065	260.4110391	1245.275482	0.697115362	8.333333333	6.25	92.76315789	58.33333333	59.375	84.10596026	22.46033574	468.5733088
Epochs 100	0.657004833	10.81081081	10.34482759	91.4893617	59.45945946	65.51724138	78.57142857	2687.782972	1245.275482	0.716346145	11.53846154	10	94.07894737	57.69230769	53.33333333	85.43046358	1.717215489	468.5733088
Epochs 120	0.729468584	13.33333333	6.666666667	90.12345679	63.33333333	80	78.88198758	1644.365515	1245.275482	0.740384638	12.5	4.347826087	93.16770186	62.5	47.82608696	85.625	18.79561265	468.5733088
Epochs 140	0.748792291	12.5	6.666666667	89.88095238	62.5	80	79.04191617	1984.45471	1245.275482	0.783653855	14.28571429	5.882352941	93.52941176	57.14285714	47.05882353	85.20710059	61.34903512	468.5733088
Epochs 160	0.768115938	13.63636364	7.692307692	90.11627907	63.63636364	76.92307692	79.53216374	2078.346804	1245.275482	0.793269217	16.66666667	0	93.10344828	55.55555556	43.75	84.97109827	57.27157448	468.5733088
Epochs 180	0.782608688	11.11111111	0	89.38547486	72.22222222	70	79.21348315	2277.778704	1245.275482	0.836538434	20	0	93.44262295	66.66666667	50	85.71428571	97.19770608	468.5733088
Epochs 200	0.787439585	11.76470588	0	89.44444444	76.47058824	70	79.32960894	2240.162226	1245.275482	0.841346145	15.38461538	0	93.01075269	61.53846154	44.44444444	85.40540541	21.92775955	468.5733088
Walmart Model	Non-Recession									Recession								

	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.467889905	5.714285714	7.228915663	94	48.57142857	43.37349398	86.86868687	-1.27827814	9380.979094	0.452054799	9.090909091	8.571428571	93.61702128	58.18181818	51.42857143	86.02150538	206.0663556	255.7316817
Epochs 40	0.417431206	4.761904762	6.818181818	94.31818182	54.76190476	46.59090909	87.35632184	85.38097252	9380.979094	0.429223746	5.660377358	11.39240506	94.25287356	49.05660377	53.16455696	86.04651163	54.21589664	255.7316817
Epochs 60	0.495412856	5.714285714	7.792207792	94.33962264	60	45.45454545	85.71428571	394.4856036	9380.979094	0.511415541	4.444444444	10	91.22807018	53.33333333	53.33333333	83.18584071	40.7640183	255.7316817
Epochs 80	0.573394477	6.451612903	8.064516129	94.4	61.29032258	43.5483871	87.09677419	340.6345862	9380.979094	0.561643839	4.651162791	11.76470588	92	51.1627907	50.98039216	83.06451613	38.93980896	255.7316817
Epochs 100	0.582568824	7.142857143	6.557377049	93.79844961	60.71428571	42.62295082	85.9375	107.6112764	9380.979094	0.611872137	5.405405405	13.04347826	92.64705882	54.05405405	47.82608696	84.44444444	192.1640404	255.7316817
Epochs 120	0.633027494	9.090909091	7.272727273	93.61702128	72.72727273	40	85.71428571	58.2077008	9380.979094	0.671232879	6.896551724	12.82051282	92.71523179	58.62068966	48.71794872	84.66666667	164.9249398	255.7316817
Epochs 140	0.665137589	0	8.163265306	92.15686275	75	40.81632653	84.86842105	109.9811699	9380.979094	0.776255727	10.52631579	19.23076923	93.67816092	52.63157895	50	86.70520231	565.8483269	255.7316817
Epochs 160	0.669724762	0	8.333333333	92.20779221	75	39.58333333	84.96732026	109.9811699	9380.979094	0.753424644	10.52631579	13.79310345	92.98245614	47.36842105	48.27586207	85.29411765	383.0642732	255.7316817
Epochs 180	0.688073397	0	8.695652174	92.40506329	78.57142857	39.13043478	85.35031847	145.0470734	9380.979094	0.794520557	14.28571429	13.04347826	92.85714286	42.85714286	39.13043478	85.63535912	119.667249	255.7316817
Epochs 200	0.711009145	0	9.302325581	92.63803681	91.66666667	39.53488372	85.18518519	150.9360159	9380.979094	0.771689475	11.11111111	12.5	92.65536723	44.44444444	41.66666667	85.22727273	112.9945236	255.7316817
Fresh Del Monte Produce Inc (small cap) Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.555045843	12.82051282	13.63636364	94.69026549	56.41025641	56.92307692	86.72566372	913.8423315	5.320148705	0.584474862	4	10	90.29850746	54.16666667	55	82.08955224	519.845292	-65.97131265
Epochs 40	0.412844032	12.6984127	10.38961039	94.87179487	63.49206349	53.94736842	84.61538462	497.6097318	5.320148705	0.465753436	6.666666667	9.589041096	91.08910891	52.27272727	53.42465753	84.15841584	-8.8484433	-65.97131265
Epochs 60	0.449541271	10.20408163	9.210526316	92.47311828	65.30612245	53.33333333	83.87096774	309.6934068	5.320148705	0.506849289	8.333333333	9.589041096	91.81818182	60	54.79452055	83.63636364	10.34145735	-65.97131265
Epochs 80	0.504587173	10.86956522	10.44776119	93.33333333	65.2173913	54.54545455	84.76190476	771.207029	5.320148705	0.547945201	5.882352941	8.333333333	90.4	63.63636364	53.33333333	83.2	1534.314367	-65.97131265
Epochs 100	0.582568824	8.823529412	11.86440678	93.6	67.64705882	58.62068966	85.6	5287.285525	5.320148705	0.616438329	7.407407407	9.615384615	91.42857143	61.53846154	61.53846154	84.28571429	1512.451076	-65.97131265
Epochs 120	0.587155938	6.451612903	10.52631579	92.30769231	74.19354839	55.35714286	84.61538462	3196.176241	5.320148705	0.652968049	9.090909091	10.20408163	91.89189189	68.18181818	60.41666667	84.45945946	1922.092964	-65.97131265
Epochs 140	0.596330285	7.142857143	10.34482759	92.42424242	75	52.63157895	84.09090909	3029.455327	5.320148705	0.675799072	11.11111111	10.41666667	92.15686275	72.22222222	59.57446809	83.66013072	2475.913597	-65.97131265
Epochs 160	0.651376128	8.333333333	12	93.05555556	66.66666667	55.10204082	85.41666667	2870.893772	5.320148705	0.694063902	6.25	7.317073171	91.35802469	62.5	55	82.71604938	960.0882301	-65.97131265
Epochs 180	0.674311936	10.71428571	14.28571429	93.24324324	71.42857143	56.09756098	85.13513514	2214.677379	5.320148705	0.707762539	6.666666667	7.894736842	90.96385542	66.66666667	60.52631579	83.03030303	790.3103967	-65.97131265
Epochs 200	0.678899109	11.11111111	14.28571429	93.2885906	74.07407407	51.2195122	85.90604027	687.0726243	5.320148705	0.707762539	6.25	7.894736842	91.51515152	62.5	60.52631579	83.53658537	1485.823851	-65.97131265

Table 12-2 Results of Experiment for LSTM Models Trained Using Non-Cyclic Stock Data, Using 5 Trading Days Lookback Period

Singapore Airlines Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.504587173	8.196721311	10.20408163	92.59259259	53.33333333	61.2244898	80.55555556	-63.5457455	-64.15459983	0.404651165	7.407407407	9.433962264	93.82716049	48.14814815	64.1509434	88.75	-72.9328086	-78.23835547
Epochs 40	0.481651366	11.29032258	11.47540984	95.78947368	63.93442623	54.09836066	87.36842105	-50.5331394	-64.15459983	0.441860467	6.578947368	10.20408163	94.44444444	46.05263158	61.2244898	88.76404494	-60.7608639	-78.23835547
Epochs 60	0.536697268	12.28070175	10	94.59459459	57.89473684	52	84.54545455	-25.6331339	-64.15459983	0.493023247	6.944444444	7.894736842	93.33333333	48.61111111	57.89473684	88.46153846	-76.7805569	-78.23835547
Epochs 80	0.582568824	13.04347826	8.510638298	93.6	60.86956522	48.93617021	82.25806452	-62.8049276	-64.15459983	0.57209301	5.769230769	5.714285714	92.1875	53.84615385	68.57142857	86.61417323	-28.2835303	-78.23835547
Epochs 100	0.623853207	13.95348837	7.692307692	93.38235294	62.79069767	48.71794872	82.96296296	-38.5218436	-64.15459983	0.632558167	6	8.333333333	92.90780142	50	66.66666667	87.14285714	-82.7671908	-78.23835547
Epochs 120	0.674311936	10.34482759	3.125	91.08280255	58.62068966	43.75	80.12820513	-61.419526	-64.15459983	0.697674394	5.714285714	5.263157895	91.30434783	60	73.68421053	85.625	-80.5780866	-78.23835547
Epochs 140	0.747706413	15.38461538	4.761904762	92.39766082	61.53846154	52.38095238	79.41176471	-7.84905822	-64.15459983	0.739534855	6.451612903	0	91.27906977	58.06451613	66.66666667	85.38011696	-95.5905055	-78.23835547
Epochs 160	0.75688076	17.39130435	4.545454545	92.48554913	56.52173913	50	80.81395349	-11.0795466	-64.15459983	0.744186044	6.896551724	0	91.32947977	58.62068966	69.23076923	85.46511628	-91.4567805	-78.23835547
Epochs 180	0.779816508	14.28571429	5.882352941	92.22222222	57.14285714	41.17647059	79.88826816	47.41622904	-64.15459983	0.781395376	7.692307692	0	91.71270718	57.69230769	62.5	85.55555556	-95.3071362	-78.23835547
Epochs 200	0.788990855	13.63636364	7.142857143	92.30769231	54.54545455	35.71428571	80.11049724	-45.438965	-64.15459983	0.795348823	8	0	91.84782609	64	66.66666667	85.79234973	-96.0969467	-78.23835547

OCBC Bank Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.275229365	6.329113924	6.976744186	92.45283019	50.63291139	51.76470588	86.79245283	-87.20588	-55.90202866	0.293023258	8.571428571	9.782608696	90.56603774	52.85714286	55.43478261	82.69230769	-50.8247502	-24.56291964
Epochs 40	0.316513747	6.849315068	5.128205128	89.55223881	49.31506849	51.94805195	82.08955224	-87.1401897	-55.90202866	0.38139534	4.761904762	12.16216216	89.74358974	53.96825397	60.2739726	85.8974359	-44.0626729	-24.56291964
Epochs 60	0.431192666	8.333333333	7.352941176	93.33333333	51.66666667	54.41176471	87.64044944	-35.6803858	-55.90202866	0.441860467	5.357142857	12.12121212	90.32258065	50	60	87.09677419	-29.6016617	-24.56291964
Epochs 80	0.509174287	6	8.928571429	91.96428571	52	57.14285714	86.48648649	40.88032657	-55.90202866	0.539534867	6.12244898	16	90.51724138	46.93877551	66	86.95652174	-27.3267212	-24.56291964
Epochs 100	0.555045843	2.702702703	5.660377358	91.40625	43.24324324	54.71698113	85.03937008	40.88848759	-55.90202866	0.600000024	5.555555556	15.2173913	90.22556391	47.22222222	65.2173913	85.60606061	-37.9297575	-24.56291964
Epochs 120	0.596330285	3.571428571	5.769230769	91.30434783	46.42857143	53.84615385	85.40145985	-42.3844885	-55.90202866	0.651162803	7.407407407	15.90909091	90.97222222	59.25925926	65.90909091	86.71328671	-35.0976521	-24.56291964
Epochs 140	0.623853207	0	4.255319149	89.93288591	36.36363636	53.19148936	83.10810811	-95.4490481	-55.90202866	0.688372076	9.523809524	13.15789474	90.38461538	61.9047619	63.15789474	86.4516129	-42.0214333	-24.56291964
Epochs 160	0.655963302	0	4.761904762	90.38461538	35	57.14285714	83.22580645	-97.9704424	-55.90202866	0.706976771	11.76470588	15	91.13924051	64.70588235	65	87.2611465	-40.9510116	-24.56291964
Epochs 180	0.683486223	0	3.125	90.24390244	36.36363636	56.25	83.43558282	-88.9116289	-55.90202866	0.706976771	11.11111111	15.38461538	91.13924051	66.66666667	64.1025641	87.2611465	-38.0109944	-24.56291964
Epochs 200	0.678899109	0	2.941176471	90.18404908	38.0952381	58.82352941	83.33333333	-32.319645	-55.90202866	0.730232537	9.090909091	13.51351351	90.41916168	54.54545455	62.16216216	86.74698795	-51.7296971	-24.56291964

CNOOC Limited Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.758293867	0	0	90.90909091	50	45.45454545	80.68181818	253.7168299	-54.68960087	0.718309879	14.28571429	3.125	89.82035928	64.28571429	51.61290323	82.63473054	-74.5416213	-84.2898875
Epochs 40	0.374407589	5.633802817	7.692307692	93.33333333	59.15492958	57.8125	81.33333333	237.9501711	-54.68960087	0.42723006	9.677419355	10.29411765	93.97590361	51.61290323	56.71641791	83.13253012	-73.5440372	-84.2898875
Epochs 60	0.421800941	3.03030303	9.090909091	91.11111111	59.09090909	61.11111111	81.11111111	-30.1252158	-54.68960087	0.50234741	11.53846154	8.620689655	93.2038835	57.69230769	57.89473684	84.46601942	-47.3867241	-84.2898875
Epochs 80	0.507108986	3.448275862	9.302325581	91.81818182	60.34482759	62.79069767	83.48623853	-41.6547328	-54.68960087	0.57276994	12.19512195	9.803921569	92.56198347	60.97560976	58	85.12396694	4.382216252	-84.2898875

Epochs 100	0.578199029	3.703703704	7.407407407	90.76923077	62.96296296	70.37037037	82.17054264	-52.2478572	-54.68960087	0.605633795	11.36363636	10.52631579	91.60305344	65.90909091	56.75675676	82.44274809	78.97324183	-84.2898875
Epochs 120	0.620853066	4.166666667	8.333333333	91.36690647	60.41666667	66.66666667	82.60869565	-51.665348	-54.68960087	0.690140843	16.21621622	13.79310345	93.19727891	67.56756757	60.71428571	85.03401361	-35.6395722	-84.2898875
Epochs 140	0.68246448	2.857142857	9.090909091	91.55844156	57.14285714	63.63636364	83.66013072	-66.2703882	-54.68960087	0.741784036	11.11111111	13.33333333	92.12121212	77.77777778	62.06896552	84.84848485	-33.2998703	-84.2898875
Epochs 160	0.720379174	3.333333333	10.52631579	91.97530864	56.66666667	68.42105263	82.60869565	-44.0702451	-54.68960087	0.732394338	5.882352941	13.33333333	90.96385542	76.47058824	65.51724138	83.73493976	51.37911141	-84.2898875
Epochs 180	0.758293867	3.846153846	0	91.37931034	53.84615385	63.63636364	82.08092486	-62.5277306	-54.68960087	0.769953072	6.666666667	13.63636364	90.90909091	80	71.42857143	84.09090909	144.6240561	-84.2898875
Epochs 200	0.777251184	0	0	91.11111111	54.54545455	55.55555556	81.56424581	-50.6991383	-54.68960087	0.798122048	10	10.52631579	90.76086957	70	61.11111111	83.15217391	105.964521	-84.2898875
JP Morgan Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.266055048	13.33333333	3.669724771	93.87755102	51.66666667	47.22222222	85.71428571	4866.183907	1576.179166	0.356164396	8.064516129	10.58823529	88.88888889	45.16129032	55.29411765	85.91549296	60.48978869	-31.90034799
Epochs 40	0.481651366	15.38461538	2.702702703	92.38095238	53.84615385	50.68493151	86.66666667	4927.941463	1576.179166	0.547945201	9.756097561	11.86440678	91.59663866	46.34146341	57.62711864	84.74576271	-74.7049279	-31.90034799
Epochs 60	0.596330285	15.15151515	1.960784314	92.53731343	54.54545455	56	87.31343284	5730.694851	1576.179166	0.639269412	13.51351351	10.52631579	90.97222222	51.35135135	55.26315789	83.21678322	-59.9921021	-31.90034799
Epochs 80	0.69266057	17.39130435	0	92.45283019	60.86956522	51.42857143	86.16352201	5010.01521	1576.179166	0.680365324	6.666666667	10.71428571	89.44099379	50	53.57142857	80.625	-71.4376668	-31.90034799
Epochs 100	0.720183492	17.64705882	0	91.66666667	64.70588235	45.45454545	86.22754491	257.3855534	1576.179166	0.716894984	7.692307692	12.5	89.9408284	50	54.16666667	82.14285714	-73.2661203	-31.90034799
Epochs 120	0.766055048	20	0	92.13483146	60	52	85.87570621	567.4857487	1576.179166	0.757990897	11.11111111	13.04347826	90.4494382	66.66666667	52.17391304	82.48587571	-67.1256028	-31.90034799
Epochs 140	0.747706413	11.11111111	0	91.01123596	55.55555556	45.16129032	84.74576271	358.2060455	1576.179166	0.776255727	14.28571429	16	91.11111111	64.28571429	52	83.24022346	-74.0582789	-31.90034799
Epochs 160	0.816513777	0	0	91.28205128	66.66666667	45	85.05154639	333.4254432	1576.179166	0.785388112	13.33333333	18.18181818	91.20879121	66.66666667	59.09090909	83.42541436	-66.3667615	-31.90034799
Epochs 180	0.821100891	0	0	91.32653061	75	44.44444444	85.12820513	445.5701404	1576.179166	0.794520557	14.28571429	15.78947368	90.86021505	71.42857143	57.89473684	83.24324324	-35.1398473	-31.90034799
Epochs 200	0.816513777	0	0	91.28205128	80	44.44444444	85.05154639	362.3095527	1576.179166	0.79908675	13.33333333	17.64705882	90.90909091	73.33333333	58.82352941	83.33333333	-15.0932588	-31.90034799
American Axle (small cap) Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.362385333	6.25	5.194805195	92.20779221	37.5	49.35064935	84.21052632	-55.1244506	-40.19620025	0.378995448	8.695652174	6.666666667	87.95180723	52.17391304	56.66666667	82.92682927	289.9861199	-32.50977019
Epochs 40	0.495412856	1.851851852	7.843137255	91.15044248	44.44444444	52.94117647	83.03571429	-63.3429783	-40.19620025	0.506849289	12.76595745	6.779661017	89.38053097	59.57446809	62.71186441	83.92857143	77.65884322	-32.50977019
Epochs 60	0.600917459	2.43902439	5.405405405	91.42857143	39.02439024	45.94594595	84.17266187	-54.8791628	-40.19620025	0.566210032	13.15789474	4.081632653	88.63636364	60.52631579	59.18367347	83.96946565	40.0763874	-32.50977019
Epochs 80	0.62844038	2.702702703	8.108108108	92.36111111	32.43243243	51.35135135	84.61538462	40.40403432	-40.19620025	0.611872137	14.70588235	4.651162791	89.43661972	61.76470588	55.81395349	83.68794326	24.08907725	-32.50977019
Epochs 100	0.720183492	4	7.407407407	92.77108434	44	51.85185185	85.45454545	-36.3308815	-40.19620025	0.675799072	16	7.894736842	90.38461538	48	52.63157895	84.51612903	315.4527399	-32.50977019
Epochs 120	0.770642221	5.263157895	5	92.73743017	42.10526316	60	85.39325843	-41.405502	-40.19620025	0.726027369	15	3.846153846	89.59537572	50	50	83.13953488	-5.73124251	-32.50977019
Epochs 140	0.802752316	7.142857143	5.555555556	93.01075269	42.85714286	66.66666667	85.40540541	-33.4343645	-40.19620025	0.785388112	21.42857143	5.263157895	90.32258065	57.14285714	57.89473684	84.32432432	363.2726482	-32.50977019
Epochs 160	0.798165143	6.25	5.882352941	92.97297297	50	64.70588235	85.86956522	-55.7952382	-40.19620025	0.785388112	18.75	5.882352941	90.32258065	56.25	58.82352941	84.32432432	120.500155	-32.50977019
Epochs 180	0.821100891	7.692307692	6.666666667	93.15789474	53.84615385	60	85.71428571	-45.6733657	-40.19620025	0.81735158	14.28571429	10	90.25641026	57.14285714	60	84.53608247	65.61973975	-32.50977019
Epochs 200	0.825688064	10	6.25	92.70833333	50	62.5	85.34031414	0.356621207	-40.19620025	0.808219194	14.28571429	8.333333333	90.15544041	57.14285714	66.66666667	84.375	20.05595151	-32.50977019

Table 12-3 Results of Experiment for LSTM Models Trained Using Cyclic Stock Data, Using 10 Trading Days Lookback Period

Kweichow Moutai Co., Ltd. Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.280193239	9.090909091	6.976744186	83.63636364	56.92307692	47.6744186	80	11543.4437	1666.892281	0.288461536	9.756097561	7.826086957	90.38461538	43.90243902	49.56521739	82.35294118	693.2625576	678.7940879
Epochs 40	0.516908228	15	10.9375	91.26213592	60	50.79365079	88.34951456	27266.72315	1666.892281	0.423076928	14.70588235	6.666666667	91.66666667	52.94117647	50.56179775	86.9047619	165.3469656	678.7940879
Epochs 60	0.536231875	20	10	91.58878505	66.66666667	50.72463768	87.85046729	20291.86125	1666.892281	0.399038464	14.28571429	6.12244898	89.02439024	53.57142857	47.42268041	84.14634146	207.2397991	678.7940879
Epochs 80	0.603864729	14.28571429	10.52631579	89.92248062	61.9047619	49.12280702	85.9375	7138.139859	1666.892281	0.447115391	13.63636364	6.52173913	89.36170213	45.45454545	46.73913043	84.94623656	350.4023702	678.7940879
Epochs 100	0.63285023	15	8.333333333	89.20863309	60	52.08333333	85.50724638	7555.202131	1666.892281	0.519230783	15.78947368	6.41025641	90.09009009	42.10526316	50	84.54545455	324.6969063	678.7940879
Epochs 120	0.67632848	17.64705882	9.523809524	89.86486486	52.94117647	50	86.39455782	9957.86084	1666.892281	0.557692289	15.78947368	5.882352941	90.08264463	47.36842105	48.52941176	84.16666667	337.1412454	678.7940879
Epochs 140	0.705313981	17.64705882	11.11111111	90.25974026	52.94117647	55.55555556	87.58169935	9645.383339	1666.892281	0.600961566	17.64705882	3.50877193	89.55223881	47.05882353	47.36842105	82.70676692	381.0641312	678.7940879
Epochs 160	0.758454084	21.42857143	14.28571429	90.90909091	50	53.57142857	87.80487805	9548.028359	1666.892281	0.673076928	16.66666667	4.87804878	90.60402685	44.44444444	43.90243902	83.78378378	393.4197273	678.7940879
Epochs 180	0.782608688	15.38461538	18.18181818	90.69767442	46.15384615	54.54545455	87.71929825	5803.226317	1666.892281	0.677884638	17.64705882	2.564102564	90.13157895	52.94117647	46.15384615	83.44370861	392.0673104	678.7940879
Epochs 200	0.806763291	21.42857143	18.75	90.96045198	50	62.5	88.06818182	8712.02525	1666.892281	0.6875	0	2.857142857	88.75	38.46153846	48.57142857	82.38993711	106.1286207	678.7940879
Midea Group Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.053140096	5.314009662	0	0	45.63106796	0	0	1245.275482	1245.275482	0.033653848	3.365384615	0	0	42.02898551	0	0	468.5733088	468.5733088
Epochs 40	0.115942031	6.179775281	18.75	76.92307692	48.58757062	75	69.23076923	2278.365733	1245.275482	0.043269232	3.482587065	0	100	42	60	100	396.2046897	468.5733088
Epochs 60	0.463768125	6.896551724	6.382978723	87.25490196	55.17241379	57.44680851	76.23762376	1338.766472	1245.275482	0.475961536	3.076923077	5	92.23300971	47.69230769	61.53846154	86.40776699	232.3923811	468.5733088
Epochs 80	0.637681186	12.90322581	10	91.17647059	70.96774194	57.5	80.74074074	3583.168419	1245.275482	0.625	11.42857143	8.888888889	95.3125	57.14285714	62.22222222	87.4015748	288.5278212	468.5733088
Epochs 100	0.695652187	10.34482759	8.333333333	90.25974026	62.06896552	70.83333333	79.08496732	891.3125724	1245.275482	0.6875	10.71428571	10.81081081	95.1048951	57.14285714	59.45945946	86.61971831	77.37213944	468.5733088
Epochs 120	0.753623188	15.15151515	16.66666667	91.97530864	63.63636364	83.33333333	81.36645963	412.2842432	1245.275482	0.764423072	16	12.5	95.59748428	56	58.33333333	86.70886076	86.08471472	468.5733088
Epochs 140	0.739130437	13.51351351	18.18181818	91.82389937	64.86486486	90.90909091	81.01265823	376.8652522	1245.275482	0.783653855	14.81481481	16.66666667	95.70552147	55.55555556	66.66666667	87.03703704	113.6234942	468.5733088
Epochs 160	0.753623188	12.12121212	20	91.46341463	69.6969697	90	80.98159509	446.3730553	1245.275482	0.817307711	15.78947368	13.33333333	94.82758621	47.36842105	60	86.70520231	141.3782552	468.5733088
Epochs 180	0.729468584	11.11111111	16.66666667	91.19496855	63.88888889	91.66666667	81.01265823	246.2125281	1245.275482	0.783653855	13.63636364	5.882352941	94.08284024	45.45454545	52.94117647	85.71428571	28.11759484	468.5733088
Epochs 200	0.739130437	6.060606061	14.28571429	89.82035928	66.66666667	85.71428571	80.12048193	101.5999037	1245.275482	0.817307711	13.63636364	0	93.82022472	59.09090909	50	86.44067797	77.6762433	468.5733088
Walmart Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.348623842	4.166666667	7.216494845	91.78082192	52.08333333	45.83333333	87.67123288	126.8325135	9380.979094	0.374429226	9.090909091	10.63829787	95.71428571	62.96296296	50	84.28571429	107.3165458	255.7316817
Epochs 40	0.458715588	6.382978723	4.411764706	91.26213592	61.70212766	42.64705882	84.31372549	1098.128921	9380.979094	0.506849289	10.16949153	13.55932203	96.03960396	61.01694915	54.23728814	87	365.0964476	255.7316817

Epochs 60	0.472477078	6.382978723	4.615384615	91.50943396	55.31914894	44.61538462	83.80952381	224.1527925	9380.979094	0.598173499	12.76595745	9.302325581	93.79844961	57.44680851	45.23809524	86.82170543	48.89580902	255.7316817
Epochs 80	0.518348634	4.444444444	3.773584906	90.83333333	53.33333333	43.39622642	83.19327731	316.9021283	9380.979094	0.611872137	11.76470588	11.11111111	93.93939394	56.8627451	45.71428571	87.12121212	7.638807705	255.7316817
Epochs 100	0.591743112	2.777777778	2.380952381	90.71428571	50	42.85714286	82.73381295	127.4666011	9380.979094	0.648401797	12.19512195	8.823529412	93.05555556	60.97560976	45.45454545	86.11111111	477.655423	255.7316817
Epochs 120	0.62844038	5.714285714	2.777777778	91.15646259	51.42857143	50	82.87671233	168.75548	9380.979094	0.684931517	13.51351351	10	93.42105263	64.86486486	48.27586207	86.84210526	266.8328108	255.7316817
Epochs 140	0.706422031	4.545454545	3.333333333	91.56626506	54.54545455	46.66666667	83.03030303	229.8514864	9380.979094	0.721461177	10.34482759	8.333333333	92.1686747	58.62068966	39.13043478	85.54216867	145.4933567	255.7316817
Epochs 160	0.724770665	4.761904762	3.703703704	91.76470588	61.9047619	51.85185185	83.43195266	220.0807691	9380.979094	0.716894984	4	4.347826087	90.64327485	60	40.90909091	84.79532164	3.284236731	255.7316817
Epochs 180	0.74311924	4.761904762	4.347826087	91.95402299	52.38095238	56.52173913	83.23699422	115.726611	9380.979094	0.739726007	4.761904762	0	90.4494382	57.14285714	31.57894737	84.83146067	50.46672237	255.7316817
Epochs 200	0.766055048	6.25	4.347826087	92.17877095	56.25	56.52173913	83.70786517	261.1396169	9380.979094	0.748858452	5.555555556	0	90.55555556	55.55555556	35	84.44444444	49.86737131	255.7316817
Fresh Del Monte Produce Inc (small cap) Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.30733946	9.87654321	9.638554217	94.44444444	53.08641975	52.43902439	79.62962963	262.565327	5.320148705	0.182648405	4.716981132	5.194805195	86.11111111	47.61904762	50.64935065	80.55555556	-49.4497863	-65.97131265
Epochs 40	0.403669715	10.38961039	8.474576271	91.46341463	53.24675325	55.17241379	79.26829268	402.3949116	5.320148705	0.397260278	9.210526316	6.557377049	92.68292683	53.33333333	55.73770492	84.14634146	-52.0280351	-65.97131265
Epochs 60	0.495412856	11.5942029	10.63829787	93.1372549	57.97101449	50	81.37254902	365.2422016	5.320148705	0.484018266	8.064516129	7.692307692	92.38095238	52.45901639	57.69230769	84.76190476	-9.40173058	-65.97131265
Epochs 80	0.587155938	13.63636364	10.41666667	92.85714286	61.36363636	48.93617021	83.33333333	1096.309883	5.320148705	0.552511394	5.555555556	5.555555556	89.92248062	51.42857143	55.55555556	82.94573643	-94.3198158	-65.97131265
Epochs 100	0.669724762	11.11111111	12.5	92	63.88888889	53.125	83.22147651	2763.081487	5.320148705	0.634703219	7.142857143	6.976744186	90.54054054	57.14285714	58.13953488	83.67346939	-89.4814205	-65.97131265
Epochs 120	0.729357779	12.12121212	15	92.12121212	60.60606061	65	84.14634146	2113.55697	5.320148705	0.643835604	0	2.631578947	88.05031447	50	55.26315789	81.01265823	-90.4987484	-65.97131265
Epochs 140	0.747706413	12.5	17.64705882	92.30769231	59.375	70.58823529	83.92857143	1599.735288	5.320148705	0.716894984	0	3.225806452	89.14285714	53.84615385	64.51612903	82.75862069	-85.5740034	-65.97131265
Epochs 160	0.770642221	14.28571429	18.75	92.52873563	60.71428571	68.75	84.39306358	7556.334282	5.320148705	0.744292259	0	7.142857143	89.94413408	58.33333333	64.28571429	83.70786517	-91.3488104	-65.97131265
Epochs 180	0.802752316	13.63636364	18.18181818	91.89189189	59.09090909	72.72727273	84.23913043	85.32415241	5.320148705	0.771689475	0	4.545454545	89.83957219	40	54.54545455	82.79569892	-85.6628387	-65.97131265
Epochs 200	0.798165143	21.73913043	7.692307692	92.30769231	60.86956522	61.53846154	84.53038674	842.3345964	5.320148705	0.776255727	0	0	89.94708995	36.36363636	57.89473684	82.44680851	-94.6587198	-65.97131265

Table 12-4 Results of Experiment for LSTM Models Trained Using Non-Cyclic Stock Data, Using 10 Trading Days Lookback Period

Singapore Airlines Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.279816508	7.317073171	7.228915663	92.45283019	53.65853659	48.19277108	80.76923077	-58.83374049	-64.15459983	0.28372094	4.301075269	7.8125	89.65517241	47.31182796	54.6875	82.45614035	-45.0661934	-78.23835547
Epochs 40	0.279816508	5.882352941	8.974358974	89.09090909	48.23529412	50	77.77777778	-74.65996202	-64.15459983	0.362790704	6.52173913	8.163265306	91.89189189	50	59.18367347	86.30136986	17.84965149	-78.23835547
Epochs 60	0.467889905	7.843137255	8.955223881	92	54.90196078	50.74626866	81.81818182	-63.93784477	-64.15459983	0.497674406	4.6875	9.756097561	90.90909091	43.75	60.97560976	85.32110092	10.00197723	-78.23835547
Epochs 80	0.513761461	9.090909091	7.843137255	91.96428571	56.36363636	49.01960784	81.98198198	-32.81700181	-64.15459983	0.595348835	6.451612903	5.555555556	91.11111111	45.16129032	61.11111111	83.58208955	-70.5331312	-78.23835547
Epochs 100	0.56422019	10	6.976744186	92	56	53.48837209	81.4516129	-1.655239495	-64.15459983	0.604651153	6.666666667	0	91.30434783	45	52.94117647	83.94160584	-70.9008021	-78.23835547
Epochs 120	0.600917459	9.756097561	7.142857143	91.85185185	58.53658537	50	81.34328358	-8.118980659	-64.15459983	0.646511614	4.347826087	0	90.72847682	47.82608696	38.88888889	82	-67.8111069	-78.23835547

Epochs 140	0.660550475	10.34482759	5.263157895	92.05298013	55.17241379	44.73684211	81.33333333	-56.00152346	-64.15459983	0.711627901	3.03030303	0	90.47619048	60.60606061	42.85714286	82.63473054	-64.2801309	-78.23835547
Epochs 160	0.711009145	13.63636364	3.225806452	91.51515152	50	41.93548387	81.09756098	-40.96365167	-64.15459983	0.730232537	3.03030303	0	90.69767442	60.60606061	50	83.04093567	-78.5207015	-78.23835547
Epochs 180	0.729357779	15	6.451612903	92.21556886	50	48.38709677	81.92771084	4.567637827	-64.15459983	0.758139551	3.846153846	0	91.01123596	61.53846154	54.54545455	83.61581921	-54.437032	-78.23835547
Epochs 200	0.75688076	11.11111111	0	91.06145251	55.55555556	42.85714286	80.8988764	121.0281797	-64.15459983	0.800000012	5	0	91.44385027	70	62.5	84.40860215	131.249305	-78.23835547
OCBC Bank Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.431192666	5.194805195	4.651162791	89.79591837	49.35064935	52.38095238	84.69387755	-83.55391024	-55.90202866	0.446511626	5.555555556	5.263157895	85.71428571	56.94444444	51.35135135	81.9047619	-67.779613	-24.56291964
Epochs 40	0.518348634	4.255319149	5.882352941	90	46.80851064	54	85	-94.9007696	-55.90202866	0.497674406	6.153846154	5.882352941	87.06896552	53.84615385	51.51515152	84.48275862	-46.1787976	-24.56291964
Epochs 60	0.550458729	5.769230769	11.11111111	92.56198347	48.07692308	59.09090909	88.42975207	-80.40054944	-55.90202866	0.553488374	4.761904762	9.090909091	87.69230769	52.38095238	50	82.94573643	-56.082971	-24.56291964
Epochs 80	0.541284382	5.172413793	10.25641026	91.73553719	51.72413793	65.78947368	89.25619835	-90.25351992	-55.90202866	0.511627913	4.166666667	8.333333333	88.23529412	48.61111111	54.16666667	83.05084746	-52.0265973	-24.56291964
Epochs 100	0.591743112	4.166666667	6.25	90.57971014	47.91666667	61.29032258	86.95652174	-91.9645974	-55.90202866	0.520930231	2.941176471	4.545454545	87.2	47.05882353	45.45454545	83.06451613	-58.5123982	-24.56291964
Epochs 120	0.610091746	4.761904762	5.882352941	90.84507042	47.61904762	66.66666667	85.21126761	-83.44257676	-55.90202866	0.604651153	3.921568627	5	88.19444444	47.05882353	45	83.91608392	-48.7956072	-24.56291964
Epochs 140	0.600917459	4.761904762	5.555555556	90.71428571	47.61904762	65.71428571	85.71428571	-75.25495458	-55.90202866	0.609302342	2	10.52631579	87.67123288	48	52.63157895	83.44827586	22.73973216	-24.56291964
Epochs 160	0.623853207	2.5	6.451612903	90.47619048	42.5	63.33333333	85.03401361	-57.18465448	-55.90202866	0.641860485	4.166666667	12.5	88.74172185	50	56.25	84.66666667	6.447586166	-24.56291964
Epochs 180	0.623853207	2.702702703	5.714285714	91.09589041	51.35135135	58.82352941	85.61643836	50.27433507	-55.90202866	0.665116251	2.380952381	13.33333333	88.60759494	52.38095238	53.33333333	84.7133758	50.24075379	-24.56291964
Epochs 200	0.665137589	3.125	6.451612903	91.61290323	43.75	61.29032258	85.71428571	-22.96728891	-55.90202866	0.679069757	2.702702703	7.142857143	87.80487805	56.75675676	57.14285714	84.04907975	48.29035158	-24.56291964
CNOOC Limited Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.270142168	5.072463768	5.882352941	87.5	48.90510949	76.47058824	82.14285714	-2.176413259	-54.68960087	0.258215964	4.861111111	11.11111111	90.19607843	40.55944056	55.55555556	78.43137255	-75.6737199	-84.2898875
Epochs 40	0.355450243	2.53164557	9.259259259	87.17948718	51.89873418	64.1509434	75.64102564	-67.4261818	-54.68960087	0.42723006	8.235294118	14.58333333	96.25	47.05882353	57.44680851	90	-19.8132428	-84.2898875
Epochs 60	0.48815167	4.6875	7.5	90.65420561	50	57.5	80.18867925	-92.35173445	-54.68960087	0.591549277	6.557377049	16	92.91338583	44.26229508	50	85.03937008	-70.246675	-84.2898875
Epochs 80	0.597156405	5.555555556	11.53846154	91.60305344	55.55555556	50	80.76923077	-89.86220972	-54.68960087	0.713615	7.5	25	92.3566879	40	50	84.61538462	-92.4638623	-84.2898875
Epochs 100	0.611374378	2.127659574	4.545454545	89.43661972	46.80851064	54.54545455	80.14184397	-91.61318358	-54.68960087	0.788732409	10.34482759	40	92.52873563	37.93103448	60	84.39306358	-59.7198153	-84.2898875
Epochs 120	0.639810443	0	6.666666667	89.33333333	45.65217391	60	79.86577181	-71.1232237	-54.68960087	0.78403753	10.34482759	28.57142857	91.52542373	41.37931034	57.14285714	83.52272727	-74.0811589	-84.2898875
Epochs 140	0.654028416	0	10.52631579	90.06622517	46.34146341	52.63157895	80	-69.72390809	-54.68960087	0.821596265	14.28571429	28.57142857	91.89189189	52.38095238	42.85714286	84.7826087	-77.9714436	-84.2898875
Epochs 160	0.725118458	0	6.666666667	90.47619048	42.85714286	60	82.03592814	-56.6335528	-54.68960087	0.835680723	15.78947368	33.33333333	92.0212766	52.63157895	50	84.49197861	-77.9714436	-84.2898875
Epochs 180	0.800947845	0	12.5	91.30434783	47.36842105	75	82.5136612	-52.20210434	-54.68960087	0.85446012	20	33.33333333	92.1875	53.33333333	50	84.29319372	-33.5503334	-84.2898875
Epochs 200	0.815165877	0	8.333333333	91.44385027	33.33333333	66.66666667	83.33333333	-57.40395225	-54.68960087	0.873239458	27.27272727	33.33333333	92.34693878	54.54545455	50	84.1025641	39.17596309	-84.2898875
JP Morgan Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit

Epochs 20	0.339449555	10.22727273	5.970149254	96.82539683	47.72727273	39.39393939	87.3015873	2263.149661	1576.179166	0.333333343	7.766990291	11.76470588	90.76923077	47.05882353	62.74509804	81.53846154	54.24334087	-31.90034799
Epochs 40	0.38532111	10.95890411	4.47761194	93.58974359	46.57534247	43.93939394	84.61538462	2175.388115	1576.179166	0.438356161	8.860759494	10.41666667	91.30434783	52.56410256	52.08333333	82.60869565	-13.2759445	-31.90034799
Epochs 60	0.495412856	12.6984127	3.921568627	94.23076923	47.61904762	42	84.61538462	1915.926539	1576.179166	0.502283096	7.142857143	8.163265306	89.47368421	48.21428571	50	80.70175439	41.13144049	-31.90034799
Epochs 80	0.62844038	13.46153846	6.451612903	94.81481481	50	45.16129032	85.82089552	3451.268959	1576.179166	0.602739751	9.756097561	9.756097561	90.51094891	43.90243902	52.5	82.48175182	2.227883196	-31.90034799
Epochs 100	0.715596318	12.19512195	10.52631579	94.30379747	46.34146341	52.63157895	85.35031847	3183.17125	1576.179166	0.726027369	8.333333333	9.090909091	89.59537572	45.83333333	57.14285714	82.08092486	101.184931	-31.90034799
Epochs 120	0.729357779	15.38461538	10	94.96855346	51.28205128	50	86.07594937	11715.14135	1576.179166	0.767123282	9.090909091	13.33333333	90.10989011	45.45454545	57.14285714	82.41758242	156.9002968	-31.90034799
Epochs 140	0.747706413	13.15789474	7.692307692	94.01197605	44.73684211	46.15384615	86.74698795	892.1900366	1576.179166	0.808219194	11.11111111	20	90.57591623	44.44444444	66.66666667	82.72251309	203.4259075	-31.90034799
Epochs 160	0.825688064	18.18181818	10	94.08602151	54.54545455	60	87.02702703	592.3120499	1576.179166	0.821917832	11.11111111	20	90.30612245	50	50	82.14285714	32.88933211	-31.90034799
Epochs 180	0.839449525	25	10	94.14893617	55	70	86.63101604	675.6183914	1576.179166	0.812785387	12.5	11.11111111	90.20618557	43.75	50	82.4742268	32.88933211	-31.90034799
Epochs 200	0.844036698	15	16.66666667	93.75	50	66.66666667	86.38743455	440.7967105	1576.179166	0.840182662	16.66666667	14.28571429	90.5	33.33333333	66.66666667	83	16.46494984	-31.90034799
American Axle (small cap) Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.339449555	4.395604396	3.773584906	91.89189189	45.05494505	54.71698113	86.30136986	-90.95922472	-40.19620025	0.337899536	9.090909091	3.333333333	91.17647059	50.83333333	46.66666667	86.76470588	43.8123627	-32.50977019
Epochs 40	0.380733937	3.333333333	5.194805195	95.0617284	40	45.45454545	85	-91.40770043	-40.19620025	0.452054799	14.51612903	4.6875	93.5483871	63.93442623	53.125	88.17204301	39.53260113	-32.50977019
Epochs 60	0.380733937	1.724137931	5.263157895	92.85714286	37.93103448	46.66666667	80.95238095	-93.04853119	-40.19620025	0.470319629	12.6984127	3.636363636	92.07920792	59.67741935	58.18181818	87.12871287	-58.5661717	-32.50977019
Epochs 80	0.472477078	2.325581395	4.47761194	91.66666667	37.20930233	46.96969697	82.40740741	-87.71354349	-40.19620025	0.543379009	14.58333333	4	90.90909091	64.58333333	60	86.66666667	190.3672644	-32.50977019
Epochs 100	0.587155938	2.702702703	8.163265306	93.18181818	29.72972973	46.93877551	83.20610687	-97.44270888	-40.19620025	0.584474862	9.523809524	2.631578947	88.48920863	64.28571429	57.89473684	84.05797101	0.85126465	-32.50977019
Epochs 120	0.582568824	2.325581395	9.090909091	93.12977099	37.20930233	45.45454545	83.84615385	-85.87833882	-40.19620025	0.607305944	10.81081081	5	89.43661972	54.05405405	57.5	83.68794326	-37.6641276	-32.50977019
Epochs 140	0.614678919	2.631578947	7.5	92.85714286	39.47368421	42.5	84.17266187	-85.69800251	-40.19620025	0.712328792	16.66666667	6.666666667	90.90909091	50	60	85.97560976	-23.864066	-32.50977019
Epochs 160	0.646789014	3.03030303	7.894736842	93.19727891	39.39393939	44.73684211	84.24657534	-57.64592593	-40.19620025	0.703196347	0	3.333333333	88.95348837	41.17647059	50	84.21052632	-54.761297	-32.50977019
Epochs 180	0.674311936	0	7.142857143	92.90322581	33.33333333	45.23809524	84.41558442	-57.01910914	-40.19620025	0.726027369	0	3.448275862	88.76404494	50	55.17241379	84.18079096	-21.1566815	-32.50977019
Epochs 200	0.69266057	3.846153846	8.571428571	93.63057325	34.61538462	42.85714286	85.25641026	-72.45946854	-40.19620025	0.744292259	0	4.166666667	89.01098901	46.15384615	58.33333333	83.97790055	-15.3407983	-32.50977019

Table 12-5 Results of Experiment for LSTM Models Trained Using Cyclic Stock Data, Using 20 Trading Days Lookback Period

Kweichow Moutai Co., Ltd. Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.357487917	9.333333333	7.8125	91.17647059	47.2972973	40.625	89.70588235	265.5263802	1666.892281	0.432692319	4.651162791	6.666666667	91.30434783	40.69767442	56.66666667	86.81318681	844.3531424	678.7940879
Epochs 40	0.420289844	7.5	8.641975309	89.53488372	52.5	47.5	83.72093023	-7.575572571	1666.892281	0.490384609	10.25641026	6.153846154	90.38461538	43.58974359	47.69230769	84.46601942	90.26371864	678.7940879
Epochs 60	0.512077272	9.090909091	10.29411765	90.56603774	54.54545455	49.25373134	84.90566038	122.4877005	1666.892281	0.567307711	8.823529412	7.692307692	90.98360656	47.05882353	54.90196078	84.42622951	289.1498537	678.7940879
Epochs 80	0.613526583	13.04347826	10.90909091	91.47286822	43.47826087	53.7037037	86.82170543	-15.22526262	1666.892281	0.668269217	4.347826087	12.19512195	92.36111111	47.82608696	58.53658537	84.61538462	360.1762846	678.7940879

Epochs 100	0.671497583	11.76470588	9.523809524	89.86486486	41.17647059	58.53658537	85.81081081	26.27141667	1666.892281	0.807692289	0	22.72727273	93.14285714	45.45454545	59.09090909	86.7816092	506.254706	678.7940879
Epochs 120	0.739130437	20	10	90.74074074	46.66666667	65.51724138	87.03703704	301.3795342	1666.892281	0.807692289	0	16.66666667	91.66666667	40	61.11111111	85.47486034	506.254706	678.7940879
Epochs 140	0.768115938	16.66666667	7.407407407	89.65517241	66.66666667	61.53846154	86.20689655	221.1855364	1666.892281	0.831730783	0	14.28571429	91.93548387	37.5	50	85.94594595	243.7076413	678.7940879
Epochs 160	0.758454084	22.22222222	10	90.47619048	55.55555556	68.96551724	86.9047619	290.3268025	1666.892281	0.822115362	8.333333333	15.38461538	91.80327869	50	38.46153846	85.71428571	561.7231938	678.7940879
Epochs 180	0.826086938	33.33333333	11.11111111	90.32258065	66.66666667	55.55555556	86.48648649	222.19595	1666.892281	0.855769217	0	11.11111111	91.2371134	40	33.33333333	85.49222798	310.2200729	678.7940879
Epochs 200	0.826086938	20	13.33333333	89.83957219	40	66.66666667	86.02150538	263.7144274	1666.892281	0.860576928	0	12.5	91.28205128	40	37.5	85.56701031	283.7570984	678.7940879
Midea Group Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.053140096	5.314009662	0	0	45.63106796	0	0	1245.275482	1245.275482	0.033653848	3.365384615	0	0	42.02898551	0	0	468.5733088	468.5733088
Epochs 40	0.086956523	5.384615385	7.042253521	100	46.92307692	42.85714286	100	-1.806738746	1245.275482	0.120192304	5.46875	4.615384615	100	45.66929134	50.76923077	73.33333333	124.5945417	468.5733088
Epochs 60	0.342995167	7.894736842	8.823529412	93.65079365	51.31578947	47.05882353	82.25806452	217.5174934	1245.275482	0.384615391	7.575757576	3.125	93.58974359	43.93939394	55.55555556	85.8974359	245.8480726	468.5733088
Epochs 80	0.473429948	6.944444444	10.81081081	90.81632653	55.55555556	45.94594595	80.41237113	1249.884632	1245.275482	0.586538434	4.444444444	2.857142857	92.96875	44.44444444	67.64705882	86.71875	1347.728463	468.5733088
Epochs 100	0.66183573	10.52631579	16.66666667	92.08633094	55.26315789	53.33333333	81.15942029	548.7819752	1245.275482	0.629807711	0	2.777777778	90.90909091	55.17241379	63.88888889	83.8028169	198.8854437	468.5733088
Epochs 120	0.666666687	3.225806452	14.28571429	89.86486486	58.06451613	53.57142857	79.59183673	908.009625	1245.275482	0.682692289	0	2.857142857	91.55844156	57.89473684	54.28571429	84.31372549	122.960142	468.5733088
Epochs 140	0.705313981	3.448275862	16.66666667	91.55844156	55.17241379	54.16666667	80.39215686	621.1410755	1245.275482	0.716346145	0	3.703703704	91.92546584	60	51.85185185	84.375	-49.6604352	468.5733088
Epochs 160	0.729468584	3.703703704	15.78947368	91.30434783	55.55555556	52.63157895	80	684.1170815	1245.275482	0.6875	0	3.125	91.61290323	61.9047619	56.25	84.41558442	-28.722869	468.5733088
Epochs 180	0.768115938	4.761904762	17.64705882	91.71597633	52.38095238	58.82352941	80.35714286	632.9636405	1245.275482	0.711538434	0	0	91.35802469	55.55555556	47.36842105	83.22981366	54.93627089	468.5733088
Epochs 200	0.782608688	5.882352941	17.64705882	91.32947977	58.82352941	52.94117647	80.23255814	757.4330716	1245.275482	0.735576928	0	0	91.61676647	57.89473684	54.54545455	83.73493976	59.5317084	468.5733088
Walmart Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.444954127	3.846153846	4.615384615	91.08910891	51.92307692	46.875	83.16831683	45.75227106	9380.979094	0.484018266	6.944444444	9.302325581	93.26923077	55.55555556	55.81395349	84.46601942	658.5506171	255.7316817
Epochs 40	0.518348634	5.714285714	5.970149254	92.24137931	54.28571429	52.23880597	86.95652174	88.07931279	9380.979094	0.506849289	6.451612903	14	93.45794393	59.01639344	58	85.98130841	226.8255688	255.7316817
Epochs 60	0.536697268	5.555555556	7.8125	93.22033898	52.77777778	53.125	87.17948718	330.8686766	9380.979094	0.525114179	6.896551724	10.86956522	92.17391304	59.64912281	50	85.2173913	611.2208008	255.7316817
Epochs 80	0.605504572	3.703703704	9.090909091	92.64705882	55.55555556	52.72727273	86.66666667	-14.82738577	9380.979094	0.607305944	6.666666667	12.82051282	92.59259259	61.36363636	51.28205128	85.92592593	345.2605036	255.7316817
Epochs 100	0.660550475	8.333333333	8.695652174	93.24324324	58.33333333	58.69565217	86.39455782	133.7962885	9380.979094	0.698630154	8.108108108	18.51851852	93.5483871	58.33333333	48.14814815	87.09677419	315.7051225	255.7316817
Epochs 120	0.683486223	8.333333333	9.756097561	93.46405229	54.16666667	60.97560976	85.52631579	96.83132446	9380.979094	0.730593622	9.375	14.28571429	92.77108434	58.06451613	38.0952381	86.14457831	201.2436202	255.7316817
Epochs 140	0.715596318	5	8.823529412	92.68292683	55	61.76470588	85.27607362	3.515162833	9380.979094	0.757990897	9.677419355	14.28571429	92.52873563	53.33333333	42.85714286	86.20689655	351.3226889	255.7316817
Epochs 160	0.74311924	6.25	9.375	92.94117647	56.25	59.375	85.20710059	-9.776823628	9380.979094	0.780821919	10.71428571	16.66666667	92.73743017	59.25925926	33.33333333	86.59217877	347.8796496	255.7316817
Epochs 180	0.747706413	5.555555556	10.34482759	92.98245614	50	62.06896552	85.88235294	67.05027358	9380.979094	0.794520557	12	0	91.93548387	58.33333333	37.5	86.55913978	226.422391	255.7316817
Epochs 200	0.752293587	0	9.090909091	92.52873563	63.63636364	63.63636364	84.97109827	129.4681499	9380.979094	0.794520557	13.04347826	0	91.93548387	54.54545455	40	86.55913978	355.4449727	255.7316817

Fresh Del Monte Produce Inc (small cap) Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.440366983	8.928571429	11.11111111	92.22222222	53.57142857	50.70422535	80	1375.511731	5.320148705	0.538812757	4.166666667	6.818181818	88.97637795	56.25	52.27272727	79.36507937	436.4354533	-65.97131265
Epochs 40	0.463302761	8	4.918032787	87.85046729	52	49.18032787	79.24528302	921.395046	5.320148705	0.520547926	4.255319149	9.259259259	90.6779661	51.06382979	48.14814815	82.05128205	-28.4281477	-65.97131265
Epochs 60	0.550458729	8.695652174	2.325581395	89.14728682	45.65217391	50	81.39534884	168.7784414	5.320148705	0.570776284	2.083333333	12.5	90.83969466	52.08333333	50	83.07692308	-68.4648322	-65.97131265
Epochs 80	0.596330285	6.976744186	3.03030303	88.73239437	46.51162791	45.45454545	82.26950355	-30.80266179	5.320148705	0.589041114	5.769230769	9.677419355	90.44117647	55.76923077	48.38709677	83.7037037	90.54764023	-65.97131265
Epochs 100	0.623853207	6.976744186	3.703703704	89.18918919	46.51162791	44.44444444	82.99319728	114.3217565	5.320148705	0.621004581	6	11.53846154	90.90909091	52	46.15384615	84.50704225	15.05189976	-65.97131265
Epochs 120	0.660550475	8.571428571	0	89.24050633	42.85714286	40	82.80254777	-18.54921196	5.320148705	0.680365324	8.108108108	11.53846154	91.66666667	54.05405405	42.30769231	85.80645161	124.638052	-65.97131265
Epochs 140	0.715596318	3.846153846	0	89.08045977	42.30769231	44.44444444	83.23699422	-20.33294916	5.320148705	0.721461177	6.25	11.11111111	91.12426036	53.125	38.88888889	84.52380952	14.84407718	-65.97131265
Epochs 160	0.729357779	4	0	89.26553672	52	43.75	83.52272727	-31.73946477	5.320148705	0.735159814	6.666666667	6.666666667	90.8045977	53.33333333	26.66666667	84.97109827	-24.8625211	-65.97131265
Epochs 180	0.75688076	5	0	89.61748634	50	46.66666667	83.51648352	-19.49389012	5.320148705	0.757990897	7.407407407	7.692307692	91.06145251	55.55555556	30.76923077	84.83146067	-33.0365205	-65.97131265
Epochs 200	0.75688076	5.882352941	0	89.61748634	52.94117647	44.44444444	82.96703297	-45.26165306	5.320148705	0.767123282	8.333333333	7.142857143	91.16022099	54.16666667	28.57142857	85	57.76594064	-65.97131265

Table 12-6 Results of Experiment for LSTM Models Trained Using Non-Cyclic Stock Data, Using 20 Trading Days Lookback Period

Singapore Airlines Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.30733946	6.481481481	8.163265306	91.80327869	54.62962963	57.14285714	76.66666667	-58.20851596	-64.15459983	0.297674417	5.607476636	8.510638298	88.52459016	45.79439252	57.44680851	85	-44.16635827	-78.23835547
Epochs 40	0.353211015	7.692307692	7.407407407	90.4109589	52.74725275	51.85185185	80.55555556	-14.98621678	-64.15459983	0.362790704	7.142857143	7.01754386	91.89189189	46.42857143	50	85.13513514	-87.06337667	-78.23835547
Epochs 60	0.449541271	8.695652174	5.882352941	90.81632653	50.72463768	50.98039216	81.44329897	-65.71620085	-64.15459983	0.441860467	7.894736842	6.666666667	91.4893617	51.31578947	47.72727273	82.9787234	-86.08745637	-78.23835547
Epochs 80	0.490825683	9.677419355	6.12244898	91.58878505	58.06451613	51.02040816	80.18867925	-56.1185895	-64.15459983	0.437209308	7.894736842	6.52173913	91.39784946	50	51.11111111	83.87096774	-72.05312075	-78.23835547
Epochs 100	0.504587173	8.620689655	6.25	91.07142857	56.89655172	52.08333333	80.18018018	-48.18003046	-64.15459983	0.437209308	5.970149254	5.882352941	89.69072165	47.76119403	46	83.50515464	72.4122014	-78.23835547
Epochs 120	0.536697268	8.771929825	9.090909091	92.30769231	57.89473684	56.81818182	80.17241379	-49.48606768	-64.15459983	0.520930231	3.389830508	5.555555556	90	47.45762712	54.28571429	85	-91.19793294	-78.23835547
Epochs 140	0.591743112	9.259259259	9.090909091	92.36641221	57.40740741	54.54545455	80.76923077	-49.31664785	-64.15459983	0.595348835	5.263157895	8.695652174	91.11111111	49.12280702	68.18181818	85.18518519	-71.07536609	-78.23835547
Epochs 160	0.660550475	10.25641026	12.12121212	93.15068493	64.1025641	63.63636364	82.75862069	47.01989004	-64.15459983	0.632558167	5.882352941	9.523809524	91.60839161	47.05882353	70	85.31468531	-92.48941619	-78.23835547
Epochs 180	0.678899109	11.11111111	7.142857143	92.20779221	63.88888889	64.28571429	81.69934641	-24.91399431	-64.15459983	0.655813932	6.25	10.52631579	91.89189189	43.75	77.77777778	85.81081081	-94.41025352	-78.23835547
Epochs 200	0.701834857	12.12121212	7.692307692	92.45283019	66.66666667	65.38461538	81.01265823	-31.14313982	-64.15459983	0.665116251	4.255319149	12.5	91.44736842	42.55319149	75	84.10596026	-93.70275061	-78.23835547
OCBC Bank Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.348623842	9.210526316	4.347826087	90.4109589	53.94736842	47.05882353	80.82191781	-49.5230962	-55.90202866	0.483720928	9.259259259	5.769230769	88.0733945	61.11111111	47.05882353	84.40366972	-14.3955243	-24.56291964

Epochs 40	0.376146793	6.593406593	6.382978723	91.25	51.64835165	54.34782609	85	-70.26351433	-55.90202866	0.516279042	7.462686567	9.090909091	89.56521739	62.68656716	54.54545455	85.96491228	-28.53584243	-24.56291964
Epochs 60	0.541284382	9.433962264	8.333333333	93.16239316	58.49056604	57.44680851	88.88888889	-3.304666995	-55.90202866	0.600000024	6	8	88.57142857	58	56	83.45323741	-49.15650343	-24.56291964
Epochs 80	0.619266033	10	9.523809524	93.38235294	60	65.85365854	87.5	173.6495642	-55.90202866	0.627906978	4.166666667	10.52631579	88.51351351	62.5	47.36842105	84.3537415	10.75225486	-24.56291964
Epochs 100	0.683486223	11.11111111	5.714285714	92.30769231	55.55555556	60	87.09677419	172.3923758	-55.90202866	0.679069757	3.333333333	4.545454545	88.34355828	56.66666667	36.36363636	84.56790123	400.6899853	-24.56291964
Epochs 120	0.688073397	9.375	3.703703704	91.82389937	56.25	62.96296296	84.81012658	498.0088307	-55.90202866	0.688372076	3.571428571	4.545454545	88.48484848	67.85714286	40.90909091	84.14634146	520.059855	-24.56291964
Epochs 140	0.665137589	9.677419355	5.555555556	92.71523179	54.83870968	58.33333333	86.66666667	123.9871434	-55.90202866	0.688372076	6.666666667	4.545454545	88.95705521	63.33333333	40.90909091	85.18518519	262.4606401	-24.56291964
Epochs 160	0.706422031	12	6.25	92.54658385	60	62.5	86.25	158.675401	-55.90202866	0.706976771	6.666666667	5.263157895	89.75903614	63.33333333	36.84210526	86.06060606	-12.89509856	-24.56291964
Epochs 180	0.724770665	12	10	93.25153374	56	60	87.03703704	270.262367	-55.90202866	0.706976771	6.451612903	5.555555556	89.75903614	61.29032258	33.33333333	86.06060606	-26.84911891	-24.56291964
Epochs 200	0.733944952	12.5	7.407407407	92.81437126	62.5	59.25925926	86.74698795	270.262367	-55.90202866	0.725581408	6.896551724	6.25	90	65.51724138	37.5	86.39053254	-26.84911891	-24.56291964
CNOOC Limited Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.265402853	4.516129032	0	92.45283019	42.20779221	66.66666667	88.67924528	-43.30734729	-54.68960087	0.258215964	3.973509934	16.66666667	85.71428571	40	50	76.78571429	-51.31091968	-84.2898875
Epochs 40	0.355450243	7.407407407	6.779661017	91.54929577	53.08641975	58.62068966	83.09859155	3.629569093	-54.68960087	0.347417831	5	5.405405405	88.15789474	40	41.66666667	75	-87.10609636	-84.2898875
Epochs 60	0.412322283	6.172839506	10.63829787	92.77108434	55.55555556	57.44680851	84.14634146	-10.91774644	-54.68960087	0.408450693	5.747126437	8.108108108	88.76404494	41.37931034	47.22222222	77.52808989	-57.65637448	-84.2898875
Epochs 80	0.497630328	6.060606061	11.9047619	93.2038835	50	54.76190476	81.37254902	-32.5994799	-54.68960087	0.558685422	7.462686567	12.5	90.98360656	40.29850746	45.83333333	81.81818182	-66.47247512	-84.2898875
Epochs 100	0.540284336	6.896551724	12.19512195	93.75	50	56.09756098	82.88288288	-91.16720226	-54.68960087	0.600938976	6.896551724	17.39130435	90.90909091	46.55172414	47.82608696	82.44274809	-64.61898218	-84.2898875
Epochs 120	0.587677717	6.25	12.82051282	93.5483871	54.16666667	58.97435897	83.7398374	-91.39284589	-54.68960087	0.638497651	6	19.04761905	90.84507042	42	57.14285714	81.56028369	-30.66659827	-84.2898875
Epochs 140	0.654028416	5.882352941	9.090909091	92.36111111	50	63.63636364	83.21678322	-91.93022527	-54.68960087	0.685446024	7.142857143	13.33333333	90.38461538	40.47619048	46.66666667	81.93548387	-73.69413344	-84.2898875
Epochs 160	0.663507104	3.225806452	6.666666667	91.33333333	51.61290323	60	82.55033557	-89.55389759	-54.68960087	0.708920181	8.333333333	12.5	90.68322981	38.88888889	43.75	81.875	-76.26326046	-84.2898875
Epochs 180	0.71563983	4	8.333333333	91.35802469	52	58.33333333	81.98757764	-78.69109077	-54.68960087	0.723004699	9.375	6.666666667	90.36144578	37.5	40	80.60606061	-73.56162641	-84.2898875
Epochs 200	0.744075835	0	10	91.17647059	42.85714286	60	81.65680473	-80.23719363	-54.68960087	0.737089217	10.34482759	6.666666667	90.53254438	41.37931034	40	80.95238095	-53.00111922	-84.2898875
JP Morgan Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.422018349	7.547169811	4.285714286	89.47368421	47.16981132	46.37681159	82.10526316	1810.196438	1576.179166	0.429223746	10.81081081	12.90322581	93.97590361	52.05479452	51.61290323	84.3373494	121.2889392	-31.90034799
Epochs 40	0.399082571	11.47540984	4.054054054	92.77108434	55.73770492	48.64864865	81.70731707	4147.797301	1576.179166	0.415525109	11.26760563	11.5942029	94.93670886	52.85714286	52.17391304	82.27848101	15.92880025	-31.90034799
Epochs 60	0.486238539	12.5	5	94.11764706	53.57142857	50	87.12871287	4956.4966	1576.179166	0.465753436	10.9375	12.6984127	94.56521739	55.55555556	53.96825397	83.69565217	-12.37586364	-31.90034799
Epochs 80	0.5	12	4.918032787	93.45794393	54	47.54098361	86.79245283	4074.455909	1576.179166	0.511415541	11.66666667	12.96296296	93.33333333	57.62711864	55.55555556	83.80952381	142.8619691	-31.90034799
Epochs 100	0.527522922	13.04347826	5.172413793	92.98245614	58.69565217	46.55172414	87.61061947	6587.916239	1576.179166	0.593607306	12.5	15.2173913	93.6	53.19148936	58.69565217	85.6	-31.25732857	-31.90034799
Epochs 120	0.573394477	14.28571429	6.25	95.04132231	55.10204082	45.83333333	89.16666667	4131.557072	1576.179166	0.616438329	8.695652174	18.42105263	91.85185185	55.55555556	60.52631579	83.7037037	87.04699753	-31.90034799

Epochs 140	0.591743112	15	4.166666667	93.07692308	55	43.75	87.59689922	1920.43689	1576.179166	0.662100434	11.76470588	15.78947368	91.83673469	57.57575758	63.15789474	83.67346939	73.20384933	-31.90034799
Epochs 160	0.678899109	8	2.941176471	91.19496855	60	52.94117647	84.81012658	3591.718686	1576.179166	0.721461177	11.53846154	8.695652174	90	64	56.52173913	82.94117647	-64.85624226	-31.90034799
Epochs 180	0.715596318	11.11111111	3.03030303	91.61676647	66.66666667	51.51515152	85.54216867	2910.459506	1576.179166	0.780821919	15.78947368	11.76470588	90.71038251	57.89473684	58.82352941	83.51648352	-68.36441829	-31.90034799
Epochs 200	0.75688076	15.38461538	3.448275862	92.04545455	61.53846154	55.17241379	85.71428571	4750.542257	1576.179166	0.803652942	17.64705882	14.28571429	90.95744681	64.70588235	57.14285714	83.42245989	-68.36441829	-31.90034799
American Axle (small cap) Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.266055048	4.761904762	4.87804878	96.15384615	41.66666667	50	82.35294118	-67.13280801	-40.19620025	0.283105016	10.22727273	5.333333333	87.5	49.42528736	52	82.14285714	151.1671831	-32.50977019
Epochs 40	0.408256888	7.692307692	3.03030303	94.25287356	41.53846154	49.23076923	86.20689655	-74.73852571	-40.19620025	0.388127863	11.5942029	6.944444444	92.30769231	54.41176471	58.33333333	85.8974359	1433.667985	-32.50977019
Epochs 60	0.431192666	7.8125	1.694915254	92.63157895	39.0625	46.55172414	84.21052632	-77.86313418	-40.19620025	0.456620991	9.803921569	8.450704225	91.75257732	56	54.92957746	86.59793814	523.554719	-32.50977019
Epochs 80	0.513761461	8.333333333	2.325581395	92.17391304	40	45.23809524	83.47826087	-92.58162919	-40.19620025	0.515981734	8.695652174	10	91.15044248	55.55555556	56.66666667	86.72566372	660.8573952	-32.50977019
Epochs 100	0.614678919	7.317073171	2.777777778	92.19858156	43.90243902	48.57142857	84.39716312	-82.0239918	-40.19620025	0.579908669	11.42857143	9.259259259	90.76923077	67.64705882	59.25925926	86.15384615	-65.57871676	-32.50977019
Epochs 120	0.683486223	8.571428571	3.703703704	92.94871795	37.14285714	44.44444444	85.16129032	-94.81861859	-40.19620025	0.652968049	11.11111111	11.36363636	91.21621622	70.37037037	59.09090909	86.39455782	-40.56548341	-32.50977019
Epochs 140	0.720183492	7.142857143	4.347826087	92.21556886	39.28571429	43.47826087	84.3373494	-50.91549638	-40.19620025	0.698630154	12.5	9.375	90.18404908	70.83333333	53.125	84.56790123	-54.53414449	-32.50977019
Epochs 160	0.733944952	6.896551724	5.263157895	92.35294118	44.82758621	52.63157895	84.61538462	-52.13046252	-40.19620025	0.716894984	15.78947368	9.090909091	90.41916168	73.68421053	54.54545455	85.54216867	-67.78482525	-32.50977019
Epochs 180	0.798165143	11.11111111	0	92.47311828	55.55555556	57.14285714	85.40540541	-57.6948689	-40.19620025	0.776255727	25	11.11111111	91.11111111	66.66666667	55.55555556	85.47486034	956.0547229	-32.50977019
Epochs 200	0.816513777	18.18181818	5.263157895	93.08510638	63.63636364	57.89473684	86.09625668	9.811979601	-40.19620025	0.785388112	20	10.71428571	90.32258065	60	57.14285714	84.86486486	886.5548215	-32.50977019

Table 12-7 Results of Experiment for LSTM Models Trained Using Cyclic Stock Data, Using 25 Trading Days Lookback Period

Kweichow Moutai Co., Ltd. Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.328502417	7.246376812	7.142857143	85.29411765	46.37681159	43.47826087	82.35294118	380.3204113	1666.892281	0.341346145	6.25	4.109589041	90.14084507	39.0625	41.09589041	80	183.2734245	678.7940879
Epochs 40	0.449275374	12.24489796	11.26760563	90.8045977	55.10204082	50	85.05747126	239.3448733	1666.892281	0.408653855	4	7.142857143	90.58823529	56	49.48453608	84.70588235	104.850582	678.7940879
Epochs 60	0.541062772	10.63829787	10.63829787	90.26548673	46.80851064	52.17391304	85.84070796	246.1128149	1666.892281	0.432692319	7.692307692	5.494505495	91.20879121	57.69230769	50	85.71428571	209.2710172	678.7940879
Epochs 80	0.545893729	8.695652174	11.11111111	89.65517241	43.47826087	50	85.34482759	191.4292475	1666.892281	0.5	6.666666667	6.849315068	92.38095238	53.33333333	52.05479452	86.53846154	374.5816848	678.7940879
Epochs 100	0.63285023	10.25641026	12.90322581	89.7810219	43.58974359	63.33333333	86.13138686	463.5217578	1666.892281	0.596153855	6.451612903	6.25	92.24806202	51.61290323	54.16666667	86.71875	428.0086969	678.7940879
Epochs 120	0.69082123	11.11111111	11.11111111	89.54248366	52.77777778	52.94117647	84.96732026	304.4613064	1666.892281	0.673076928	4	3.125	91.39072848	52	46.875	85.33333333	432.2791732	678.7940879
Epochs 140	0.729468584	14.81481481	5.882352941	89.57055215	55.55555556	43.75	85.27607362	142.2439016	1666.892281	0.716346145	4	8.333333333	91.82389937	48	50	85.44303797	592.3506959	678.7940879
Epochs 160	0.743961334	12	7.142857143	89.28571429	52	53.84615385	85.11904762	1486.021415	1666.892281	0.745192289	0	5.263157895	91.66666667	38.0952381	42.10526316	85.02994012	588.4041876	678.7940879
Epochs 180	0.768115938	15	7.142857143	89.59537572	55	61.53846154	85.54913295	1526.122027	1666.892281	0.764423072	0	5.882352941	90.28571429	43.75	52.94117647	83.90804598	1108.54789	678.7940879

Epochs 200	0.792270541	16.66666667	9.090909091	89.88764045	61.11111111	50	85.95505618	1424.547772	1666.892281	0.788461566	0	10	92.04545455	50	50	85.71428571	208.7056341	678.7940879
Midea Group Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.053140096	5.314009662	0	0	45.63106796	0	0	1245.275482	1245.275482	0.033653848	3.365384615	0	0	42.02898551	0	0	468.5733088	468.5733088
Epochs 40	0.483091801	4.395604396	7.692307692	92.23300971	41.75824176	38.46153846	84.31372549	2940.759848	1245.275482	0.418269217	2	0	90.42553191	39.39393939	35.71428571	84.04255319	347.4698663	468.5733088
Epochs 60	0.594202876	5	8.620689655	90.69767442	45	44.82758621	82.03125	-1.001315643	1245.275482	0.615384638	8.695652174	2.040816327	91.91176471	52.17391304	45.83333333	85.29411765	-19.97326435	468.5733088
Epochs 80	0.613526583	8.163265306	15.38461538	90.15151515	46.93877551	46.15384615	79.38931298	2169.380508	1245.275482	0.620192289	8.333333333	0	93.33333333	52.77777778	52.77777778	87.40740741	252.0826427	468.5733088
Epochs 100	0.734299541	9.677419355	20	90.68322981	48.38709677	46.66666667	81.25	4511.891686	1245.275482	0.6875	3.846153846	0	92.20779221	53.84615385	53.57142857	84.96732026	-15.13767682	468.5733088
Epochs 120	0.768115938	4.545454545	18.18181818	89.65517241	40.90909091	54.54545455	81.50289017	634.9822012	1245.275482	0.706730783	5	0	92.40506329	50	60	85.98726115	-81.23691511	468.5733088
Epochs 140	0.806763291	0	11.11111111	89.24731183	41.66666667	44.44444444	81.62162162	508.2207622	1245.275482	0.745192289	5.555555556	0	92.77108434	55.55555556	54.16666667	86.06060606	-68.11958422	468.5733088
Epochs 160	0.845410645	0	14.28571429	89.69072165	33.33333333	42.85714286	81.34715026	-25.73058476	1245.275482	0.745192289	6.25	0	93.33333333	56.25	51.85185185	85.97560976	-79.02970612	468.5733088
Epochs 180	0.859903395	0	0	89.44723618	40	33.33333333	80.3030303	46.86192249	1245.275482	0.745192289	0	0	92.81437126	47.05882353	50	84.93975904	-77.14600295	468.5733088
Epochs 200	0.874396145	0	0	89.6039604	50	33.33333333	80.09950249	-12.89965322	1245.275482	0.754807711	0	0	92.35294118	47.05882353	52.38095238	84.61538462	-55.08274326	468.5733088
Walmart Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.302752286	4.87804878	6.756756757	91.93548387	46.91358025	47.2972973	88.70967742	1246.421315	9380.979094	0.351598173	5.940594059	12.24489796	94.20289855	52	48.97959184	88.4057971	960.93865	255.7316817
Epochs 40	0.380733937	4.081632653	6.896551724	91.46341463	46.93877551	43.02325581	87.80487805	1.49896229	9380.979094	0.474885851	7.936507937	12.06896552	93.87755102	58.06451613	50	87.75510204	759.4416091	255.7316817
Epochs 60	0.513761461	3.125	5.714285714	92.24137931	51.61290323	44.28571429	87.93103448	-40.68949862	9380.979094	0.589041114	8	14.28571429	93.7007874	57.14285714	45.23809524	87.4015748	128.3555562	255.7316817
Epochs 80	0.62844038	4.166666667	4.081632653	92.4137931	52.17391304	40.81632653	87.5862069	-47.39682308	9380.979094	0.675799072	6.451612903	9.375	91.66666667	56.66666667	40.625	85.8974359	121.6660746	255.7316817
Epochs 100	0.660550475	6.25	4.081632653	92.15686275	75	45.83333333	86.2745098	-4.196229105	9380.979094	0.675799072	4.166666667	8.108108108	91.13924051	60.86956522	35.13513514	86.07594937	162.8341803	255.7316817
Epochs 120	0.733944952	7.692307692	3.03030303	91.86046512	66.66666667	54.54545455	84.88372093	85.88808158	9380.979094	0.726027369	5.555555556	9.375	91.71597633	58.82352941	46.875	86.39053254	154.2069911	255.7316817
Epochs 140	0.747706413	8.333333333	3.225806452	92	58.33333333	50	84.57142857	85.88808158	9380.979094	0.739726007	8.333333333	8.571428571	91.86046512	58.33333333	40	85.96491228	498.3412826	255.7316817
Epochs 160	0.770642221	10	3.571428571	92.22222222	60	44.44444444	85	123.3092608	9380.979094	0.762557089	14.28571429	10.81081081	92.57142857	71.42857143	40.54054054	86.7816092	584.3162662	255.7316817
Epochs 180	0.761467874	10	3.333333333	92.13483146	70	48.27586207	84.83146067	131.1677914	9380.979094	0.762557089	14.28571429	10.81081081	92.57142857	71.42857143	40.54054054	86.7816092	584.3162662	255.7316817
Epochs 200	0.779816508	10	3.846153846	92.30769231	70	52	84.61538462	131.1677914	9380.979094	0.771689475	0	11.42857143	92.17877095	60	40	86.51685393	128.6651119	255.7316817
Fresh Del Monte Produce Inc (small cap) Model	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.5	13.1147541	10.71428571	94.05940594	52.45901639	48.21428571	87	501.8994708	5.320148705	0.543379009	2.739726027	0	88.63636364	47.22222222	50	80.3030303	-43.35831942	-65.97131265
Epochs 40	0.513761461	13.46153846	8.474576271	93.45794393	48.07692308	50.84745763	86.79245283	40.81904982	5.320148705	0.529680371	5.357142857	9.523809524	90.08264463	53.57142857	47.61904762	79.16666667	-21.91331644	-65.97131265

Epochs 60	0.545871556	10.25641026	6.896551724	91.73553719	48.71794872	50	85	-11.03155392	5.320148705	0.616438329	11.11111111	6.976744186	91.42857143	58.33333333	48.8372093	82.01438849	-17.51420348	-65.97131265
Epochs 80	0.605504572	7.407407407	7.407407407	91.97080292	40.74074074	55.55555556	84.55882353	-78.87381496	5.320148705	0.634703219	9.375	5	91.15646259	59.375	50	82.19178082	44.22664409	-65.97131265
Epochs 100	0.655963302	7.692307692	2.777777778	89.74358974	42.30769231	61.11111111	83.87096774	93.53180476	5.320148705	0.739726007	7.407407407	10.52631579	91.32947977	59.25925926	52.63157895	82.55813953	127.5723958	-65.97131265
Epochs 120	0.75688076	5.882352941	4.761904762	90.55555556	47.05882353	61.9047619	84.3575419	39.30834426	5.320148705	0.803652942	10.52631579	10	91.05263158	57.89473684	50	82.01058201	50.27072422	-65.97131265
Epochs 140	0.779816508	0	5	90.37433155	54.54545455	65	84.94623656	-52.4705845	5.320148705	0.780821919	12.5	5.555555556	90.81081081	62.5	50	82.06521739	66.69698792	-65.97131265
Epochs 160	0.802752316	0	0	89.74358974	54.54545455	66.66666667	84.02061856	-58.24015459	5.320148705	0.780821919	13.33333333	5.263157895	90.81081081	60	57.89473684	82.06521739	99.35133706	-65.97131265
Epochs 180	0.830275238	0	0	90.04975124	75	66.66666667	83.5	50.4263872	5.320148705	0.844748855	25	8.333333333	91.45728643	75	50	82.82828283	194.9964954	-65.97131265
Epochs 200	0.839449525	0	0	90.14778325	71.42857143	62.5	83.66336634	33.16829999	5.320148705	0.844748855	22.22222222	0	91.04477612	66.66666667	44.44444444	82.5	81.96387107	-65.97131265

Table 12-8 Results of Experiment for LSTM Models Trained Using Non-Cyclic Stock Data, Using 25 Trading Days Lookback Period

13 Appendix 8

Singapore Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.110091746	8.910891089	4.716981132	90.90909091	52	41.50943396	72.72727273	12.7850483	-64.15459983	0.065116279	5.303030303	7.407407407	50	43.93939394	55	50	-92.786985	-78.23835547
Epochs 40	0.188073397	7.894736842	8	89.65517241	53.98230088	45.33333333	72.4137931	-86.54037625	-64.15459983	0.111627907	5.035971223	8.064516129	85.71428571	43.47826087	58.06451613	64.28571429	-76.46078252	-78.23835547
Epochs 60	0.233944952	8.823529412	8.860759494	94.59459459	53.46534653	41.7721519	75.67567568	-85.63011448	-64.15459983	0.181395352	4.918032787	8.196721311	87.5	45.90163934	58.33333333	81.25	-84.56248974	-78.23835547
Epochs 80	0.211009175	8	8.333333333	91.17647059	55	44.04761905	78.78787879	-83.9180136	-64.15459983	0.200000003	6.086956522	7.575757576	91.17647059	45.2173913	61.53846154	82.35294118	-82.39322051	-78.23835547
Epochs 100	0.325688064	6.862745098	9.803921569	90.76923077	55.88235294	43.1372549	76.5625	-75.94115111	-64.15459983	0.260465115	4.958677686	9.090909091	92	43.80165289	58.13953488	84	-96.27068841	-78.23835547
Epochs 120	0.266055048	6.603773585	8.333333333	88.46153846	52.83018868	46.66666667	72.54901961	-83.18371331	-64.15459983	0.265116274	5.128205128	10.20408163	93.87755102	43.58974359	60.41666667	85.71428571	-86.94431185	-78.23835547
Epochs 140	0.275229365	5.940594059	8.196721311	87.5	50.4950495	47.54098361	72.72727273	-69.0892114	-64.15459983	0.246511623	5.217391304	10.52631579	95.34883721	43.47826087	62.5	86.04651163	-89.13096567	-78.23835547
Epochs 160	0.25688073	6.382978723	8.108108108	88	53.19148936	45.94594595	71.42857143	-79.67130643	-64.15459983	0.213953495	5.607476636	8.219178082	97.14285714	40.18691589	58.33333333	88.57142857	-89.75990326	-78.23835547
Epochs 180	0.270642191	6.382978723	8.450704225	88.67924528	51.06382979	46.47887324	75	-82.80044482	-64.15459983	0.200000003	5.504587156	8.108108108	96.875	42.20183486	58.90410959	87.5	-88.07075641	-78.23835547
Epochs 200	0.293577969	6.315789474	9.230769231	89.65517241	51.57894737	47.69230769	75.43859649	-79.69914319	-64.15459983	0.246511623	5.607476636	9.230769231	95.34883721	42.99065421	57.8125	83.72093023	-88.55291697	-78.23835547
OCBC Bank Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.082568809	6.956521739	7	100	52.17391304	53.53535354	100	-92.80345339	-55.90202866	0.116279073	8.333333333	10.11235955	100	52.5	54.54545455	100	-7.600607439	-24.56291964
Epochs 40	0.114678897	6.837606838	8.791208791	90	53.84615385	56.66666667	80	-95.88930628	-55.90202866	0.16744186	7.142857143	12.85714286	94.73684211	49.20634921	59.42028986	94.73684211	-13.53171224	-24.56291964
Epochs 60	0.188073397	7.692307692	8.139534884	92.85714286	53.84615385	54.11764706	82.14285714	-96.67625438	-55.90202866	0.232558146	7.207207207	13.23529412	91.66666667	54.05405405	59.70149254	88.88888889	-20.78771714	-24.56291964
Epochs 80	0.17889908	7.843137255	8.695652174	95.83333333	53.92156863	56.04395604	83.33333333	-89.72779324	-55.90202866	0.218604654	6.542056075	12.16216216	91.17647059	55.14018692	60.2739726	88.23529412	-27.02111261	-24.56291964
Epochs 100	0.211009175	7.476635514	6.756756757	89.18918919	55.14018692	53.42465753	81.08108108	-89.18956979	-55.90202866	0.293023258	6.666666667	11.32075472	87.71929825	54.28571429	63.46153846	85.96491228	-44.5558772	-24.56291964
Epochs 120	0.192660555	7.547169811	7.407407407	90.32258065	55.66037736	55	87.09677419	-90.99508359	-55.90202866	0.269767433	5.882352941	10.34482759	83.63636364	53.92156863	66.66666667	81.81818182	-35.32736442	-24.56291964
Epochs 140	0.192660555	6.730769231	7.407407407	87.87878788	53.84615385	53.08641975	81.25	-89.98985856	-55.90202866	0.269767433	5.769230769	12.06896552	84.90566038	53.84615385	68.42105263	83.01886792	0.824369084	-24.56291964
Epochs 160	0.142201841	5.940594059	6.451612903	79.16666667	54.45544554	53.26086957	79.16666667	-96.13590089	-55.90202866	0.265116274	6.12244898	11.76470588	87.75510204	56.12244898	68.65671642	83.67346939	-23.63770776	-24.56291964
Epochs 180	0.146788985	6.796116505	6.52173913	82.60869565	54.36893204	54.34782609	81.81818182	-93.92443556	-55.90202866	0.246511623	6.060606061	11.42857143	84.7826087	56.56565657	66.66666667	82.60869565	-38.95525196	-24.56291964
Epochs 200	0.17889908	6	6.976744186	84.375	54	53.48837209	77.41935484	-91.30265926	-55.90202866	0.297674417	6.25	12.90322581	87.71929825	56.25	70.49180328	85.96491228	-3.154013106	-24.56291964
CNOOC Limited Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.061611373	4	6.097560976	75	47.2	53.08641975	75	50.61477266	-54.68960087	0.084507041	5.64516129	8.235294118	100	45.16129032	52.38095238	100	-42.0387062	-84.2898875
Epochs 40	0.09952607	3.816793893	8.695652174	90.90909091	48.85496183	57.35294118	81.81818182	63.84913408	-54.68960087	0.10798122	6.015037594	9.722222222	100	46.61654135	59.15492958	100	-61.6612395	-84.2898875

Epochs 60	0.156398103	2.678571429	7.246376812	83.33333333	50.89285714	52.94117647	66.66666667	256.8388497	-54.68960087	0.169014081	6.779661017	9.459459459	100	44.91525424	52.05479452	85.71428571	-70.92636204	-84.2898875
Epochs 80	0.123222746	3.50877193	6.666666667	77.27272727	50	52.7027027	63.63636364	-2.886498917	-54.68960087	0.164319247	6.896551724	10.25641026	100	46.55172414	54.54545455	84.21052632	-64.02726188	-84.2898875
Epochs 100	0.184834123	4.166666667	7.01754386	88.23529412	50	55.35714286	79.41176471	374.2673664	-54.68960087	0.234741777	6.779661017	10.34482759	97.2972973	44.91525424	56.14035088	83.78378378	-82.07595847	-84.2898875
Epochs 120	0.180094793	4.237288136	8.064516129	90.32258065	50	54.09836066	80.64516129	187.849569	-54.68960087	0.21596244	6.896551724	8.064516129	94.28571429	46.55172414	54.09836066	82.85714286	-79.8280109	-84.2898875
Epochs 140	0.189573467	4.347826087	7.936507937	90.90909091	50.43478261	51.61290323	81.81818182	285.1047714	-54.68960087	0.201877937	7.079646018	7.352941176	93.75	46.90265487	53.73134328	78.125	-80.7610753	-84.2898875
Epochs 160	0.194312796	4.854368932	8	90.90909091	50.48543689	52.7027027	81.81818182	148.2911095	-54.68960087	0.183098584	7.619047619	8.43373494	96	44.76190476	50	84	-72.50001601	-84.2898875
Epochs 180	0.189573467	4.716981132	8.219178082	90.625	50	52.77777778	81.25	193.0699066	-54.68960087	0.173708916	7.692307692	7.142857143	92	45.19230769	50.60240964	80	-71.52719773	-84.2898875
Epochs 200	0.222748816	5	8.450704225	90	51	55.71428571	82.5	268.3352905	-54.68960087	0.201877937	7.766990291	7.594936709	93.5483871	46.60194175	51.28205128	83.87096774	-73.60160017	-84.2898875
JP Morgan Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.091743119	10.1010101	3.539823009	100	44.44444444	44.64285714	100	8327.944096	1576.179166	0.118721463	7.96460177	10.20408163	87.5	48.21428571	53.06122449	87.5	176.8530121	-31.90034799
Epochs 40	0.128440365	10.20408163	3.773584906	100	45.91836735	44.76190476	92.85714286	2259.621509	1576.179166	0.159817353	7.751937984	13.33333333	100	49.21875	58.66666667	86.66666667	320.6456147	-31.90034799
Epochs 60	0.155963302	11.23595506	3.669724771	100	48.31460674	46.2962963	100	1968.886176	1576.179166	0.242009133	9.009009009	12.32876712	97.14285714	49.54954955	60.2739726	85.29411765	277.0455203	-31.90034799
Epochs 80	0.128440365	11.62790698	3.389830508	100	48.8372093	47.86324786	100	734.0256168	1576.179166	0.228310496	9.433962264	13.25301205	96.66666667	51.88679245	61.44578313	86.20689655	404.8922933	-31.90034799
Epochs 100	0.174311921	10.41666667	4.081632653	100	48.42105263	48.97959184	100	2024.02185	1576.179166	0.246575341	8.695652174	10.9375	92.5	48.69565217	57.8125	84.61538462	-2.081341497	-31.90034799
Epochs 120	0.155963302	10.1010101	4.04040404	100	48.97959184	49.49494949	95	604.1506549	1576.179166	0.246575341	9.009009009	11.42857143	94.73684211	47.74774775	55.71428571	86.48648649	804.5377097	-31.90034799
Epochs 140	0.165137619	10.75268817	3.883495146	100	47.31182796	49.01960784	95.45454545	901.1026853	1576.179166	0.223744288	8.411214953	10.38961039	91.42857143	47.6635514	53.24675325	82.35294118	1257.892117	-31.90034799
Epochs 160	0.119266056	12.04819277	3.25203252	100	50.60240964	47.54098361	100	352.6837875	1576.179166	0.214611873	8.333333333	10.11235955	88.23529412	48.95833333	52.80898876	78.78787879	244.1119503	-31.90034799
Epochs 180	0.133027524	11.76470588	3.389830508	100	49.41176471	46.15384615	93.33333333	401.1372669	1576.179166	0.214611873	8.333333333	10	90.90909091	50	53.33333333	81.25	147.6994033	-31.90034799
Epochs 200	0.137614682	11.9047619	3.418803419	94.11764706	50	44.82758621	88.23529412	287.0402985	1576.179166	0.237442926	8.421052632	10.46511628	92.10526316	49.47368421	54.65116279	83.78378378	257.2859488	-31.90034799
American Axle (small cap) Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.096330278	4.918032787	7.954545455	100	43.44262295	48.27586207	87.5	-95.25254283	-40.19620025	0.132420093	9.615384615	8.571428571	100	51.45631068	56.19047619	100	-40.44584356	-32.50977019
Epochs 40	0.114678897	5.737704918	8.235294118	100	44.62809917	52.94117647	72.72727273	-92.36088118	-40.19620025	0.159817353	8.620689655	9.411764706	94.44444444	51.30434783	61.17647059	83.33333333	6.276778617	-32.50977019
Epochs 60	0.174311921	4.807692308	8.235294118	89.65517241	44.66019417	56.47058824	79.31034483	-89.23924837	-40.19620025	0.232876718	9.090909091	9.523809524	94.44444444	53.06122449	59.52380952	88.88888889	2.861662747	-32.50977019
Epochs 80	0.142201841	4.854368932	7.52688172	86.36363636	45.09803922	54.83870968	81.81818182	-87.74697856	-40.19620025	0.210045666	9.574468085	8.602150538	90.625	54.83870968	55.91397849	84.375	8.372233055	-32.50977019
Epochs 100	0.24311927	5.555555556	7.8125	91.30434783	46.72897196	56.25	82.60869565	-72.91462622	-40.19620025	0.315068483	9.473684211	11.94029851	91.22807018	54.25531915	58.20895522	82.45614035	66.17926592	-32.50977019
Epochs 120	0.197247714	5.454545455	6.944444444	88.88888889	45.87155963	56.94444444	80.55555556	-76.61347715	-40.19620025	0.264840186	8.333333333	10.38961039	91.30434783	52.63157895	53.24675325	78.26086957	-69.1923456	-32.50977019
Epochs 140	0.192660555	5.454545455	6.849315068	88.57142857	45.45454545	57.53424658	79.41176471	-73.28914557	-40.19620025	0.260273963	8.602150538	9.87654321	91.11111111	53.26086957	54.32098765	77.77777778	-41.98674075	-32.50977019
Epochs 160	0.206422016	5	9.411764706	96.96969697	46	53.57142857	84.84848485	-72.32416356	-40.19620025	0.232876718	9.195402299	8.602150538	89.74358974	53.48837209	51.61290323	79.48717949	-43.54142642	-32.50977019

Epochs 180	0.192660555	4.901960784	9.302325581	96.66666667	46.07843137	54.11764706	86.66666667	-77.06235646	-40.19620025	0.232876718	9.195402299	8.602150538	89.74358974	55.81395349	52.68817204	79.48717949	-45.44969436	-32.50977019
Epochs 200	0.201834857	4.95049505	8.536585366	91.42857143	46.53465347	54.32098765	82.85714286	-80.20970361	-40.19620025	0.232876718	9.090909091	8.791208791	87.5	55.17241379	52.74725275	75	-36.89114517	-32.50977019

Table 13-1 Results of 25 Percent More Buy Class CNN Models , Cyclic Stocks

Kweichow Moutai Co., Ltd. Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.14009662	10.37735849	7.865168539	91.66666667	50.94339623	51.13636364	83.33333333	8286.176638	1666.892281	0.120192304	9.677419355	5.825242718	83.33333333	47.31182796	50	66.66666667	788.9558613	678.7940879
Epochs 40	0.14009662	10.11235955	8.571428571	84.61538462	52.80898876	50	84.61538462	2772.676222	1666.892281	0.105769232	10.95890411	6.299212598	75	54.79452055	51.96850394	57.14285714	512.6143459	678.7940879
Epochs 60	0.16908212	11.45833333	9.375	100	54.73684211	52.08333333	100	4225.336026	1666.892281	0.149038464	11.53846154	6.956521739	93.33333333	53.24675325	52.17391304	73.33333333	396.1508416	678.7940879
Epochs 80	0.198067635	12.35955056	9.278350515	100	56.81818182	49.48453608	100	1737.073954	1666.892281	0.168269232	12	7.01754386	94.73684211	56.75675676	52.63157895	73.68421053	415.0890537	678.7940879
Epochs 100	0.202898547	13.25301205	8.080808081	92	58.53658537	47.47474747	92	2644.248231	1666.892281	0.182692304	11.26760563	7.079646018	91.66666667	55.71428571	53.09734513	70.83333333	212.2266068	678.7940879
Epochs 120	0.256038636	12.98701299	8.602150538	94.59459459	57.89473684	47.31182796	94.59459459	2500.705855	1666.892281	0.1875	10.29411765	7.079646018	88.88888889	56.71641791	54.86725664	74.07407407	134.9516646	678.7940879
Epochs 140	0.236714974	13.69863014	8	91.17647059	58.33333333	45	91.17647059	2336.185779	1666.892281	0.225961536	10.76923077	7.407407407	91.42857143	59.375	55.55555556	80	152.4023434	678.7940879
Epochs 160	0.30917874	13.69863014	8.333333333	94	58.33333333	44.04761905	90	2623.896285	1666.892281	0.283653855	10.60606061	7.52688172	91.83673469	58.46153846	54.83870968	83.67346939	220.5875652	678.7940879
Epochs 180	0.36714977	14.75409836	8.641975309	92.30769231	60	44.44444444	89.23076923	3257.7232	1666.892281	0.331730783	10.71428571	7.608695652	93.33333333	61.81818182	54.34782609	86.66666667	248.5635291	678.7940879
Epochs 200	0.30917874	14.08450704	9.090909091	95.83333333	60	44.31818182	91.66666667	2203.920825	1666.892281	0.288461536	11.29032258	7.216494845	93.87755102	60.6557377	53.60824742	85.71428571	225.4842224	678.7940879
Midea Group Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.115942031	6.481481481	9.302325581	69.23076923	55.55555556	53.48837209	66.66666667	11769.63282	1245.275482	0.096153848	7.142857143	2.040816327	91.66666667	47.95918367	49.48453608	91.66666667	40.94291047	468.5733088
Epochs 40	0.115942031	9.473684211	8.571428571	85.71428571	57.89473684	57.69230769	71.42857143	40179.41806	1245.275482	0.086538464	6.896551724	5.217391304	100	52.87356322	52.63157895	100	112.2687607	468.5733088
Epochs 60	0.16908212	9.708737864	10.22727273	100	58.25242718	60.91954023	75	165218.4493	1245.275482	0.115384616	6.25	5.102040816	92.85714286	52.63157895	55.10204082	85.71428571	34.54562077	468.5733088
Epochs 80	0.202898547	9.090909091	9.87654321	92.59259259	56.56565657	60.49382716	65.38461538	59339.9119	1245.275482	0.129807696	6.593406593	4.081632653	89.47368421	53.33333333	56.12244898	84.21052632	-1.919538523	468.5733088
Epochs 100	0.251207739	9.677419355	10.25641026	97.22222222	55.91397849	58.97435897	71.42857143	94254.53656	1245.275482	0.125	6.818181818	3.921568627	88.88888889	55.17241379	56.8627451	83.33333333	111.8753332	468.5733088
Epochs 120	0.270531386	10.34482759	10	97.5	57.47126437	58.75	82.05128205	123788.7946	1245.275482	0.139423072	7.228915663	4.716981132	94.73684211	55.42168675	54.71698113	94.44444444	60.45705582	468.5733088
Epochs 140	0.289855063	10.38961039	10.46511628	97.72727273	57.14285714	54.65116279	81.39534884	201230.8819	1245.275482	0.163461536	7.692307692	3.846153846	92.30769231	56.41025641	54.80769231	92	57.8885342	468.5733088
Epochs 160	0.347826093	10.52631579	10.95890411	96.55172414	56	58.90410959	82.75862069	217739.4726	1245.275482	0.235576928	8	3.370786517	90.90909091	56	57.30337079	90.69767442	15.70361442	468.5733088
Epochs 180	0.400966197	10.60606061	11.42857143	95.77464789	58.46153846	58.57142857	83.09859155	180539.3375	1245.275482	0.302884609	6.557377049	3.571428571	88.88888889	60.6557377	58.33333333	87.09677419	-40.11105524	468.5733088
Epochs 200	0.347826093	10.66666667	10.81081081	96.55172414	56.75675676	56.75675676	82.75862069	147948.295	1245.275482	0.197115391	8	3.125	86.48648649	57.33333333	54.16666667	86.11111111	24.86870138	468.5733088
Walmart Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit

Epochs 20	0.114678897	5.982905983	5.882352941	81.25	48.71794872	38.0952381	81.25	162.7626362	9380.979094	0.077625573	4.511278195	8.536585366	100	50	48.7804878	75	-92.18275578	255.7316817
Epochs 40	0.091743119	6.12244898	6.194690265	100	52.04081633	45.53571429	100	137.3496315	9380.979094	0.086757988	4.918032787	7.777777778	85.71428571	49.58677686	45.55555556	85.71428571	-93.04694355	255.7316817
Epochs 60	0.105504587	6.862745098	5.769230769	83.33333333	51.96078431	44.66019417	75	316.9681466	9380.979094	0.105022833	4.6875	8.641975309	100	49.60629921	48.14814815	100	92.64168092	255.7316817
Epochs 80	0.169724777	7.291666667	6.25	92.30769231	53.125	45.26315789	84.61538462	265.6071864	9380.979094	0.146118715	4.958677686	7.894736842	90.90909091	50	47.36842105	81.81818182	251.7749927	255.7316817
Epochs 100	0.165137619	6.451612903	6.12244898	88.88888889	52.68817204	45.36082474	77.77777778	225.0156115	9380.979094	0.168949768	4.504504505	7.792207792	83.87096774	51.81818182	45.45454545	77.41935484	247.1238249	255.7316817
Epochs 120	0.215596333	8.045977011	6.315789474	94.44444444	56.32183908	45.74468085	88.88888889	1680.501635	9380.979094	0.228310496	5	8	88.63636364	55.55555556	46.66666667	86.36363636	239.9610475	255.7316817
Epochs 140	0.275229365	9.090909091	6.52173913	95.91836735	55.84415584	43.95604396	85.71428571	280.9377311	9380.979094	0.251141548	5.434782609	9.756097561	93.33333333	55.43478261	42.68292683	86.36363636	376.8270187	255.7316817
Epochs 160	0.288990825	8.75	6.976744186	96.15384615	57.5	41.86046512	88.23529412	1565.843056	9380.979094	0.264840186	5.434782609	6.849315068	88.88888889	54.34782609	42.46575342	84.90566038	330.41991	255.7316817
Epochs 180	0.344036698	6.060606061	6.25	91.66666667	54.54545455	41.25	84.50704225	237.9851791	9380.979094	0.365296811	4.225352113	9.85915493	90.90909091	53.52112676	46.47887324	82.89473684	392.2627127	255.7316817
Epochs 200	0.293577969	8	6.818181818	94.54545455	54.66666667	41.37931034	85.45454545	275.6013116	9380.979094	0.315068483	5.813953488	10.81081081	94.91525424	54.65116279	45.94594595	89.65517241	354.7288973	255.7316817
Fresh Del Monte Produce Inc (small cap)Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.128440365	6.896551724	6.976744186	87.5	36.52173913	41.86046512	75	62.49074573	5.320148705	0.10958904	5.882352941	6.818181818	91.66666667	49.15254237	45.45454545	75	-31.80207378	-65.97131265
Epochs 40	0.105504587	9.278350515	8.547008547	100	44.79166667	43.58974359	75	196.2684341	5.320148705	0.091324203	6.603773585	6.666666667	75	49.52380952	48.57142857	75	-19.88122374	-65.97131265
Epochs 60	0.146788985	8.490566038	8.333333333	93.75	43.80952381	45.83333333	75	-11.84796987	5.320148705	0.10958904	7.75862069	6.52173913	81.81818182	50.43478261	47.82608696	54.54545455	1.199608271	-65.97131265
Epochs 80	0.183486238	9	8.510638298	95.83333333	46.46464646	47.87234043	87.5	-15.79651558	5.320148705	0.182648405	9.259259259	8.045977011	95.83333333	52.3364486	50.57471264	79.16666667	74.60333755	-65.97131265
Epochs 100	0.211009175	9.574468085	8.602150538	93.5483871	46.23655914	47.31182796	87.09677419	7.335469985	5.320148705	0.187214613	7.692307692	9.090909091	92.59259259	52.42718447	53.40909091	81.48148148	129.2766808	-65.97131265
Epochs 120	0.270642191	7.317073171	9.302325581	90	47.56097561	47.6744186	83.67346939	-22.15134181	5.320148705	0.242009133	7.446808511	9.523809524	92.68292683	56.98924731	55.95238095	80.48780488	41.84456177	-65.97131265
Epochs 140	0.32110092	8.571428571	9.195402299	91.80327869	50	50.57471264	85	-17.01223109	5.320148705	0.287671238	8.43373494	9.411764706	94.11764706	56.09756098	54.11764706	82.35294118	89.00896301	-65.97131265
Epochs 160	0.339449555	8.823529412	8.43373494	91.04477612	48.52941176	50.60240964	81.81818182	-46.3305592	5.320148705	0.310502291	5.952380952	10.66666667	91.66666667	55.42168675	56	83.33333333	35.34898707	-65.97131265
Epochs 180	0.426605493	7.843137255	9.090909091	91.11111111	52.94117647	49.35064935	84.26966292	-42.91819768	5.320148705	0.378995448	6.756756757	10.29411765	92.20779221	54.05405405	55.88235294	84.21052632	83.66071032	-65.97131265
Epochs 200	0.357798159	9.090909091	8.641975309	91.54929577	48.48484848	51.85185185	84.28571429	-55.33797008	5.320148705	0.319634706	6.097560976	9.589041096	90.625	55.55555556	53.42465753	81.25	58.17547581	-65.97131265

Table 13-2 Results of 25 Percent More Buy Class CNN Models , Non-Cyclic Stocks

Singapore Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.068807341	8.653846154	4.424778761	100	52.42718447	44.24778761	100	62.89796012	-64.15459983	0.065116279	5.691056911	7.608695652	0	44.71544715	54.94505495	0	-92.81056915	-78.23835547
Epochs 40	0.114678897	8.910891089	8.181818182	100	52	46.36363636	100	-89.20579872	-64.15459983	0.102325581	5.785123967	9.195402299	100	46.28099174	56.97674419	100	-86.44932664	-78.23835547
Epochs 60	0.17889908	9.473684211	8.823529412	100	52.12765957	47.05882353	95.23809524	-83.37542111	-64.15459983	0.116279073	5.882352941	7.317073171	85.71428571	45.37815126	56.79012346	78.57142857	-84.70376358	-78.23835547
Epochs 80	0.201834857	9.756097561	7.547169811	93.33333333	51.85185185	47.16981132	90	-69.62633018	-64.15459983	0.186046511	6.930693069	6.024096386	90.32258065	47.52475248	57.31707317	80.64516129	-86.64513825	-78.23835547
Epochs 100	0.233944952	8.510638298	8.235294118	92.30769231	53.76344086	48.23529412	74.35897436	-80.32252966	-64.15459983	0.223255813	6.542056075	5.882352941	92.5	47.6635514	58.20895522	90	-88.31583166	-78.23835547
Epochs 120	0.284403682	9.195402299	7.594936709	92.30769231	56.97674419	46.83544304	78.84615385	-81.50992576	-64.15459983	0.269767433	6.930693069	6.25	94	49.5049505	55.55555556	88	-87.79801962	-78.23835547
Epochs 140	0.233944952	8.602150538	9.090909091	94.59459459	53.26086957	48.86363636	81.08108108	-73.70215628	-64.15459983	0.232558146	6.603773585	5.882352941	95.12195122	45.28301887	53.73134328	87.80487805	-92.91689543	-78.23835547
Epochs 160	0.293577969	10.12658228	8.045977011	94.23076923	56.41025641	47.12643678	80.76923077	-82.3494334	-64.15459983	0.297674417	4.545454545	6.153846154	90.32258065	47.72727273	56.25	82.25806452	-85.53282264	-78.23835547
Epochs 180	0.330275238	9.333333333	7.5	93.65079365	56	48.10126582	80.95238095	-77.95554559	-64.15459983	0.339534879	4.819277108	6.557377049	91.54929577	49.39759036	53.33333333	84.50704225	-89.8768371	-78.23835547
Epochs 200	0.344036698	10.44776119	7.058823529	93.93939394	53.73134328	50	84.84848485	-71.88815435	-64.15459983	0.348837197	5.063291139	6.349206349	91.78082192	46.83544304	56.4516129	80.82191781	-91.81802134	-78.23835547

OCBC Bank Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.077981651	7.207207207	7.547169811	100	51.35135135	51.42857143	100	-92.9842109	-55.90202866	0.088372096	8.196721311	8.695652174	100	51.63934426	52.74725275	100	-6.696366534	-24.56291964
Epochs 40	0.110091746	7.843137255	8.256880734	100	54.90196078	54.62962963	85.71428571	-94.74228961	-55.90202866	0.111627907	8.474576271	9.782608696	100	52.54237288	56.04395604	80	-47.42471678	-24.56291964
Epochs 60	0.128440365	7.920792079	8.490566038	100	55.44554455	56.19047619	90.90909091	-92.66054131	-55.90202866	0.14418605	7.339449541	9.090909091	83.33333333	52.29357798	57.47126437	77.77777778	-17.92113863	-24.56291964
Epochs 80	0.183486238	8.139534884	8.411214953	96	59.30232558	56.60377358	92	-88.66114478	-55.90202866	0.158139542	6.12244898	8.695652174	80	52.04081633	56.04395604	72	-59.40832113	-24.56291964
Epochs 100	0.188073397	7.368421053	7.52688172	90	58.94736842	56.52173913	86.66666667	-74.74824529	-55.90202866	0.218604654	5.940594059	9.459459459	85	51.48514851	57.53424658	80	-51.56618594	-24.56291964
Epochs 120	0.233944952	7.865168539	6.896551724	90.47619048	59.5505618	52.3255814	80.95238095	-94.45309695	-55.90202866	0.246511623	5.319148936	9.722222222	83.67346939	53.19148936	60.56338028	77.55102041	-58.7959054	-24.56291964
Epochs 140	0.17889908	5.434782609	6.52173913	82.35294118	57.60869565	52.74725275	70.58823529	-93.66806586	-55.90202866	0.223255813	5.263157895	10.25641026	83.33333333	52.63157895	58.44155844	78.57142857	-66.12908217	-24.56291964
Epochs 160	0.24311927	6.024096386	7.865168539	89.13043478	56.62650602	52.27272727	80.43478261	-75.06664839	-55.90202866	0.251162797	5.494505495	9.333333333	85.71428571	51.64835165	55.40540541	81.63265306	-67.84488517	-24.56291964
Epochs 180	0.266055048	6.329113924	6.976744186	88.67924528	59.49367089	51.76470588	81.13207547	-92.60350851	-55.90202866	0.306976736	4.819277108	9.090909091	84.84848485	51.80722892	59.09090909	81.53846154	-68.61335693	-24.56291964
Epochs 200	0.261467904	6.493506494	6.741573034	88.46153846	61.03896104	52.27272727	80.76923077	-89.52564636	-55.90202866	0.344186038	5.263157895	10.44776119	87.5	52.63157895	59.70149254	84.50704225	-54.00848651	-24.56291964

CNOOC Limited Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.047393367	4.166666667	5.494505495	0	45.83333333	50	0	54.90711934	-54.68960087	0.070422538	5.785123967	8.695652174	0	45.45454545	49.45054945	0	-36.1306794	-84.2898875
Epochs 40	0.066350713	3.539823009	5.376344086	100	50.44247788	55.43478261	80	-8.582473259	-54.68960087	0.098591551	6.086956522	7.777777778	87.5	46.95652174	53.93258427	50	-65.11060291	-84.2898875
Epochs 60	0.080568723	4.504504505	5.494505495	77.77777778	53.15315315	54.44444444	55.55555556	19.92732722	-54.68960087	0.12206573	6.25	7.954545455	92.30769231	47.32142857	54.02298851	69.23076923	-72.94431026	-84.2898875
Epochs 80	0.175355449	4.255319149	6.896551724	90	57.44680851	54.65116279	80	157.9494828	-54.68960087	0.17840375	7.291666667	7.608695652	96	46.875	52.74725275	88	-88.82873195	-84.2898875

Epochs 100	0.189573467	3.921568627	6.756756757	88.57142857	54.90196078	53.42465753	74.28571429	184.5925693	-54.68960087	0.201877937	6.796116505	8.75	96.66666667	46.60194175	53.16455696	83.33333333	-73.57209742	-84.2898875
Epochs 120	0.222748816	5.050505051	5.797101449	88.37209302	56.56565657	52.94117647	76.74418605	587.2195558	-54.68960087	0.211267605	6.930693069	8.860759494	93.93939394	46.53465347	51.28205128	81.81818182	-70.21387818	-84.2898875
Epochs 140	0.194312796	5.882352941	5.405405405	88.57142857	54.90196078	52.05479452	80	224.2889372	-54.68960087	0.169014081	6.730769231	8.235294118	91.66666667	47.11538462	51.19047619	79.16666667	-63.14057885	-84.2898875
Epochs 160	0.241706163	6.666666667	5.263157895	91.11111111	56.66666667	54.66666667	80	214.9300951	-54.68960087	0.244131461	7.777777778	7.407407407	92.85714286	48.88888889	51.25	85.71428571	-64.92329939	-84.2898875
Epochs 180	0.2843602	6.896551724	5.714285714	92.59259259	56.32183908	53.62318841	85.18518519	196.2516552	-54.68960087	0.272300482	7.954545455	7.792207792	93.75	48.86363636	50	83.33333333	-66.03028647	-84.2898875
Epochs 200	0.2843602	7.058823529	5.479452055	94.33962264	54.11764706	55.55555556	88.67924528	502.254685	-54.68960087	0.295774639	8.43373494	7.792207792	94.33962264	46.98795181	51.31578947	84.90566038	-84.87122976	-84.2898875
JP Morgan Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.068807341	9.473684211	4.098360656	100	45.26315789	43.80165289	100	1386.46916	1576.179166	0.091324203	8.571428571	9.649122807	0	48.07692308	49.12280702	0	468.2993878	-31.90034799
Epochs 40	0.082568809	12.04819277	3.100775194	66.66666667	49.39759036	45.3125	50	708.7449285	1576.179166	0.146118715	8.571428571	10	92.85714286	50	53	85.71428571	15.32754176	-31.90034799
Epochs 60	0.110091746	12.34567901	3.174603175	90.90909091	49.38271605	46.4	90.90909091	790.5890825	1576.179166	0.196347028	8.823529412	11.70212766	100	50.4950495	54.25531915	86.95652174	27.83755157	-31.90034799
Epochs 80	0.137614682	14.08450704	3.076923077	94.11764706	54.92957746	46.51162791	82.35294118	261.4318793	1576.179166	0.283105016	10.12658228	11.57894737	95.55555556	51.89873418	53.68421053	86.36363636	-11.24040677	-31.90034799
Epochs 100	0.151376143	12.5	3.389830508	95	52.5	47.86324786	95	742.458467	1576.179166	0.287671238	8.888888889	13.0952381	97.77777778	48.88888889	52.38095238	88.63636364	89.54128507	-31.90034799
Epochs 120	0.206422016	12.98701299	3.669724771	96.875	54.54545455	50	96.875	152.6540004	1576.179166	0.337899536	9.638554217	12.82051282	96.55172414	51.80722892	56.41025641	85.96491228	63.20753857	-31.90034799
Epochs 140	0.16055046	11.84210526	4.132231405	100	53.94736842	47.5	100	13.35500964	1576.179166	0.237442926	6.896551724	10.98901099	87.80487805	48.27586207	52.22222222	78.04878049	-6.937296519	-31.90034799
Epochs 160	0.17889908	12.5	4.132231405	100	54.16666667	47.5	100	3.008301039	1576.179166	0.296803653	8.860759494	11.49425287	90.56603774	48.10126582	51.1627907	81.13207547	-7.822842909	-31.90034799
Epochs 180	0.24311927	13.43283582	3.603603604	100	55.2238806	47.27272727	97.5	11.31363063	1576.179166	0.337899536	9.589041096	10.97560976	90.625	47.94520548	51.85185185	82.8125	4.649831798	-31.90034799
Epochs 200	0.220183492	13.84615385	3.389830508	100	55.38461538	47.00854701	97.14285714	290.773911	1576.179166	0.333333343	9.85915493	11.49425287	91.80327869	47.88732394	51.1627907	83.60655738	-2.171563604	-31.90034799
American Axle (small cap) Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.055045873	4.385964912	6.730769231	0	44.73684211	46.60194175	0	-84.52928381	-40.19620025	0.086757988	9.009009009	8.333333333	0	48.18181818	55.55555556	0	-6.604599727	-32.50977019
Epochs 40	0.073394492	5.607476636	6.542056075	75	43.92523364	49.53271028	66.66666667	-55.69353337	-40.19620025	0.114155248	9.433962264	8.411214953	100	50.47619048	56.07476636	100	-59.42517299	-32.50977019
Epochs 60	0.100917429	4.081632653	6.666666667	73.33333333	43.87755102	50.47619048	71.42857143	-51.05956516	-40.19620025	0.178082198	10	8.411214953	95.45454545	52.80898876	57.00934579	90.90909091	-35.62158349	-32.50977019
Epochs 80	0.16055046	3.488372093	7.692307692	85.71428571	44.18604651	50.96153846	77.77777778	-54.72729807	-40.19620025	0.200913236	11.25	8.108108108	92.85714286	56.96202532	55.85585586	92.85714286	-5.822593129	-32.50977019
Epochs 100	0.201834857	4.210526316	9.195402299	88.88888889	48.42105263	55.17241379	82.85714286	-36.38618649	-40.19620025	0.264840186	10.58823529	9.782608696	95.23809524	54.76190476	56.52173913	88.0952381	-20.42116883	-32.50977019
Epochs 120	0.206422016	4.255319149	8.235294118	87.17948718	50	54.11764706	81.57894737	-48.9868495	-40.19620025	0.287671238	10.58823529	9.411764706	93.87755102	54.76190476	55.29411765	87.75510204	154.1022201	-32.50977019
Epochs 140	0.17889908	4.12371134	8.791208791	90	48.45360825	54.94505495	79.31034483	-87.00362242	-40.19620025	0.260273963	10.97560976	9.375	95.12195122	54.87804878	54.16666667	87.5	2.336783361	-32.50977019
Epochs 160	0.197247714	4.347826087	8.695652174	91.17647059	48.91304348	54.34782609	78.78787879	-96.92236723	-40.19620025	0.305936068	9.722222222	9.89010989	91.07142857	56.94444444	57.14285714	85.45454545	161.3675903	-32.50977019
Epochs 180	0.238532111	4.444444444	8.43373494	91.11111111	48.88888889	55.42168675	81.81818182	-97.00507522	-40.19620025	0.328767121	10	9.302325581	90.47619048	58.57142857	55.81395349	83.87096774	112.8278784	-32.50977019
Epochs 200	0.215596333	4.545454545	7.777777778	90	46.59090909	53.93258427	82.5	-97.59054271	-40.19620025	0.324200898	10.29411765	9.89010989	91.66666667	60.29411765	53.84615385	84.74576271	117.1822481	-32.50977019

Table 13-3 Results of 25 Percent More Hold Class CNN Models , Cyclic Stocks

Kweichow Moutai Co., Ltd. Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.188405797	10.18518519	8	91.66666667	49.07407407	48.64864865	83.33333333	16112.95514	1666.892281	0.1875	8.888888889	5.617977528	89.65517241	43.33333333	47.19101124	78.57142857	254.4041918	678.7940879
Epochs 40	0.15458937	10.98901099	8.910891089	86.66666667	54.94505495	51	80	1967.884662	1666.892281	0.149038464	10.52631579	7.692307692	93.33333333	51.31578947	51.72413793	80	609.1661178	678.7940879
Epochs 60	0.178743958	10.38961039	9.259259259	86.36363636	54.54545455	51.40186916	81.81818182	2190.958562	1666.892281	0.125	11.11111111	6.766917293	83.33333333	58.73015873	50.75757576	75	421.7335893	678.7940879
Epochs 80	0.227053136	13.75	9.900990099	100	55	51.48514851	100	2736.199748	1666.892281	0.177884609	10.60606061	7.56302521	91.30434783	56.06060606	50.42016807	77.27272727	335.2931563	678.7940879
Epochs 100	0.246376812	14.66666667	9.803921569	100	54.66666667	50	100	1854.124784	1666.892281	0.197115391	12.6984127	7.5	96	53.96825397	49.16666667	83.33333333	228.9463539	678.7940879
Epochs 120	0.217391297	13.88888889	8.411214953	92.85714286	55.55555556	47.6635514	92.59259259	1324.971604	1666.892281	0.245192304	11.76470588	7.692307692	90	54.90196078	48.71794872	79.48717949	218.8026157	678.7940879
Epochs 140	0.231884062	13.33333333	8.910891089	93.5483871	56.75675676	48.51485149	90.32258065	1666.600573	1666.892281	0.264423072	10.52631579	8.411214953	90.90909091	54.38596491	53.27102804	79.06976744	262.8316509	678.7940879
Epochs 160	0.304347813	13.51351351	9.411764706	93.75	56.16438356	49.41176471	91.66666667	1865.652592	1666.892281	0.307692319	10.9375	6.896551724	89.47368421	54.6875	58.62068966	78.57142857	1213.842952	678.7940879
Epochs 180	0.29468599	15.625	8.333333333	91.4893617	59.375	46.875	86.95652174	1365.067579	1666.892281	0.293269217	11.32075472	6.060606061	87.5	56.60377358	55.10204082	76.78571429	313.4018009	678.7940879
Epochs 200	0.289855063	15.51724138	7.920792079	89.58333333	60.34482759	45.54455446	85.10638298	1162.363884	1666.892281	0.322115391	12.76595745	6.060606061	88.70967742	59.57446809	56.12244898	79.03225806	500.2060849	678.7940879
Midea Group Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.14009662	6.25	8.108108108	76.19047619	53.57142857	54.05405405	70	11820.50271	1245.275482	0.163461536	6.796116505	2.5	100	47.57281553	48.10126582	88	143.1604612	468.5733088
Epochs 40	0.149758458	9.278350515	9.278350515	100	57.73195876	56.25	69.23076923	41928.04937	1245.275482	0.096153848	7.692307692	3.773584906	81.81818182	52.74725275	51.42857143	81.81818182	152.5830702	468.5733088
Epochs 60	0.188405797	9.87654321	8.737864078	95.65217391	58.02469136	54.90196078	60.86956522	25917.92414	1245.275482	0.139423072	7.692307692	5.309734513	100	53.84615385	54.46428571	100	45.01904165	468.5733088
Epochs 80	0.207729474	10.34482759	9.574468085	96.15384615	56.32183908	55.91397849	65.38461538	28399.64105	1245.275482	0.15384616	7.5	4.716981132	95.45454545	53.75	54.71698113	95.23809524	47.97600869	468.5733088
Epochs 100	0.227053136	9.756097561	8.791208791	91.17647059	56.09756098	55.55555556	64.70588235	29541.62323	1245.275482	0.15865384	8	4.587155963	91.66666667	57.33333333	55.04587156	86.95652174	6.719684764	468.5733088
Epochs 120	0.227053136	10.38961039	8.333333333	91.17647059	54.54545455	55.78947368	67.64705882	62060.25801	1245.275482	0.144230768	8.219178082	4.385964912	90.47619048	58.90410959	53.50877193	85	25.47790688	468.5733088
Epochs 140	0.236714974	9.523809524	9.195402299	91.66666667	57.14285714	56.97674419	69.44444444	19051.64313	1245.275482	0.163461536	7.792207792	4.716981132	92	55.84415584	54.71698113	83.33333333	27.31509291	468.5733088
Epochs 160	0.289855063	10.34482759	9.589041096	93.61702128	56.32183908	58.90410959	78.26086957	74000.56802	1245.275482	0.1875	7.894736842	4	90.625	56.57894737	55	87.09677419	76.36722895	468.5733088
Epochs 180	0.256038636	9.87654321	8.333333333	90.47619048	56.79012346	55.95238095	73.17073171	20929.10404	1245.275482	0.225961536	7.692307692	4.901960784	90.24390244	58.46153846	55.88235294	87.5	-2.303149689	468.5733088
Epochs 200	0.275362313	9.722222222	8.045977011	89.58333333	54.16666667	55.17241379	70.21276596	11851.84561	1245.275482	0.245192304	8.196721311	6.603773585	95.12195122	60.6557377	54.71698113	92.5	-51.9368868	468.5733088
Walmart Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.133027524	4.237288136	6.41025641	86.36363636	46.61016949	35.06493506	72.72727273	127.110837	9380.979094	0.114155248	4.316546763	9.090909091	92.85714286	49.27536232	50	85.71428571	278.1923207	255.7316817

Epochs 40	0.146788985	6.25	5.050505051	91.30434783	52.08333333	42.85714286	82.60869565	85.58307439	9380.979094	0.105022833	4.87804878	7.142857143	91.66666667	51.63934426	48.80952381	83.33333333	-85.50370157	255.7316817
Epochs 60	0.165137619	7.5	5.309734513	96	56.25	44.64285714	92	130.097934	9380.979094	0.16438356	5.607476636	8.045977011	92	53.77358491	47.12643678	84	428.0890884	255.7316817
Epochs 80	0.188073397	7.058823529	5.882352941	93.5483871	55.29411765	45.54455446	90.32258065	203.7079942	9380.979094	0.155251145	5.309734513	8.43373494	91.30434783	51.78571429	46.98795181	86.95652174	164.4487619	255.7316817
Epochs 100	0.188073397	6.097560976	5.882352941	88.23529412	53.65853659	46.53465347	85.29411765	161.8729631	9380.979094	0.19178082	4.854368932	8.43373494	90.90909091	50.98039216	46.98795181	81.81818182	285.3373432	255.7316817
Epochs 120	0.220183492	7.042253521	5.555555556	94.87179487	53.52112676	44.85981308	92.30769231	133.1064921	9380.979094	0.210045666	5.376344086	8.045977011	87.17948718	54.34782609	47.12643678	82.05128205	444.5605361	255.7316817
Epochs 140	0.201834857	6.41025641	5.769230769	91.66666667	51.28205128	46.60194175	88.88888889	183.2690508	9380.979094	0.19178082	4.95049505	8.43373494	85.71428571	53	46.98795181	80	235.917515	255.7316817
Epochs 160	0.215596333	5.882352941	5.434782609	90.24390244	50.58823529	45.05494505	82.92682927	437.3192792	9380.979094	0.242009133	5	7.246376812	86	54.54545455	46.37681159	82	322.4261871	255.7316817
Epochs 180	0.266055048	7.246376812	5.154639175	92.30769231	52.17391304	44.79166667	82.69230769	231.0914702	9380.979094	0.278538823	5.747126437	8.974358974	90.74074074	55.81395349	44.87179487	87.03703704	347.8241843	255.7316817
Epochs 200	0.284403682	5.172413793	5.882352941	91.37931034	51.72413793	43.56435644	84.48275862	148.8078357	9380.979094	0.292237431	5.063291139	8.641975309	89.83050847	57.69230769	48.14814815	86.44067797	277.5151834	255.7316817
Fresh Del Monte Produce Inc (small cap)Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.169724777	6.722689076	6.944444444	88.88888889	38.13559322	41.66666667	81.48148148	14.39054457	5.320148705	0.132420093	5.6	6.666666667	89.47368421	50	46.66666667	73.68421053	-13.94723276	-65.97131265
Epochs 40	0.169724777	8.791208791	8.571428571	90.90909091	43.95604396	42.85714286	76.19047619	362.9220425	5.320148705	0.09589041	5.607476636	6	75	50.94339623	48	58.33333333	89.90672968	-65.97131265
Epochs 60	0.188073397	9.87654321	8.108108108	92.30769231	46.91358025	44.14414414	84	432.1779464	5.320148705	0.12328767	6.25	5.714285714	83.33333333	51.57894737	46.66666667	66.66666667	-18.62044826	-65.97131265
Epochs 80	0.192660555	9.89010989	8.823529412	96	46.66666667	47.05882353	92	368.7318044	5.320148705	0.127853885	6.060606061	6	80	51.02040816	47	70	-26.57976423	-65.97131265
Epochs 100	0.206422016	9.411764706	7.920792079	90.625	47.05882353	45.54455446	83.87096774	312.9130277	5.320148705	0.182648405	6.52173913	6.451612903	82.35294118	53.84615385	48.38709677	70.58823529	-37.68998489	-65.97131265
Epochs 120	0.224770635	9.459459459	7.547169811	89.47368421	47.2972973	45.28301887	81.08108108	2132.278893	5.320148705	0.210045666	7.228915663	7.142857143	86.84210526	54.87804878	48.97959184	71.05263158	-60.37305557	-65.97131265
Epochs 140	0.206422016	9.523809524	7.843137255	90.625	47.61904762	46.07843137	83.87096774	413.9568978	5.320148705	0.232876718	7.692307692	8.988764045	92.30769231	54.44444444	51.68539326	76.92307692	-14.14890025	-65.97131265
Epochs 160	0.261467904	9.638554217	8.791208791	93.18181818	45.78313253	46.15384615	86.04651163	102.1864574	5.320148705	0.273972601	6.382978723	9.589041096	90.38461538	54.83870968	57.53424658	76.92307692	47.33376664	-65.97131265
Epochs 180	0.275229365	7.575757576	8	90.38461538	43.93939394	48	86.2745098	276.2760998	5.320148705	0.315068483	7.042253521	9.302325581	90.32258065	52.85714286	53.48837209	75.80645161	-41.28685194	-65.97131265
Epochs 200	0.30733946	8.928571429	7.843137255	90	44.64285714	48.03921569	84.74576271	1142.375546	5.320148705	0.319634706	7.352941176	9.090909091	90.47619048	58.20895522	54.54545455	77.77777778	-8.794723659	-65.97131265

Table 13-4 Results of 25 Percent More Hold Class CNN Models , Non-Cyclic Stocks

Singapore Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.133027524	9.090909091	4.464285714	88.88888889	51.13636364	39.63963964	77.77777778	25.98085819	-64.15459983	0.134883717	6.25	7.058823529	88.88888889	47.32142857	54.76190476	88.88888889	-71.84545173	-78.23835547
Epochs 40	0.16055046	9.375	6.930693069	90.47619048	50.52631579	43.56435644	76.19047619	-87.33658466	-64.15459983	0.134883717	5.737704918	9.090909091	93.75	47.54098361	57.89473684	81.25	-84.13938865	-78.23835547
Epochs 60	0.211009175	9.375	7.777777778	93.75	51.57894737	43.33333333	78.125	-83.94048791	-64.15459983	0.176744193	5.263157895	8.333333333	89.65517241	46.49122807	59.15492958	82.75862069	-79.53530292	-78.23835547
Epochs 80	0.247706428	9.89010989	7.058823529	92.85714286	53.33333333	42.35294118	80.95238095	-80.31161188	-64.15459983	0.213953495	5.357142857	9.230769231	89.47368421	45.53571429	59.375	84.21052632	-78.93244796	-78.23835547
Epochs 100	0.188073397	8.411214953	7.317073171	89.65517241	51.88679245	42.68292683	72.4137931	-85.58731125	-64.15459983	0.16744186	5.64516129	7.8125	88.88888889	44.35483871	57.14285714	88.88888889	-84.30373494	-78.23835547

Epochs 120	0.233944952	8.163265306	7.594936709	90.24390244	53.60824742	45.56962025	78.04878049	-76.55687984	-64.15459983	0.195348844	5.128205128	7.936507937	88.57142857	43.58974359	54.83870968	85.71428571	-64.63376398	-78.23835547
Epochs 140	0.247706428	7.52688172	7.594936709	89.13043478	54.34782609	44.30379747	78.26086957	318.7284972	-64.15459983	0.227906972	4.672897196	7.8125	88.63636364	44.85981308	53.96825397	84.09090909	-56.1181394	-78.23835547
Epochs 160	0.270642191	6.896551724	7.692307692	88.67924528	55.17241379	43.58974359	78.84615385	413.5179709	-64.15459983	0.232558146	4.854368932	7.462686567	88.88888889	45.63106796	57.57575758	84.44444444	-2.759239634	-78.23835547
Epochs 180	0.215596333	7.865168539	6.666666667	87.17948718	55.68181818	48.88888889	82.05128205	444.9473938	-64.15459983	0.209302321	3.96039604	8.108108108	87.5	44.55445545	56.16438356	85	-51.53178673	-78.23835547
Epochs 200	0.275229365	7.594936709	7.058823529	88.88888889	55.69620253	47.05882353	81.13207547	553.3998922	-64.15459983	0.255813956	4.301075269	8.333333333	90	44.08602151	56.33802817	88	28.487962	-78.23835547
OCBC Bank Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.123853214	5.825242718	8	86.66666667	53.39805825	51.51515152	86.66666667	-91.61651433	-55.90202866	0.125581399	8.181818182	9.473684211	90	51.81818182	53.19148936	90	4.270737866	-24.56291964
Epochs 40	0.096330278	6.796116505	7.476635514	75	55.33980583	55.66037736	62.5	-95.42891111	-55.90202866	0.153488368	8.333333333	9.89010989	93.75	52.77777778	56.66666667	93.75	-6.574788583	-24.56291964
Epochs 60	0.137614682	7.070707071	7.843137255	88.23529412	55.55555556	58.41584158	82.35294118	-95.90135309	-55.90202866	0.218604654	7.692307692	11.53846154	90.90909091	53.84615385	57.14285714	87.87878788	-39.70369719	-24.56291964
Epochs 80	0.146788985	6.25	7.920792079	85.71428571	54.16666667	60	80.95238095	-95.50855583	-55.90202866	0.232558146	5.050505051	12.16216216	85.71428571	52.52525253	60.2739726	80.95238095	2.72763727	-24.56291964
Epochs 100	0.128440365	6.603773585	7.291666667	87.5	54.71698113	58.94736842	75	-93.45125913	-55.90202866	0.209302321	6.542056075	12	87.87878788	52.3364486	60.81081081	84.84848485	-23.74082499	-24.56291964
Epochs 120	0.142201841	5.940594059	7.368421053	81.81818182	55.44554455	59.57446809	68.18181818	-94.72104365	-55.90202866	0.260465115	5.263157895	11.42857143	86	54.73684211	60.86956522	82	19.56715403	-24.56291964
Epochs 140	0.155963302	4.494382022	7	79.31034483	53.93258427	56.56565657	68.96551724	-95.7024447	-55.90202866	0.28372094	4.705882353	10.81081081	87.5	54.11764706	60.2739726	83.92857143	-10.99545558	-24.56291964
Epochs 160	0.165137619	5.681818182	6.930693069	82.75862069	55.68181818	55	75.86206897	-96.89177551	-55.90202866	0.306976736	5.128205128	9.459459459	87.3015873	55.12820513	58.90410959	84.12698413	-13.47124419	-24.56291964
Epochs 180	0.146788985	5.882352941	6.481481481	80	56.47058824	54.20560748	72	-96.69418307	-55.90202866	0.269767433	4.938271605	9.756097561	88.46153846	55.55555556	55.55555556	84.61538462	-7.247043836	-24.56291964
Epochs 200	0.16055046	6.024096386	6.542056075	82.14285714	56.62650602	53.77358491	75	-96.83315131	-55.90202866	0.302325577	5.194805195	9.210526316	87.09677419	55.84415584	58.66666667	83.87096774	-9.227337957	-24.56291964
CNOOC Limited Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.109004736	3.883495146	4.395604396	88.23529412	47.57281553	50	70.58823529	100.2995012	-54.68960087	0.136150241	6.603773585	7.692307692	93.75	42.45283019	50	81.25	-25.19455068	-84.2898875
Epochs 40	0.07109005	3.47826087	6.593406593	100	50.43478261	54.44444444	100	-27.55495145	-54.68960087	0.117370889	5.982905983	8.235294118	100	47.00854701	54.76190476	81.81818182	-46.65099945	-84.2898875
Epochs 60	0.113744073	3.636363636	7.142857143	82.35294118	51.81818182	55.95238095	68.75	71.11548335	-54.68960087	0.164319247	6.25	8.75	100	44.64285714	51.89873418	90.47619048	-71.43969991	-84.2898875
Epochs 80	0.146919429	3.773584906	7.407407407	87.5	52.83018868	54.32098765	73.91304348	39.38425859	-54.68960087	0.21596244	6.542056075	9.459459459	100	45.79439252	47.94520548	87.5	-73.63487895	-84.2898875
Epochs 100	0.09952607	4.201680672	6.41025641	78.57142857	50.42016807	51.94805195	78.57142857	72.26058411	-54.68960087	0.159624413	5.882352941	9.459459459	100	45.37815126	50.68493151	90	-70.61079725	-84.2898875
Epochs 120	0.17061612	4.587155963	8	92.59259259	53.21100917	54.05405405	74.07407407	100.6646036	-54.68960087	0.220657274	6.363636364	10	100	44.54545455	50.72463768	87.87878788	-68.464631	-84.2898875
Epochs 140	0.19905214	4.04040404	7.792207792	91.42857143	53.53535354	51.31578947	77.14285714	110.2680953	-54.68960087	0.225352108	6.930693069	8.974358974	100	44.55445545	48.05194805	85.29411765	-72.48819024	-84.2898875
Epochs 160	0.222748816	4.255319149	7.792207792	92.5	53.19148936	51.31578947	77.5	97.67712965	-54.68960087	0.244131461	7.216494845	7.894736842	97.5	44.32989691	45.33333333	82.5	-71.11921238	-84.2898875
Epochs 180	0.208530799	4.494382022	8.045977011	94.28571429	51.68539326	51.1627907	80	91.92934745	-54.68960087	0.201877937	7.216494845	7.058823529	96.77419355	44.32989691	48.80952381	80.64516129	-65.74533681	-84.2898875
Epochs 200	0.270142168	4.938271605	8.641975309	93.87755102	53.08641975	50	83.67346939	62.67448331	-54.68960087	0.234741777	7.52688172	7.317073171	97.36842105	45.16129032	46.91358025	81.57894737	-65.76768376	-84.2898875
JP Morgan Test Set	Non-Recession									Recession								

	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.110091746	10.46511628	3.361344538	84.61538462	46.51162791	43.22033898	76.92307692	5347.085414	1576.179166	0.127853885	8.24742268	9.821428571	90	45.83333333	48.21428571	90	92.0619541	-31.90034799
Epochs 40	0.077981651	11.36363636	3.174603175	75	47.72727273	45.6	75	545.5771053	1576.179166	0.118721463	8.108108108	9.900990099	100	49.09090909	53.46534653	100	-24.17251642	-31.90034799
Epochs 60	0.110091746	12.34567901	3.149606299	100	50.61728395	46.82539683	100	635.6681489	1576.179166	0.219178081	8.737864078	12.5	100	51.45631068	57.95454545	96.2962963	52.41674371	-31.90034799
Epochs 80	0.114678897	12.04819277	3.225806452	100	50.60240964	46.34146341	100	552.6214672	1576.179166	0.237442926	8.24742268	12.5	97.05882353	51.54639175	59.09090909	93.93939394	3.157766963	-31.90034799
Epochs 100	0.087155961	10.98901099	3.278688525	100	49.45054945	47.10743802	100	89.52338433	1576.179166	0.19178082	7.407407407	12.64367816	95.83333333	47.6635514	59.77011494	87.5	855.2724839	-31.90034799
Epochs 120	0.114678897	11.49425287	3.361344538	91.66666667	51.72413793	47.45762712	91.66666667	725.4265025	1576.179166	0.246575341	9	13.25301205	94.44444444	51	59.03614458	85.71428571	740.7776602	-31.90034799
Epochs 140	0.128440365	12.34567901	4.06504065	92.85714286	54.32098765	48.36065574	92.85714286	754.9487649	1576.179166	0.242009133	8.888888889	10.98901099	92.10526316	51.11111111	56.04395604	81.08108108	762.4741446	-31.90034799
Epochs 160	0.123853214	11.53846154	3.225806452	87.5	52.56410256	47.96747967	87.5	760.0863145	1576.179166	0.242009133	8.045977011	10.75268817	92.30769231	50.57471264	56.98924731	81.57894737	289.3666588	-31.90034799
Epochs 180	0.091743119	10.81081081	3.703703704	77.77777778	52.7027027	46.26865672	77.77777778	633.937432	1576.179166	0.200913236	8.43373494	10.18518519	92.85714286	46.98795181	55.14018692	85.71428571	143.1639939	-31.90034799
Epochs 200	0.133027524	11.5942029	3.816793893	88.88888889	53.62318841	46.15384615	83.33333333	920.6861368	1576.179166	0.255707771	8.974358974	10.89108911	95	46.15384615	55.44554455	87.17948718	131.8172838	-31.90034799
American Axle (small cap) Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.146788985	3.921568627	6.52173913	91.66666667	44.11764706	49.45054945	79.16666667	-41.78212966	-40.19620025	0.168949768	10.86956522	8.333333333	94.73684211	50.54945055	54.62962963	89.47368421	-5.892671215	-32.50977019
Epochs 40	0.091743119	4.761904762	6.730769231	88.88888889	44.76190476	50.48543689	77.77777778	-65.18886751	-40.19620025	0.159817353	10.20408163	8.571428571	100	52.57731959	56.19047619	87.5	-37.53519757	-32.50977019
Epochs 60	0.128440365	4.04040404	7.070707071	85	44.44444444	52.52525253	78.94736842	-66.7222078	-40.19620025	0.210045666	10.22727273	8.080808081	90.625	56.32183908	58.58585859	84.375	83.96400859	-32.50977019
Epochs 80	0.169724777	4.166666667	7.52688172	89.65517241	45.83333333	51.61290323	85.71428571	4.1801272	-40.19620025	0.237442926	10.58823529	8.421052632	89.74358974	55.95238095	56.84210526	82.05128205	112.356243	-32.50977019
Epochs 100	0.16055046	5.454545455	8.333333333	91.66666667	44.95412844	53.57142857	83.33333333	112.0195627	-40.19620025	0.200913236	10.30927835	8.510638298	92.85714286	51.04166667	53.19148936	82.14285714	-15.89556851	-32.50977019
Epochs 120	0.192660555	5.825242718	7.317073171	90.90909091	46.60194175	52.43902439	84.375	201.7562017	-40.19620025	0.260273963	10.46511628	8.045977011	89.13043478	52.94117647	52.87356322	80.43478261	-2.413521735	-32.50977019
Epochs 140	0.197247714	4.166666667	7.058823529	89.18918919	46.875	51.76470588	83.33333333	303.4265008	-40.19620025	0.246575341	9.638554217	8.602150538	88.37209302	52.43902439	52.68817204	79.06976744	41.77658884	-32.50977019
Epochs 160	0.211009175	3.333333333	6.976744186	88.0952381	46.66666667	52.3255814	85.36585366	142.6877532	-40.19620025	0.255707771	10.12658228	8.421052632	88.88888889	53.84615385	52.63157895	80	54.73802769	-32.50977019
Epochs 180	0.188073397	3.448275862	7.291666667	88.57142857	47.12643678	52.08333333	85.29411765	136.1187811	-40.19620025	0.232876718	10	8.080808081	87.5	55.69620253	51.51515152	82.5	67.28020373	-32.50977019
Epochs 200	0.201834857	3.529411765	6.52173913	85.36585366	48.23529412	52.17391304	82.5	134.4673044	-40.19620025	0.264840186	10.66666667	8.24742268	89.36170213	56.75675676	52.57731959	82.9787234	112.7179253	-32.50977019

Table 13-5 Results of 25 Percent More Sell Class CNN Models , Cyclic Stocks

Kweichow Moutai Co., Ltd. Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.082125604	7.857142857	7.575757576	100	47.48201439	46.96969697	100	4138.656589	1666.892281	0.0625	6.201550388	6.329113924	0	39.0625	45.56962025	0	466.7748104	678.7940879
Epochs 40	0.101449274	12.5	8.403361345	0	54.54545455	49.15254237	0	1694.926545	1666.892281	0.091346152	11.76470588	5.882352941	75	51.47058824	49.62962963	50	326.9588789	678.7940879
Epochs 60	0.135265693	14.47368421	8.064516129	100	55.26315789	47.15447154	100	2588.643901	1666.892281	0.100961536	11.94029851	5.925925926	83.33333333	53.73134328	50	50	282.6507025	678.7940879
Epochs 80	0.202898547	15.06849315	8.108108108	95.65217391	54.79452055	49.54954955	86.36363636	4917.212516	1666.892281	0.139423072	12.6984127	6.106870229	92.85714286	56.4516129	48.09160305	57.14285714	272.7848351	678.7940879
Epochs 100	0.217391297	14.28571429	8.653846154	96.15384615	55.26315789	51.92307692	88.46153846	7024.129799	1666.892281	0.15865384	12.5	5.64516129	90	52.38095238	49.19354839	65	185.9583512	678.7940879
Epochs 120	0.256038636	16.12903226	8.256880734	94.44444444	60.6557377	48.62385321	88.88888889	5080.628847	1666.892281	0.201923072	14.81481481	5.6	93.10344828	57.40740741	47.2	71.42857143	108.8827952	678.7940879
Epochs 140	0.217391297	15.71428571	8.108108108	96.15384615	57.97101449	46.84684685	92.30769231	4629.91431	1666.892281	0.182692304	14.03508772	5.511811024	95.83333333	56.14035088	49.60629921	73.91304348	145.423463	678.7940879
Epochs 160	0.256038636	16.66666667	8.411214953	97.05882353	58.46153846	45.79439252	94.11764706	4567.578075	1666.892281	0.201923072	12.5	5.691056911	96.55172414	57.14285714	49.59349593	82.14285714	135.903821	678.7940879
Epochs 180	0.265700489	16.66666667	8.571428571	97.22222222	56.92307692	45.71428571	94.44444444	4462.809766	1666.892281	0.206730768	11.86440678	5.882352941	96.66666667	52.54237288	50.42016807	75.86206897	242.3194297	678.7940879
Epochs 200	0.289855063	17.1875	8	95.34883721	58.73015873	47	90.69767442	4307.85447	1666.892281	0.21634616	12.28070175	5.882352941	96.875	54.38596491	50.42016807	77.41935484	268.0382433	678.7940879

Midea Group Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.067632847	7.142857143	5.970149254	0	51.79856115	55.2238806	0	71022.77173	1245.275482	0.043269232	5.223880597	1.369863014	100	44.02985075	48.61111111	100	94.24028395	468.5733088
Epochs 40	0.106280193	9.183673469	8.571428571	100	58.16326531	52.88461538	100	19395.47674	1245.275482	0.067307696	6.976744186	5.042016807	66.66666667	52.3255814	51.69491525	66.66666667	113.0295505	468.5733088
Epochs 60	0.164251208	9.87654321	8.333333333	94.44444444	58.02469136	54.20560748	72.22222222	32107.04589	1245.275482	0.091346152	7.894736842	4.838709677	87.5	57.89473684	54.47154472	87.5	80.96028627	468.5733088
Epochs 80	0.217391297	10.97560976	9.278350515	96.42857143	57.31707317	53.60824742	74.07407407	103857.2498	1245.275482	0.125	8	4.310344828	88.23529412	58.66666667	54.31034483	87.5	94.80839605	468.5733088
Epochs 100	0.227053136	10.22727273	10.11235955	96.66666667	59.09090909	57.30337079	79.31034483	49513.18451	1245.275482	0.115384616	7.692307692	4.347826087	86.66666667	58.97435897	55.26315789	86.66666667	52.90602716	468.5733088
Epochs 120	0.275362313	11.76470588	9.183673469	97.56097561	63.23529412	53.06122449	80	91483.88348	1245.275482	0.144230768	7.142857143	5.128205128	90.47619048	58.57142857	53.84615385	90	70.38391409	468.5733088
Epochs 140	0.222222224	10.38961039	9	96.66666667	63.15789474	54	80	119069.1048	1245.275482	0.125	6.849315068	5.128205128	83.33333333	56.16438356	52.99145299	82.35294118	39.02876308	468.5733088
Epochs 160	0.265700489	11.11111111	9.375	97.43589744	63.38028169	53.125	79.48717949	69748.8075	1245.275482	0.139423072	7.142857143	5.128205128	85.71428571	57.14285714	53.84615385	85	103.0630375	468.5733088
Epochs 180	0.265700489	10.95890411	8.602150538	95.12195122	63.88888889	53.76344086	78.04878049	62448.28907	1245.275482	0.15384616	7.142857143	5.263157895	87.5	55.71428571	54.38596491	86.95652174	73.71433757	468.5733088
Epochs 200	0.280193239	11.42857143	9.473684211	97.61904762	63.76811594	54.73684211	80.95238095	66535.00232	1245.275482	0.173076928	7.142857143	4.62962963	86.66666667	55.71428571	54.62962963	86.20689655	22.53954565	468.5733088

Walmart Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.059633028	4.861111111	8.108108108	0	41.66666667	38.35616438	0	28.42702731	9380.979094	0.059360731	4.458598726	9.677419355	0	48.71794872	50	0	92.81322262	255.7316817
Epochs 40	0.068807341	5.102040816	6.779661017	100	50	45.2991453	100	130.2393884	9380.979094	0.091324203	5.128205128	9.278350515	100	52.5862069	48.45360825	80	349.5219726	255.7316817
Epochs 60	0.114678897	5.952380952	6.557377049	100	51.19047619	45.45454545	100	170.9531486	9380.979094	0.132420093	5.660377358	9.090909091	100	52.38095238	47.47474747	92.85714286	344.6713968	255.7316817
Epochs 80	0.165137619	6.329113924	6.140350877	96	55.69620253	43.36283186	96	137.2322802	9380.979094	0.178082198	5.154639175	10.30927835	96	52.08333333	46.39175258	88	410.4443277	255.7316817

Epochs 100	0.183486238	6.976744186	6.796116505	93.10344828	53.48837209	46.07843137	89.65517241	308.1567318	9380.979094	0.196347028	5.050505051	10.11235955	93.5483871	52.04081633	47.19101124	93.5483871	257.3916708	255.7316817
Epochs 120	0.206422016	5.970149254	6.140350877	91.89189189	52.23880597	45.13274336	83.78378378	219.6448425	9380.979094	0.237442926	5.063291139	9.183673469	92.85714286	53.16455696	44.89795918	80.48780488	380.1157495	255.7316817
Epochs 140	0.174311921	5	6.422018349	93.10344828	51.25	44.44444444	89.65517241	151.2584189	9380.979094	0.19178082	4.395604396	10.30927835	90.32258065	53.33333333	46.39175258	80.64516129	485.1859721	255.7316817
Epochs 160	0.188073397	5.263157895	7.207207207	93.5483871	52.63157895	45.45454545	90.32258065	148.4194303	9380.979094	0.210045666	3.571428571	10.20408163	89.18918919	53.57142857	45.91836735	77.77777778	537.0291887	255.7316817
Epochs 180	0.192660555	5	7.476635514	96.77419355	50	46.22641509	90.32258065	149.3490999	9380.979094	0.223744288	3.614457831	10.41666667	90	54.21686747	44.79166667	79.48717949	644.6169053	255.7316817
Epochs 200	0.206422016	5.263157895	7.476635514	94.28571429	51.31578947	46.22641509	85.71428571	201.8954492	9380.979094	0.219178081	3.75	10	89.74358974	56.25	45	78.94736842	517.948007	255.7316817
Fresh Del Monte Produce Inc (small cap)Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.073394492	6.41025641	8.333333333	50	40.64516129	48.33333333	50	-7.364721352	5.320148705	0.059360731	6.12244898	5.555555556	0	48.63013699	45.83333333	0	-9.244043122	-65.97131265
Epochs 40	0.133027524	9.473684211	8.849557522	100	46.31578947	46.42857143	100	299.7595489	5.320148705	0.06849315	5.882352941	6.140350877	66.66666667	49.5049505	44.73684211	66.66666667	49.62780318	-65.97131265
Epochs 60	0.188073397	10.58823529	9.009009009	100	47.05882353	47.27272727	100	411.1420593	5.320148705	0.114155248	6.741573034	6.034482759	85.71428571	52.27272727	45.68965517	85.71428571	84.8362621	-65.97131265
Epochs 80	0.211009175	10.71428571	7.843137255	90.625	48.80952381	49.01960784	90.32258065	502.9767439	5.320148705	0.168949768	6.741573034	6.796116505	88.88888889	52.27272727	47.57281553	81.48148148	10.47098656	-65.97131265
Epochs 100	0.211009175	10.22727273	7.216494845	90.90909091	48.86363636	49.48453608	90.625	97.23943529	5.320148705	0.168949768	7.216494845	6.382978723	85.71428571	51.04166667	48.93617021	78.57142857	74.16108392	-65.97131265
Epochs 120	0.252293587	8.955223881	6.796116505	87.5	47.76119403	47.57281553	85.10638298	115.959794	5.320148705	0.223744288	9.333333333	7.547169811	89.47368421	55.40540541	50	81.57894737	-47.15939323	-65.97131265
Epochs 140	0.252293587	10.25641026	8.163265306	92.85714286	50	51.02040816	90.24390244	100.6118584	5.320148705	0.196347028	9.302325581	8.571428571	92.85714286	54.11764706	50.47619048	85.71428571	-18.00271703	-65.97131265
Epochs 160	0.298165143	10.9375	6.18556701	91.22807018	48.4375	47.42268041	85.71428571	-36.41092964	5.320148705	0.205479458	8.75	8.411214953	90.625	53.16455696	50.46728972	81.25	-52.54280293	-65.97131265
Epochs 180	0.316513747	11.76470588	5.617977528	91.80327869	47.05882353	47.19101124	86.66666667	-85.12889315	5.320148705	0.200913236	8.235294118	8.737864078	90.32258065	54.76190476	52.42718447	80.64516129	-7.380389973	-65.97131265
Epochs 200	0.32110092	9.230769231	5.813953488	88.05970149	47.69230769	48.8372093	83.33333333	-75.64092154	5.320148705	0.200913236	7.228915663	8.737864078	87.87878788	54.87804878	50.48543689	78.78787879	3.138492436	-65.97131265

Table 13-6 Results of 25 Percent More Sell Class CNN Models , Non-Cyclic Stocks

Singapore Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.082568809	7.547169811	5.555555556	100	50.94339623	42.99065421	75	164.4837106	-64.15459983	0.106976748	6.034482759	6.896551724	83.33333333	41.73913043	50.57471264	83.33333333	-96.38586863	-78.23835547
Epochs 40	0.133027524	10	6.4	100	52.5	45.96774194	100	90.47952301	-64.15459983	0.14418605	6.542056075	8.695652174	100	47.6635514	57.14285714	100	-91.44234488	-78.23835547
Epochs 60	0.137614682	9.302325581	7.56302521	100	56.97674419	48.30508475	100	-71.02419053	-64.15459983	0.130232558	6.140350877	9.090909091	100	47.36842105	58.62068966	100	-80.77861764	-78.23835547
Epochs 80	0.201834857	9.638554217	8.411214953	96.42857143	54.21686747	49.53271028	92.59259259	257.1720639	-64.15459983	0.181395352	6.542056075	9.523809524	100	48.59813084	59.03614458	95.83333333	-85.31355519	-78.23835547
Epochs 100	0.192660555	9.523809524	8.333333333	96.15384615	54.76190476	50.92592593	92	270.0388674	-64.15459983	0.19069767	5.769230769	9.638554217	96.42857143	50	60.97560976	89.28571429	-82.49757765	-78.23835547
Epochs 120	0.211009175	9.090909091	8.910891089	100	52.27272727	51	89.65517241	234.8048452	-64.15459983	0.19069767	5.660377358	9.87654321	96.42857143	47.16981132	62.5	89.28571429	-84.52765808	-78.23835547
Epochs 140	0.284403682	7.692307692	11.39240506	95.83333333	53.84615385	53.16455696	80.85106383	272.6946334	-64.15459983	0.251162797	4.854368932	9.230769231	91.4893617	45.63106796	59.375	85.10638298	-60.64150365	-78.23835547
Epochs 160	0.252293587	7.52688172	10.58823529	97.5	53.76344086	54.76190476	80	350.7749791	-64.15459983	0.227906972	4.854368932	8.571428571	90.47619048	45.63106796	62.31884058	80.95238095	-83.09634272	-78.23835547

Epochs 180	0.32110092	7.865168539	12.32876712	96.42857143	50.56179775	53.42465753	81.81818182	317.8629105	-64.15459983	0.28372094	5.102040816	9.523809524	92.59259259	44.89795918	62.90322581	83.33333333	-83.86890027	-78.23835547
Epochs 200	0.325688064	7.954545455	11.26760563	94.91525424	52.27272727	50.70422535	81.03448276	455.9843608	-64.15459983	0.260465115	4.95049505	7.936507937	90.19607843	45.54455446	62.90322581	80.39215686	-86.6446229	-78.23835547
OCBC Bank Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.077981651	6.25	6.862745098	75	50	49.5049505	75	-76.93885251	-55.90202866	0.097674422	8.26446281	7.777777778	100	50.41322314	51.68539326	100	-7.648174343	-24.56291964
Epochs 40	0.105504587	7.865168539	7.438016529	87.5	56.17977528	50	87.5	-73.75776175	-55.90202866	0.111627907	6.603773585	8.333333333	69.23076923	51.88679245	54.73684211	69.23076923	4.990273466	-24.56291964
Epochs 60	0.114678897	7.608695652	7.75862069	90	57.60869565	53.91304348	90	-86.54581874	-55.90202866	0.130232558	8.181818182	9.574468085	90.90909091	52.72727273	58.06451613	90.90909091	-23.92732558	-24.56291964
Epochs 80	0.146788985	7.608695652	8.256880734	94.11764706	55.43478261	52.77777778	94.11764706	-90.95805307	-55.90202866	0.158139542	6.730769231	10	85.71428571	51.92307692	59.5505618	85.71428571	-36.10568141	-24.56291964
Epochs 100	0.155963302	7.865168539	8.181818182	94.73684211	56.17977528	55.04587156	94.73684211	-88.60530883	-55.90202866	0.16744186	6.18556701	9.677419355	84	52.57731959	58.69565217	84	-7.23297797	-24.56291964
Epochs 120	0.169724777	7.777777778	7.619047619	95.65217391	57.77777778	53.84615385	86.95652174	-96.78766565	-55.90202866	0.195348844	6.451612903	9.89010989	87.09677419	52.68817204	57.77777778	83.87096774	-9.596364605	-24.56291964
Epochs 140	0.201834857	7.692307692	7.446808511	90.90909091	58.24175824	54.83870968	78.78787879	-86.48181038	-55.90202866	0.288372099	6.666666667	10	89.09090909	52.22222222	55.07246377	87.27272727	-35.77246317	-24.56291964
Epochs 160	0.188073397	8.421052632	8.24742268	96.15384615	58.94736842	55.20833333	84.61538462	-55.56772748	-55.90202866	0.269767433	6.818181818	9.210526316	88.23529412	52.27272727	58.66666667	86.2745098	-34.97030286	-24.56291964
Epochs 180	0.188073397	8.421052632	5.494505495	87.5	56.84210526	52.74725275	77.41935484	-75.83140051	-55.90202866	0.297674417	6.818181818	8.823529412	88.13559322	51.13636364	55.2238806	88.13559322	-40.40998919	-24.56291964
Epochs 200	0.197247714	8.421052632	5.617977528	88.23529412	55.78947368	53.93258427	78.78787879	-54.86474632	-55.90202866	0.302325577	6.896551724	6.25	85.9375	51.72413793	56.25	85.71428571	-35.19540041	-24.56291964
CNOOC Limited Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.056872036	2.586206897	4.444444444	100	46.55172414	48.31460674	80	-2.891904301	-54.68960087	0.103286386	5.128205128	8.139534884	90	41.02564103	48.23529412	90	-70.80138133	-84.2898875
Epochs 40	0.09952607	2.97029703	5.208333333	92.85714286	51.48514851	51.57894737	78.57142857	14.10023313	-54.68960087	0.12206573	7.368421053	7.476635514	100	43.15789474	50.94339623	81.81818182	-69.78973629	-84.2898875
Epochs 60	0.080568723	2.678571429	5.747126437	75	50	54.65116279	66.66666667	-9.590316214	-54.68960087	0.112676054	6.730769231	8	100	46.15384615	53.53535354	77.77777778	-73.31058893	-84.2898875
Epochs 80	0.123222746	3.703703704	7.058823529	88.88888889	51.85185185	53.57142857	77.77777778	174.1596942	-54.68960087	0.17840375	7.142857143	8.695652174	100	47.95918367	54.94505495	86.95652174	-69.83848812	-84.2898875
Epochs 100	0.123222746	3.80952381	6.818181818	88.88888889	54.28571429	52.87356322	72.22222222	226.6964387	-54.68960087	0.159624413	7.142857143	8.333333333	100	46.93877551	53.68421053	84.21052632	-70.03050935	-84.2898875
Epochs 120	0.151658773	3.846153846	6.172839506	88.46153846	53.84615385	55	69.23076923	228.8876834	-54.68960087	0.211267605	7.608695652	7.865168539	96.875	47.82608696	51.13636364	81.25	-87.0793253	-84.2898875
Epochs 140	0.218009472	3.883495146	6.25	86.36363636	54.36893204	53.96825397	75	89.49210152	-54.68960087	0.262910783	8.695652174	6.666666667	93.47826087	48.91304348	54.05405405	82.60869565	-73.37860114	-84.2898875
Epochs 160	0.218009472	4	5.882352941	88.37209302	53	50.74626866	76.74418605	72.46640537	-54.68960087	0.239436626	8.695652174	6.25	92.68292683	46.73913043	53.16455696	78.04878049	-82.52521757	-84.2898875
Epochs 180	0.232227489	4	6.25	87.23404255	53	50.79365079	74.46808511	76.21588768	-54.68960087	0.28638497	8.791208791	5.797101449	92.45283019	45.05494505	52.94117647	81.13207547	-80.69686482	-84.2898875
Epochs 200	0.260663509	4.081632653	6.666666667	88.67924528	53.06122449	49.15254237	75.47169811	66.47656465	-54.68960087	0.267605633	8.602150538	5.633802817	91.83673469	46.23655914	51.42857143	81.63265306	-82.58446873	-84.2898875
JP Morgan Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.077981651	8.910891089	3.539823009	100	44	44.24778761	100	5388.757245	1576.179166	0.12328767	7.207207207	9.278350515	90.90909091	43.63636364	50.51546392	72.72727273	261.6458854	-31.90034799
Epochs 40	0.096330278	11.36363636	4.032258065	100	46.59090909	45.52845528	100	2313.320154	1576.179166	0.159817353	8.602150538	9.259259259	94.44444444	46.73913043	50	88.88888889	189.6688832	-31.90034799

Epochs 60	0.077981651	11.36363636	3.90625	100	47.72727273	46.45669291	100	251.1026929	1576.179166	0.16438356	8.24742268	9.708737864	94.73684211	47.91666667	49.51456311	89.47368421	-36.63848435	-31.90034799
Epochs 80	0.105504587	11.49425287	3.305785124	90	47.6744186	46.28099174	80	427.0866599	1576.179166	0.246575341	8.510638298	11.36363636	97.2972973	47.87234043	53.40909091	86.11111111	11.94005948	-31.90034799
Epochs 100	0.110091746	11.9047619	3.25203252	90.90909091	49.39759036	46.34146341	81.81818182	388.9848526	1576.179166	0.232876718	7.777777778	10.75268817	94.44444444	46.66666667	52.17391304	80.55555556	-19.86784972	-31.90034799
Epochs 120	0.155963302	12.04819277	3.50877193	95.23809524	51.2195122	47.36842105	90.47619048	458.0452751	1576.179166	0.246575341	7.865168539	10.11235955	92.68292683	46.06741573	52.27272727	75.6097561	-55.17050986	-31.90034799
Epochs 140	0.233944952	11.76470588	4.255319149	94.87179487	51.19047619	47.87234043	92.30769231	2605.002301	1576.179166	0.333333343	7.692307692	13.43283582	93.44262295	48.35164835	59.09090909	81.96721311	53.70382738	-31.90034799
Epochs 160	0.201834857	10.71428571	3.921568627	96.875	50.60240964	48.03921569	93.75	828.1713974	1576.179166	0.305936068	7.52688172	12.5	94.44444444	46.23655914	54.92957746	81.48148148	-1.666255816	-31.90034799
Epochs 180	0.211009175	10.34482759	4.12371134	97.05882353	48.8372093	48.45360825	91.17647059	692.7177278	1576.179166	0.328767121	7.692307692	13.23529412	93.33333333	47.25274725	55.2238806	80	67.34900698	-31.90034799
Epochs 200	0.220183492	10.34482759	4.255319149	94.59459459	51.1627907	46.80851064	89.18918919	730.5725144	1576.179166	0.337899536	7.777777778	13.43283582	93.5483871	46.66666667	56.06060606	80.64516129	67.34900698	-31.90034799
American Axle (small cap) Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.087155961	3.47826087	6.52173913	81.81818182	40.86956522	47.25274725	81.81818182	-94.18935197	-40.19620025	0.100456618	8.035714286	7.920792079	83.33333333	46.84684685	53.46534653	83.33333333	175.9404812	-32.50977019
Epochs 40	0.087155961	3.296703297	6.034482759	81.81818182	45.05494505	49.56521739	72.72727273	-31.01596089	-40.19620025	0.141552508	11.11111111	7.258064516	92.85714286	56.25	52.41935484	78.57142857	966.2227131	-32.50977019
Epochs 60	0.077981651	4.166666667	6.140350877	75	44.79166667	50.44247788	75	-40.34923855	-40.19620025	0.132420093	10.22727273	7.56302521	91.66666667	52.87356322	53.78151261	83.33333333	10.34411375	-32.50977019
Epochs 80	0.137614682	5.376344086	7.547169811	89.47368421	46.23655914	52.83018868	88.88888889	-57.52520076	-40.19620025	0.196347028	9.87654321	7.476635514	87.09677419	56.25	57.00934579	83.87096774	295.8691878	-32.50977019
Epochs 100	0.146788985	5.555555556	7.407407407	95	46.66666667	50.46728972	90	-15.77784851	-40.19620025	0.205479458	10.52631579	7.272727273	87.87878788	57.33333333	55.45454545	87.87878788	551.7410739	-32.50977019
Epochs 120	0.151376143	4.347826087	6.930693069	88	45.65217391	51.48514851	79.16666667	-77.27470243	-40.19620025	0.219178081	8.974358974	7.766990291	86.84210526	54.54545455	55.33980583	81.57894737	119.2264473	-32.50977019
Epochs 140	0.229357794	5.319148936	8.43373494	92.68292683	46.80851064	55.42168675	82.5	-10.76642185	-40.19620025	0.278538823	8.641975309	8.333333333	87.03703704	51.25	59.52380952	83.33333333	84.25066584	-32.50977019
Epochs 160	0.201834857	4.12371134	8.235294118	91.66666667	46.39175258	55.29411765	80	-24.47971397	-40.19620025	0.260273963	8.333333333	8.139534884	87.75510204	50.60240964	56.97674419	83.67346939	35.63037177	-32.50977019
Epochs 180	0.211009175	3.125	7.5	88.0952381	45.83333333	53.75	78.04878049	-62.52405708	-40.19620025	0.278538823	8.43373494	7.407407407	87.27272727	52.43902439	54.32098765	81.81818182	71.98974611	-32.50977019
Epochs 200	0.211009175	3.06122449	7.692307692	88.0952381	44.89795918	53.84615385	78.04878049	-41.9301721	-40.19620025	0.296803653	8.536585366	7.692307692	88.13559322	51.85185185	52.56410256	83.05084746	33.66982236	-32.50977019

Table 13-7 Results of 50 Percent More Buy Class CNN Models , Cyclic Stocks

Kweichow Moutai Co., Ltd. Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.173913047	10.29411765	7.826086957	83.33333333	51.47058824	48.24561404	79.16666667	2931.577322	1666.892281	0.134615391	9.836065574	6.106870229	87.5	52.45901639	49.23076923	81.25	1490.6798	678.7940879
Epochs 40	0.101449274	11.57894737	8.928571429	0	52.63157895	47.74774775	0	1324.085141	1666.892281	0.086538464	11.39240506	6.976744186	0	49.36708861	50	0	155.2034059	678.7940879
Epochs 60	0.14009662	12.65822785	7.692307692	90.90909091	53.16455696	47.4137931	81.81818182	2238.253525	1666.892281	0.115384616	12.5	6.569343066	100	57.14285714	48.90510949	85.71428571	273.4413297	678.7940879
Epochs 80	0.159420297	15.06849315	7.5	92.85714286	56.16438356	47.05882353	85.71428571	1572.308473	1666.892281	0.129807696	12.30769231	6.818181818	90.90909091	57.8125	49.24242424	90.90909091	250.3082975	678.7940879
Epochs 100	0.16908212	14.66666667	7.75862069	93.75	55.40540541	47.4137931	93.75	2248.709552	1666.892281	0.15865384	13.33333333	6.870229008	94.11764706	59.3220339	48.85496183	82.35294118	243.250268	678.7940879
Epochs 120	0.202898547	13.75	8.653846154	95.65217391	55.69620253	48.07692308	95.65217391	2531.951127	1666.892281	0.21634616	12.5	7.894736842	93.33333333	58.73015873	53.50877193	83.33333333	130.6380379	678.7940879

Epochs 140	0.299516916	15.25423729	8.080808081	91.83673469	52.54237288	48.48484848	85.41666667	1192.925977	1666.892281	0.293269217	12	8.256880734	93.87755102	60	55.04587156	83.33333333	136.8099594	678.7940879
Epochs 160	0.33816424	15.49295775	9.638554217	96.22641509	54.28571429	48.19277108	90.56603774	1385.380153	1666.892281	0.389423072	14.03508772	8.536585366	95.65217391	61.40350877	56.09756098	86.76470588	148.8712399	678.7940879
Epochs 180	0.275362313	15.27777778	8.421052632	95	54.92957746	49.47368421	90	1304.099326	1666.892281	0.322115391	14.03508772	9.090909091	96.15384615	59.64912281	55.55555556	86.2745098	142.4338369	678.7940879
Epochs 200	0.275362313	14.47368421	7.865168539	92.85714286	53.33333333	48.31460674	88.0952381	1273.8786	1666.892281	0.302884609	11.76470588	6.896551724	92.45283019	53.73134328	56.32183908	83.01886792	133.3345213	678.7940879
Midea Group Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.149758458	6.493506494	6.422018349	90.47619048	50.64935065	48.14814815	76.19047619	10593.69234	1245.275482	0.134615391	9.523809524	3.968253968	89.47368421	53.96825397	49.6	89.47368421	64.0011217	468.5733088
Epochs 40	0.082125604	8.163265306	8.256880734	0	55.10204082	53.7037037	0	30615.15741	1245.275482	0.067307696	7.52688172	6.086956522	0	53.76344086	53.50877193	0	178.0050323	468.5733088
Epochs 60	0.123853214	6.329113924	5.691056911	93.75	54.43037975	45.90163934	87.5	128.448527	9380.979094	0.091346152	7.692307692	4.918032787	87.5	57.69230769	53.71900826	87.5	54.79690237	468.5733088
Epochs 80	0.198067635	11.39240506	8.653846154	95.83333333	60.75949367	59.22330097	75	24972.81149	1245.275482	0.096153848	7.407407407	4.273504274	90	58.02469136	53.84615385	88.88888889	71.01726732	468.5733088
Epochs 100	0.227053136	12.98701299	8.823529412	100	61.03896104	61.38613861	85.71428571	177001.2413	1245.275482	0.115384616	7.594936709	5.128205128	100	58.2278481	54.7008547	100	64.7196375	468.5733088
Epochs 120	0.299516916	13.75	9.638554217	97.72727273	58.75	63.41463415	79.54545455	502490.4473	1245.275482	0.177884609	7.407407407	5	96.2962963	56.79012346	56	96.15384615	12.1805041	468.5733088
Epochs 140	0.386473417	15.51724138	9.638554217	95.45454545	60.34482759	62.19512195	78.78787879	260577.448	1245.275482	0.25	7.8125	5.154639175	89.36170213	57.8125	55.67010309	86.95652174	-18.71133596	468.5733088
Epochs 160	0.420289844	13.43283582	11.94029851	95.89041096	55.2238806	62.12121212	82.19178082	357982.0059	1245.275482	0.269230783	6.944444444	3.703703704	87.27272727	57.74647887	54.32098765	83.63636364	-52.75910392	468.5733088
Epochs 180	0.328502417	11.84210526	9.333333333	92.85714286	59.21052632	59.45945946	82.14285714	344235.6604	1245.275482	0.21634616	6.493506494	5.494505495	87.5	53.94736842	57.14285714	82.5	-45.38492871	468.5733088
Epochs 200	0.342995167	12.94117647	10.29411765	98.14814815	56.47058824	62.68656716	87.03703704	561371.2459	1245.275482	0.206730768	6.024096386	5.747126437	86.84210526	53.65853659	56.32183908	81.57894737	-41.5930274	468.5733088
Walmart Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.188073397	2.985074627	6.837606838	91.17647059	50.74626866	44.82758621	88.23529412	121.7254544	9380.979094	0.168949768	5.319148936	7.920792079	100	47.87234043	45.54455446	86.95652174	608.0223623	255.7316817
Epochs 40	0.055045873	4.95049505	5.982905983	0	50.4950495	45.68965517	0	76.79073967	9380.979094	0.059360731	4	8.510638298	0	50	45.74468085	0	-92.50084992	255.7316817
Epochs 60	0.123853214	6.329113924	5.691056911	93.75	54.43037975	45.90163934	87.5	128.448527	9380.979094	0.12328767	4.807692308	8.080808081	87.5	51.45631068	45.45454545	81.25	45.4719896	255.7316817
Epochs 80	0.114678897	6.25	5.785123967	76.47058824	53.75	46.66666667	70.58823529	146.8093782	9380.979094	0.146118715	4.807692308	9.473684211	90	52.42718447	46.31578947	80	65.8208664	255.7316817
Epochs 100	0.142201841	6.329113924	6.034482759	82.60869565	53.16455696	46.95652174	73.91304348	118.7696812	9380.979094	0.168949768	4.95049505	9.782608696	88.46153846	52	45.65217391	84.61538462	83.10771325	255.7316817
Epochs 120	0.206422016	6.172839506	6.12244898	87.17948718	53.08641975	46.93877551	76.31578947	233.0343276	9380.979094	0.210045666	5.607476636	9.333333333	89.18918919	52.83018868	45.33333333	86.48648649	4646.968758	255.7316817
Epochs 140	0.284403682	2.985074627	5.747126437	85.9375	53.73134328	44.82758621	79.36507937	380.2160673	9380.979094	0.356164396	6.41025641	10	92.95774648	53.84615385	42.85714286	84.28571429	132.3652793	255.7316817
Epochs 160	0.353211015	5.555555556	7.042253521	90.66666667	54.16666667	43.66197183	83.78378378	450.384084	9380.979094	0.333333343	6.315789474	10.34482759	92.42424242	54.25531915	43.10344828	87.87878788	7144.1555	255.7316817
Epochs 180	0.30733946	5.405405405	6.329113924	89.23076923	54.05405405	45.56962025	81.25	732.5088241	9380.979094	0.278538823	6.18556701	8.823529412	90.74074074	53.125	41.17647059	87.03703704	9168.436821	255.7316817
Epochs 200	0.353211015	10.66666667	10.12658228	95.3125	52	49.36708861	88.88888889	221.8802049	9380.979094	0.264840186	5.555555556	9.836065574	92	53.27102804	42.62295082	88	8809.621352	255.7316817
Fresh Del Monte Produce Inc (small cap)Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit

Epochs 20	0.17889908	9.523809524	6.923076923	96	44.44444444	41.08527132	80	660.1709085	5.320148705	0.205479458	5.263157895	5.737704918	87.5	57.14285714	44.26229508	85	-19.57327312	-65.97131265
Epochs 40	0.087155961	9.782608696	7.936507937	0	42.85714286	42.06349206	0	352.0076107	5.320148705	0.063926943	6.730769231	6.086956522	0	50.48543689	42.60869565	0	76.08757652	-65.97131265
Epochs 60	0.188073397	11.5942029	8	95.83333333	47.82608696	43.2	91.30434783	658.4749241	5.320148705	0.141552508	6.896551724	6.25	90	51.1627907	45.53571429	90	-5.372449783	-65.97131265
Epochs 80	0.201834857	12.16216216	8.403361345	100	50.68493151	46.21848739	96	663.2261464	5.320148705	0.1369863	6.741573034	6.363636364	85	51.13636364	46.36363636	85	25.94236793	-65.97131265
Epochs 100	0.211009175	12.16216216	7.826086957	96.55172414	47.94520548	46.95652174	89.65517241	827.4794017	5.320148705	0.159817353	6.818181818	7.476635514	87.5	52.87356322	48.59813084	87.5	131.7761592	-65.97131265
Epochs 120	0.279816508	11.53846154	8.421052632	97.77777778	49.35064935	46.31578947	91.11111111	88.78652147	5.320148705	0.232876718	6.896551724	7.865168539	88.37209302	52.3255814	51.68539326	86.04651163	55.37436837	-65.97131265
Epochs 140	0.357798159	12.28070175	8.510638298	94.02985075	50.87719298	46.80851064	86.36363636	729.7170415	5.320148705	0.319634706	8.333333333	9.195402299	93.33333333	53.52112676	52.87356322	86.66666667	802.7556814	-65.97131265
Epochs 160	0.394495428	12.12121212	8	93.50649351	51.51515152	49.33333333	85.52631579	71.80675854	5.320148705	0.369863003	7.692307692	10.29411765	93.15068493	54.54545455	54.41176471	80.82191781	756.2038482	-65.97131265
Epochs 180	0.362385333	11.42857143	9.638554217	96.92307692	51.42857143	46.98795181	90.625	77.71607518	5.320148705	0.287671238	7.142857143	8.75	90.90909091	53.01204819	53.75	81.81818182	989.1682613	-65.97131265
Epochs 200	0.353211015	10.66666667	10.12658228	95.3125	52	49.36708861	88.88888889	221.8802049	5.320148705	0.292237431	7.692307692	9.459459459	92.59259259	52.22222222	54.05405405	81.48148148	632.1314842	-65.97131265

Table 13-8 Results of 50 Percent More Buy Class CNN Models , Non-Cyclic Stocks

Singapore Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.215596333	8.490566038	6.329113924	100	49.52380952	41.7721519	75.75757576	38.85747623	-64.15459983	0.134883717	5.34351145	7.692307692	89.47368421	43.51145038	56.92307692	77.77777778	-81.35310375	-78.23835547
Epochs 40	0.068807341	7.619047619	6.194690265	0	51.42857143	44.64285714	0	-82.75907997	-64.15459983	0.069767445	5.555555556	8.988764045	0	45.23809524	56.81818182	0	-89.88089268	-78.23835547
Epochs 60	0.110091746	7.843137255	6.666666667	81.81818182	51.96078431	43.80952381	80	-80.05799913	-64.15459983	0.097674422	5.511811024	9.756097561	100	45.66929134	55.55555556	100	-88.80574455	-78.23835547
Epochs 80	0.151376143	8.571428571	7.446808511	89.47368421	53.84615385	45.74468085	68.42105263	-71.11170204	-64.15459983	0.106976748	5.34351145	8.219178082	90.90909091	45.80152672	56.94444444	81.81818182	-84.5317825	-78.23835547
Epochs 100	0.16055046	8.988764045	8.108108108	100	52.80898876	48.18181818	83.33333333	-59.06261824	-64.15459983	0.14418605	5.454545455	8.235294118	90	49.09090909	57.14285714	85	-91.99036299	-78.23835547
Epochs 120	0.238532111	8.24742268	8.641975309	92.5	52.57731959	44.44444444	76.92307692	-82.48937331	-64.15459983	0.148837209	5.6	8.571428571	95	46.4	59.42028986	85	-85.98943166	-78.23835547
Epochs 140	0.270642191	9.090909091	8.333333333	95.65217391	52.27272727	48.19277108	78.26086957	-56.08688962	-64.15459983	0.186046511	6.086956522	8.333333333	96.42857143	48.69565217	60.56338028	82.14285714	-81.47390044	-78.23835547
Epochs 160	0.344036698	10.25641026	8.974358974	96.77419355	55.12820513	44.15584416	83.87096774	-63.31311044	-64.15459983	0.274418592	7.070707071	8.695652174	97.87234043	47.47474747	61.76470588	89.36170213	-55.33587055	-78.23835547
Epochs 180	0.376146793	9.090909091	10.16949153	95.77464789	51.13636364	44.82758621	80.28169014	-61.2714146	-64.15459983	0.293023258	6.796116505	9.677419355	100	45.63106796	63.93442623	92	-68.00985543	-78.23835547
Epochs 200	0.408256888	8.450704225	9.230769231	93.90243902	53.52112676	45.3125	81.70731707	-65.01388421	-64.15459983	0.386046499	8.75	9.375	98.5915493	46.25	61.9047619	92.95774648	-64.36146887	-78.23835547
OCBC Bank Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.110091746	6.722689076	6.896551724	83.33333333	51.2605042	51.1627907	83.33333333	-86.32459062	-55.90202866	0.162790701	7.936507937	7.575757576	86.95652174	49.20634921	53.84615385	73.91304348	9.797907625	-24.56291964
Epochs 40	0.068807341	6.603773585	7.142857143	0	51.88679245	51.35135135	0	-97.91681669	-55.90202866	0.088372096	8.403361345	9.375	0	51.2605042	54.73684211	0	-23.58604736	-24.56291964
Epochs 60	0.110091746	6.666666667	7.766990291	90	54.28571429	54.90196078	80	-92.64324918	-55.90202866	0.116279073	8.26446281	10.22727273	100	52.0661157	56.32183908	83.33333333	-47.71652849	-24.56291964
Epochs 80	0.146788985	7.407407407	8.510638298	100	53.7037037	55.91397849	87.5	-90.01915677	-55.90202866	0.14418605	8.130081301	10.25641026	92.85714286	50.40650407	57.14285714	92.85714286	-48.47218819	-24.56291964

Epochs 100	0.137614682	7.52688172	8.181818182	93.33333333	54.83870968	55.04587156	93.33333333	-90.76527691	-55.90202866	0.176744193	8.571428571	9.195402299	91.30434783	54.28571429	55.81395349	82.60869565	-41.48267942	-24.56291964
Epochs 120	0.155963302	7.547169811	8.602150538	94.73684211	57.54716981	56.98924731	83.33333333	-71.08631367	-55.90202866	0.186046511	8.547008547	10.66666667	95.65217391	51.28205128	58.10810811	91.30434783	-40.89973747	-24.56291964
Epochs 140	0.17889908	7.692307692	7.920792079	92.30769231	57.14285714	58.41584158	84	-60.93190259	-55.90202866	0.209302321	7.142857143	8.641975309	86.11111111	55.10204082	58.75	83.33333333	-50.58432959	-24.56291964
Epochs 160	0.224770635	7.142857143	7.446808511	90	57.14285714	56.38297872	84.61538462	-75.19388684	-55.90202866	0.255813956	7.368421053	8.450704225	85.71428571	54.73684211	54.92957746	81.25	-46.74399817	-24.56291964
Epochs 180	0.229357794	7.52688172	7.058823529	92.5	59.13978495	56.47058824	87.17948718	-58.52895548	-55.90202866	0.28372094	7.920792079	8.474576271	87.27272727	57.42574257	57.62711864	83.33333333	-51.46211377	-24.56291964
Epochs 200	0.266055048	7.228915663	7.058823529	92	59.03614458	56.47058824	85.71428571	-64.99490463	-55.90202866	0.367441863	7.317073171	7.407407407	87.34177215	57.31707317	57.40740741	83.33333333	-61.33341347	-24.56291964
CNOOC Limited Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.137440756	4.132231405	4.411764706	95.45454545	45.45454545	52.23880597	86.36363636	92.0087663	-54.68960087	0.126760557	5.555555556	4.545454545	80.95238095	44.44444444	46.15384615	80.95238095	-69.31010146	-84.2898875
Epochs 40	0.04265403	3.389830508	5.376344086	0	47.45762712	51.08695652	0	48.04758559	-54.68960087	0.065727696	5.833333333	7.608695652	0	47.5	50.54945055	0	-45.47030442	-84.2898875
Epochs 60	0.094786733	4.201680672	6.172839506	90.90909091	50.42016807	55	81.81818182	95.01986046	-54.68960087	0.112676054	6.086956522	8.045977011	90.90909091	47.82608696	53.48837209	81.81818182	-62.66961684	-84.2898875
Epochs 80	0.094786733	4.838709677	6.41025641	100	50	57.14285714	88.88888889	52.45029203	-54.68960087	0.150234744	6.086956522	8.860759494	94.73684211	48.69565217	55.12820513	84.21052632	-63.75626775	-84.2898875
Epochs 100	0.127962083	5.714285714	4.651162791	85	53.33333333	55.29411765	80	299.7833726	-54.68960087	0.159624413	6.930693069	7.692307692	95.23809524	49.5049505	52.22222222	80.95238095	-61.35365473	-84.2898875
Epochs 120	0.123222746	5.042016807	5.333333333	94.11764706	51.2605042	52.7027027	82.35294118	212.9058513	-54.68960087	0.164319247	5.982905983	8.333333333	91.66666667	48.71794872	53.52112676	83.33333333	-66.90795486	-84.2898875
Epochs 140	0.175355449	5.714285714	6.329113924	96.2962963	53.33333333	53.84615385	88.88888889	186.4028186	-54.68960087	0.206572771	6.862745098	7.692307692	93.93939394	47.05882353	51.94805195	90.90909091	-80.31632722	-84.2898875
Epochs 160	0.241706163	6.18556701	6.849315068	97.56097561	54.63917526	54.16666667	85.36585366	247.3093261	-54.68960087	0.262910783	6.451612903	8.333333333	91.66666667	44.08602151	50.70422535	83.33333333	-82.99006558	-84.2898875
Epochs 180	0.255924165	5.882352941	7.8125	95.55555556	55.88235294	55.55555556	80	208.1846529	-54.68960087	0.225352108	5.607476636	7.692307692	90.24390244	43.92523364	53.125	82.92682927	-70.68470963	-84.2898875
Epochs 200	0.34123224	6.976744186	8.196721311	95.3125	58.13953488	58.33333333	82.8125	108.7304653	-54.68960087	0.333333343	7.142857143	7.8125	92.30769231	42.85714286	52.38095238	83.07692308	-68.90317918	-84.2898875
JP Morgan Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.201834857	8.411214953	2.666666667	91.66666667	40.18691589	37.33333333	77.14285714	13876.98114	1576.179166	0.196347028	7.438016529	12.5	96.15384615	43.33333333	55.55555556	76.92307692	90.44461885	-31.90034799
Epochs 40	0.068807341	10.75268817	4	0	46.23655914	45.96774194	0	1733.352002	1576.179166	0.086757988	7.826086957	9.615384615	0	49.12280702	50.96153846	0	30.46466077	-31.90034799
Epochs 60	0.087155961	11.23595506	3.25203252	83.33333333	47.19101124	45.08196721	83.33333333	1267.331666	1576.179166	0.127853885	7.692307692	10.75268817	100	47.4137931	52.68817204	100	-31.30369775	-31.90034799
Epochs 80	0.114678897	11.11111111	3.448275862	91.66666667	45.55555556	45.2173913	83.33333333	1195.21005	1576.179166	0.155251145	7.5	11.9047619	100	46.21848739	53.57142857	93.33333333	0.069962301	-31.90034799
Epochs 100	0.142201841	13.15789474	3.225806452	94.44444444	52.63157895	45.52845528	94.44444444	764.2201934	1576.179166	0.19178082	8.910891089	11.45833333	100	47	51.04166667	95.45454545	-15.67376434	-31.90034799
Epochs 120	0.169724777	11.62790698	2.803738318	96	47.6744186	45.79439252	87.5	1693.453838	1576.179166	0.214611873	7.894736842	13.15789474	96.55172414	45.13274336	55.26315789	89.65517241	207.9315953	-31.90034799
Epochs 140	0.169724777	13.15789474	2.586206897	92.30769231	51.31578947	47.82608696	84.61538462	3044.560562	1576.179166	0.278538823	9.090909091	12.98701299	97.6744186	48.48484848	54.54545455	88.0952381	78.49610452	-31.90034799
Epochs 160	0.201834857	13.88888889	2.654867257	93.93939394	50	48.21428571	90.90909091	3819.808025	1576.179166	0.351598173	9.638554217	11.26760563	93.84615385	48.19277108	52.11267606	85.9375	-62.45315077	-31.90034799
Epochs 180	0.233944952	13.15789474	2	92.85714286	51.31578947	46.46464646	88.0952381	6679.354852	1576.179166	0.365296811	8.695652174	13.55932203	94.11764706	43.47826087	56.89655172	85.29411765	-17.83980107	-31.90034799
Epochs 200	0.25688073	13.04347826	2.941176471	93.61702128	53.62318841	47.52475248	89.36170213	3356.826467	1576.179166	0.388127863	7.894736842	10.9375	91.13924051	46.05263158	53.96825397	79.74683544	-64.25970935	-31.90034799

American Axle (small cap) Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.174311921	4.032258065	7.936507937	90.32258065	42.74193548	51.61290323	90.32258065	-96.86049428	-40.19620025	0.173515975	8.403361345	6.849315068	85.18518519	46.61016949	57.53424658	77.77777778	82.11173575	-32.50977019
Epochs 40	0.055045873	4.464285714	6.603773585	0	42.85714286	47.61904762	0	-84.87913444	-40.19620025	0.086757988	9.259259259	8.108108108	0	51.40186916	56.75675676	0	-46.92671119	-32.50977019
Epochs 60	0.087155961	4.464285714	7.142857143	87.5	44.64285714	51.54639175	87.5	-49.9130228	-40.19620025	0.146118715	9.708737864	8.737864078	100	52.94117647	57.2815534	100	-60.23241008	-32.50977019
Epochs 80	0.123853214	5.454545455	7.52688172	93.33333333	46.36363636	51.08695652	93.33333333	-61.08371551	-40.19620025	0.159817353	9.345794393	7.692307692	85.71428571	52.83018868	54.94505495	80.95238095	-56.63179622	-32.50977019
Epochs 100	0.146788985	4.255319149	7.843137255	90.90909091	44.68085106	50.4950495	86.36363636	-47.34766427	-40.19620025	0.178082198	10.58823529	7.339449541	88	57.14285714	55.04587156	80	142.8753659	-32.50977019
Epochs 120	0.128440365	4.587155963	7.777777778	84.21052632	45.87155963	52.80898876	78.94736842	-57.57216307	-40.19620025	0.210045666	10	8.045977011	90.625	51.51515152	55.17241379	87.5	-24.53339903	-32.50977019
Epochs 140	0.155963302	4	7.608695652	88.46153846	45	52.74725275	80.76923077	-43.64465942	-40.19620025	0.278538823	10.25641026	6.818181818	88.67924528	55.84415584	53.40909091	83.01886792	366.7060093	-32.50977019
Epochs 160	0.197247714	4.166666667	8.139534884	88.88888889	43.75	54.11764706	83.33333333	-61.83321076	-40.19620025	0.292237431	8.450704225	5.882352941	84.12698413	57.14285714	52.94117647	77.77777778	408.5024795	-32.50977019
Epochs 180	0.229357794	3.883495146	8.571428571	88.88888889	43.68932039	54.28571429	86.36363636	-48.27431562	-40.19620025	0.360730588	8	7.575757576	87.17948718	55.40540541	57.57575758	80.76923077	237.9466885	-32.50977019
Epochs 200	0.288990825	4.545454545	8.333333333	91.37931034	44.31818182	51.38888889	87.71929825	-29.03571454	-40.19620025	0.351598173	7.462686567	5.633802817	83.95061728	54.54545455	54.92957746	77.77777778	61.13511606	-32.50977019

Table 13-9 Results of 50 Percent More Hold Class CNN Models , Cyclic Stocks

Kweichow Moutai Co., Ltd. Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.12077295	10.76923077	7.518796992	88.88888889	55.38461538	45.45454545	77.77777778	1847.488492	1666.892281	0.086538464	7.272727273	6.081081081	100	50.90909091	45.57823129	100	227.3790201	678.7940879
Epochs 40	0.106280193	12.30769231	7.246376812	100	53.84615385	44.52554745	100	1139.707614	1666.892281	0.096153848	12.06896552	6.164383562	100	55.17241379	48.27586207	50	287.8753118	678.7940879
Epochs 60	0.144927531	11.9047619	8.181818182	84.61538462	57.14285714	49.5412844	84.61538462	1447.003626	1666.892281	0.129807696	12.5	6.4	90.90909091	52.77777778	52	80	239.1229477	678.7940879
Epochs 80	0.16908212	12.16216216	7.96460177	85	55.40540541	48.21428571	85	1152.614844	1666.892281	0.149038464	11.29032258	6.976744186	88.23529412	58.06451613	50.3875969	81.25	225.0459992	678.7940879
Epochs 100	0.193236709	13.33333333	7.476635514	88	57.33333333	49.05660377	84	1807.693764	1666.892281	0.201923072	11.94029851	7.142857143	89.65517241	57.57575758	52.67857143	75.86206897	135.5801158	678.7940879
Epochs 120	0.251207739	12.90322581	7.692307692	87.80487805	54.83870968	48.54368932	85.36585366	872.1109157	1666.892281	0.264423072	12.28070175	8.256880734	92.85714286	56.14035088	51.37614679	80.48780488	250.0347015	678.7940879
Epochs 140	0.222222224	14.75409836	7.079646018	87.87878788	55.73770492	48.21428571	84.84848485	1065.004474	1666.892281	0.211538464	12.28070175	7.438016529	93.33333333	56.14035088	47.9338843	75.86206897	66.00060984	678.7940879
Epochs 160	0.35265699	15	8.235294118	91.93548387	58.33333333	50.58823529	90.16393443	1690.109034	1666.892281	0.322115391	11.66666667	9.574468085	94.44444444	56.66666667	55.31914894	88.67924528	359.5171979	678.7940879
Epochs 180	0.29468599	12.5	9.195402299	91.66666667	57.74647887	47.12643678	89.58333333	1458.466169	1666.892281	0.283653855	11.5942029	7.608695652	93.61702128	56.52173913	54.34782609	89.13043478	365.7517079	678.7940879
Epochs 200	0.357487917	13.1147541	8.641975309	90.76923077	60	45.67901235	89.23076923	1293.588581	1666.892281	0.326923072	11.47540984	6.818181818	93.22033898	55.73770492	52.27272727	87.93103448	144.0324655	678.7940879
Midea Group Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.072463766	6.557377049	6.338028169	50	50.81967213	48.22695035	50	2979.666264	1245.275482	0.100961536	9.375	5.839416058	100	57.8125	50	100	30.82034468	468.5733088
Epochs 40	0.101449274	9.85915493	6.923076923	83.33333333	57.74647887	51.9379845	83.33333333	20267.50279	1245.275482	0.07692308	8.450704225	5.223880597	100	60.56338028	51.87969925	66.66666667	160.7559742	468.5733088

Epochs 60	0.135265693	9.782608696	8.653846154	90.90909091	57.60869565	59.22330097	72.72727273	10972.98383	1245.275482	0.091346152	7.058823529	4.424778761	80	55.29411765	53.57142857	80	85.55302713	468.5733088
Epochs 80	0.198067635	11.39240506	8.653846154	95.83333333	56.96202532	59.22330097	70.83333333	38335.61103	1245.275482	0.149038464	7.894736842	4.545454545	90.90909091	57.89473684	55.45454545	90.47619048	104.9814565	468.5733088
Epochs 100	0.260869563	12.04819277	10.22727273	97.22222222	59.03614458	62.06896552	72.22222222	37265.34303	1245.275482	0.144230768	7.5	4.672897196	90.47619048	57.5	57.00934579	90	100.2563907	468.5733088
Epochs 120	0.33816424	14.92537313	10.22727273	98.07692308	61.19402985	63.2183908	78.84615385	257060.5256	1245.275482	0.182692304	8.571428571	4.62962963	90	60	56.48148148	86.20689655	111.0982292	468.5733088
Epochs 140	0.304347813	14.92537313	9.375	100	59.70149254	60	81.81818182	66270.83275	1245.275482	0.177884609	8.571428571	5.405405405	92.59259259	58.57142857	56.75675676	88.46153846	78.90451266	468.5733088
Epochs 160	0.33816424	13.51351351	10.12658228	96.2962963	59.45945946	61.53846154	81.48148148	71750.66356	1245.275482	0.235576928	8.450704225	4.255319149	90.69767442	56.33802817	58.5106383	90.47619048	104.9992487	468.5733088
Epochs 180	0.318840593	12.19512195	11.53846154	100	58.53658537	63.63636364	82.9787234	128853.2568	1245.275482	0.230769232	8	6.315789474	94.73684211	57.33333333	60	94.59459459	135.0138228	468.5733088
Epochs 200	0.371980667	13.51351351	11.11111111	96.72131148	59.45945946	63.38028169	83.60655738	82653.79954	1245.275482	0.302884609	7.462686567	5.952380952	92.98245614	55.2238806	58.33333333	91.07142857	91.05685484	468.5733088
Walmart Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.082568809	10.71428571	6.25	100	46.42857143	40.88050314	50	1678.184131	5.320148705	0.08219178	5.747126437	7.03125	100	52.87356322	44.88188976	100	698.461897	255.7316817
Epochs 40	0.059633028	5.405405405	4.964539007	66.66666667	54.05405405	44.28571429	66.66666667	99.81361142	9380.979094	0.100456618	5.263157895	8.547008547	100	54.25531915	47.00854701	85.71428571	139.0742404	255.7316817
Epochs 60	0.091743119	5.319148936	6.086956522	88.88888889	52.12765957	47.36842105	88.88888889	126.7014488	9380.979094	0.10958904	4.464285714	7.446808511	92.30769231	51.35135135	46.80851064	92.30769231	28.89992072	255.7316817
Epochs 80	0.133027524	5.952380952	6.086956522	89.47368421	52.38095238	45.61403509	78.94736842	241.0689509	9380.979094	0.182648405	5.208333333	8.510638298	93.10344828	53.125	46.80851064	82.14285714	146.5108546	255.7316817
Epochs 100	0.155963302	6.451612903	5.940594059	91.66666667	52.68817204	45	83.33333333	180.5448221	9380.979094	0.210045666	4.901960784	9.638554217	97.05882353	52.47524752	46.98795181	88.23529412	142.0459143	255.7316817
Epochs 120	0.25688073	4.347826087	6.25	88.67924528	57.97101449	43.15789474	83.01886792	223.9811397	9380.979094	0.269406378	5.747126437	10.58823529	95.74468085	53.48837209	49.41176471	87.23404255	301.4076232	255.7316817
Epochs 140	0.238532111	4.411764706	6.796116505	89.36170213	57.35294118	48.03921569	85.10638298	178.1906175	9380.979094	0.232876718	5.747126437	9.574468085	97.36842105	53.48837209	47.87234043	86.84210526	274.8077131	255.7316817
Epochs 160	0.30733946	2.666666667	8.860759494	90.625	54.66666667	44.87179487	82.8125	76.47172682	9380.979094	0.328767121	4.651162791	11.5942029	93.75	52.94117647	46.37681159	87.5	344.2887601	255.7316817
Epochs 180	0.252293587	5.681818182	6.25	90	52.27272727	44.30379747	84	253.1777718	9380.979094	0.287671238	4.301075269	12.32876712	94.33962264	53.26086957	49.31506849	88.67924528	368.9405192	255.7316817
Epochs 200	0.298165143	3.797468354	6.666666667	89.0625	53.16455696	43.24324324	82.8125	119.681632	9380.979094	0.356164396	4.705882353	12.6984127	92.95774648	53.57142857	47.61904762	84.50704225	491.653284	255.7316817
Fresh Del Monte Produce Inc (small cap)Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.082568809	10.71428571	6.25	100	46.42857143	40.88050314	50	1678.184131	5.320148705	0.06849315	4.545454545	5.369127517	100	56.92307692	43.62416107	100	-43.46898065	-65.97131265
Epochs 40	0.091743119	10	6.896551724	100	50	44.44444444	100	1914.980928	5.320148705	0.09589041	6.41025641	6.015037594	100	57.14285714	46.61654135	100	387.5249851	-65.97131265
Epochs 60	0.123853214	9.89010989	7.692307692	90	48.35164835	47.00854701	88.88888889	683.3570907	5.320148705	0.105022833	7.142857143	6.363636364	81.81818182	52.57731959	45.45454545	72.72727273	173.4607538	-65.97131265
Epochs 80	0.169724777	10.71428571	7.142857143	90.90909091	47.61904762	46.42857143	90.47619048	551.3879015	5.320148705	0.146118715	6.818181818	7.272727273	85.71428571	55.17241379	45.45454545	76.19047619	271.2937871	-65.97131265
Epochs 100	0.192660555	10.11235955	7.843137255	92.59259259	47.19101124	48.03921569	88.46153846	259.9479002	5.320148705	0.159817353	6.741573034	7.619047619	84	55.68181818	46.66666667	76	150.3760387	-65.97131265
Epochs 120	0.279816508	12.5	7.142857143	93.75	51.38888889	48.97959184	87.23404255	335.2007852	5.320148705	0.210045666	7.692307692	7.619047619	88.88888889	58.44155844	46.66666667	83.33333333	96.44578075	-65.97131265
Epochs 140	0.247706428	10.95890411	6.862745098	90.69767442	50.68493151	49.01960784	83.33333333	328.9161196	5.320148705	0.19178082	7.894736842	6.363636364	87.87878788	57.33333333	47.27272727	81.81818182	164.1522835	-65.97131265
Epochs 160	0.339449555	11.26760563	8.43373494	92.1875	50.70422535	50.60240964	84.12698413	401.2068949	5.320148705	0.278538823	7.5	7.142857143	89.09090909	55.69620253	48.80952381	81.81818182	202.6454505	-65.97131265

Epochs 180	0.25688073	10.46511628	7.954545455	90.90909091	51.1627907	51.13636364	86.04651163	222.3354191	5.320148705	0.242009133	7.058823529	6.896551724	87.23404255	55.95238095	50.57471264	78.72340426	332.4132169	-65.97131265
Epochs 200	0.376146793	12.5	8.108108108	93.05555556	52.77777778	47.2972973	81.69014085	195.3424439	5.320148705	0.292237431	7.594936709	6.25	88.33333333	55.12820513	51.25	80	153.2146732	-65.97131265

Table 13-10 Results of 50 Percent More Hold Class CNN Models , Non-Cyclic Stocks

Singapore Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.206422016	3.389830508	6.722689076	87.5	49.15254237	48.30508475	82.5	-97.08162896	-55.90202866	0.227906972	5.263157895	6.956521739	88.37209302	42.10526316	53.50877193	83.72093023	-93.75007717	-78.23835547
Epochs 40	0.091743119	9.411764706	6.923076923	100	55.29411765	46.51162791	100	68.45129805	-64.15459983	0.088372096	6.481481481	7.766990291	100	46.2962963	53.92156863	100	-87.22119554	-78.23835547
Epochs 60	0.16055046	10	5.309734513	84	53.75	43.36283186	83.33333333	-85.83232961	-64.15459983	0.186046511	6.666666667	7.407407407	93.10344828	47.61904762	57.5	89.65517241	-84.00478637	-78.23835547
Epochs 80	0.206422016	10.52631579	7.96460177	96.55172414	53.94736842	46.01769912	96.42857143	190.433405	-64.15459983	0.246511623	7.52688172	8.536585366	97.5	46.23655914	55.55555556	95	-61.25320155	-78.23835547
Epochs 100	0.169724777	9.523809524	7.96460177	95.23809524	52.38095238	46.01769912	95	165.242799	-64.15459983	0.204651162	6.603773585	10	100	46.22641509	56.96202532	96.55172414	-83.43090878	-78.23835547
Epochs 120	0.215596333	10.52631579	8.108108108	96.77419355	53.94736842	45.94594595	86.66666667	245.02637	-64.15459983	0.260465115	7.368421053	9.090909091	97.6744186	47.36842105	56.57894737	95.34883721	-77.21535587	-78.23835547
Epochs 140	0.284403682	10.95890411	8.24742268	95.83333333	54.79452055	44.32989691	85.10638298	-60.70324712	-64.15459983	0.306976736	5.747126437	7.352941176	93.33333333	43.67816092	56.71641791	88.33333333	-81.98768411	-78.23835547
Epochs 160	0.192660555	9.638554217	8.256880734	96.15384615	54.21686747	46.78899083	92	279.9810089	-64.15459983	0.246511623	5.319148936	8.974358974	95.34883721	43.61702128	57.14285714	90.69767442	-80.96116619	-78.23835547
Epochs 180	0.188073397	9.523809524	7.476635514	92.59259259	53.57142857	45.79439252	88.46153846	-49.0418769	-64.15459983	0.241860464	5.376344086	8.75	95.23809524	45.16129032	55.69620253	92.85714286	-83.31115548	-78.23835547
Epochs 200	0.142201841	8.510638298	7.476635514	88.23529412	52.12765957	43.92523364	87.5	185.6196508	-64.15459983	0.200000003	4.901960784	7.594936709	94.11764706	45.09803922	58.97435897	91.17647059	-85.1844707	-78.23835547
OCBC Bank Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.206422016	3.389830508	6.722689076	87.5	49.15254237	48.30508475	82.5	-97.08162896	-55.90202866	0.227906972	6.451612903	7.96460177	90	53.22580645	50	90	-50.55253138	-24.56291964
Epochs 40	0.091743119	7.368421053	7.56302521	100	53.68421053	51.69491525	100	-97.37174947	-55.90202866	0.097674422	9.345794393	8.490566038	100	53.27102804	53.33333333	100	53.44876355	-24.56291964
Epochs 60	0.183486238	8.641975309	8.035714286	96	58.02469136	54.95495495	92	-92.22155724	-55.90202866	0.19069767	7.216494845	10	89.28571429	52.57731959	56.17977528	89.28571429	-26.11238683	-24.56291964
Epochs 80	0.188073397	6.849315068	7.079646018	87.5	58.90410959	55.35714286	84.375	-88.99914296	-55.90202866	0.213953495	7.317073171	9.090909091	91.17647059	53.65853659	55.10204082	88.23529412	-21.02986186	-24.56291964
Epochs 100	0.151376143	6.976744186	8.035714286	90	59.30232558	55.85585586	90	-90.09289521	-55.90202866	0.19069767	6.666666667	9.375	89.65517241	53.33333333	56.84210526	86.20689655	-30.7099181	-24.56291964
Epochs 120	0.16055046	7.228915663	6.422018349	84.61538462	60.24096386	56.48148148	80.76923077	-95.37278743	-55.90202866	0.232558146	6.097560976	9.677419355	90	53.65853659	58.69565217	87.5	-28.34849684	-24.56291964
Epochs 140	0.220183492	6.329113924	7.142857143	87.80487805	58.2278481	56.70103093	85.36585366	-98.78216747	-55.90202866	0.311627895	6.666666667	9.87654321	91.52542373	58.66666667	60	89.83050847	-34.13498666	-24.56291964
Epochs 160	0.155963302	6.097560976	6.422018349	81.48148148	59.75609756	53.7037037	77.77777778	-97.49624497	-55.90202866	0.237209305	6.329113924	9.375	92.5	55.69620253	56.84210526	90	8.124797568	-24.56291964
Epochs 180	0.169724777	6.172839506	7.339449541	85.71428571	58.02469136	53.7037037	82.14285714	-93.80904553	-55.90202866	0.255813956	6.578947368	9.473684211	93.18181818	57.89473684	57.44680851	93.18181818	-35.17714155	-24.56291964
Epochs 200	0.146788985	6.976744186	7.207207207	85.71428571	58.13953488	52.72727273	76.19047619	-84.92411303	-55.90202866	0.255813956	6.493506494	9.574468085	93.18181818	54.54545455	58.06451613	93.18181818	4.389880789	-24.56291964
CNOOC Limited Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit

Epochs 20	0.222748816	3.389830508	5.504587156	90.69767442	52.54237288	50.92592593	76.74418605	23.17696754	-54.68960087	0.244131461	3.448275862	6.666666667	86	36.20689655	48.07692308	78	-88.08968391	-84.2898875
Epochs 40	0.061611373	2.884615385	5.825242718	100	49.03846154	50.98039216	100	-14.85983296	-54.68960087	0.079812206	6.666666667	6.666666667	100	40.95238095	48.07692308	100	-70.78244745	-84.2898875
Epochs 60	0.151658773	4.347826087	6.382978723	88	54.34782609	53.76344086	76	46.24768181	-54.68960087	0.225352108	6.976744186	7.777777778	94.59459459	45.34883721	52.80898876	83.78378378	-67.13225307	-84.2898875
Epochs 80	0.180094793	3.703703704	6.18556701	87.87878788	58.02469136	55.20833333	75.75757576	48.47582264	-54.68960087	0.239436626	7.594936709	7.446808511	95	45.56962025	52.68817204	85	-87.54827355	-84.2898875
Epochs 100	0.1421801	5.263157895	6.382978723	86.36363636	57.89473684	55.91397849	77.27272727	56.73445423	-54.68960087	0.183098584	6.52173913	7.52688172	92.85714286	44.56521739	52.17391304	82.14285714	-75.02329483	-84.2898875
Epochs 120	0.151658773	5.434782609	6.315789474	87.5	57.60869565	54.25531915	79.16666667	82.59647212	-54.68960087	0.220657274	7.058823529	7.608695652	94.44444444	42.35294118	51.64835165	80.55555556	-76.26957198	-84.2898875
Epochs 140	0.213270143	5.555555556	7.142857143	91.89189189	57.77777778	53.01204819	70.27027027	47.45347856	-54.68960087	0.300469488	10.12658228	8.333333333	98	48.10126582	50.60240964	86	-84.80304198	-84.2898875
Epochs 160	0.156398103	5.555555556	7.142857143	91.30434783	57.77777778	53.60824742	78.26086957	110.8531969	-54.68960087	0.220657274	7.407407407	7.216494845	97.14285714	48.14814815	48.95833333	82.85714286	-96.37113491	-84.2898875
Epochs 180	0.17061612	4.494382022	7.446808511	89.28571429	57.30337079	54.83870968	75	61.46735206	-54.68960087	0.244131461	8.43373494	7.777777778	95	49.39759036	49.43820225	82.5	-84.92233545	-84.2898875
Epochs 200	0.180094793	5.494505495	7.52688172	96.2962963	56.04395604	54.34782609	85.18518519	61.25541169	-54.68960087	0.211267605	7.954545455	7.52688172	96.875	48.86363636	50	84.375	-94.85092014	-84.2898875
JP Morgan Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.128440365	10	4.285714286	88.88888889	51.66666667	45.32374101	83.33333333	2734.455347	1576.179166	0.255707771	13.95348837	8.148148148	95.12195122	52.38095238	45.92592593	87.80487805	125.2255546	-31.90034799
Epochs 40	0.077981651	11.68831169	4.316546763	100	50.64935065	47.10144928	100	3144.364367	1576.179166	0.100456618	9.302325581	8.461538462	100	49.41176471	46.92307692	100	195.7820818	-31.90034799
Epochs 60	0.114678897	12.98701299	4.545454545	100	50.64935065	45.03816794	88.88888889	2556.076879	1576.179166	0.19178082	9.756097561	9.734513274	95.83333333	46.34146341	49.55752212	91.30434783	18.62232352	-31.90034799
Epochs 80	0.119266056	14.08450704	4.379562044	100	53.52112676	46.32352941	90	3030.077537	1576.179166	0.255707771	11.5942029	9.821428571	97.36842105	49.27536232	49.10714286	86.48648649	22.962357	-31.90034799
Epochs 100	0.087155961	12.98701299	3.649635036	100	50.64935065	45.58823529	100	2306.082026	1576.179166	0.251141548	10	10.78431373	97.2972973	47.5	51.96078431	83.33333333	-43.23593769	-31.90034799
Epochs 120	0.123853214	12.5	3.787878788	92.85714286	54.16666667	45.03816794	92.85714286	3086.145332	1576.179166	0.296803653	10.14492754	10.89108911	95.91836735	46.37681159	51.48514851	81.25	-88.09833624	-31.90034799
Epochs 140	0.151376143	12.67605634	3.968253968	90.47619048	54.92957746	44.8	90.47619048	982.1268134	1576.179166	0.360730588	9.230769231	12.35955056	95.38461538	47.69230769	56.17977528	85.9375	-56.52059411	-31.90034799
Epochs 160	0.105504587	11.94029851	3.597122302	83.33333333	55.2238806	44.92753623	83.33333333	866.4541384	1576.179166	0.296803653	9.375	10.57692308	94.11764706	48.4375	51.45631068	84.31372549	46.45233002	-31.90034799
Epochs 180	0.123853214	13.23529412	3.703703704	86.66666667	55.88235294	45.52238806	86.66666667	1056.021219	1576.179166	0.301369876	10.60606061	10.67961165	96	45.45454545	50.98039216	86	264.5121513	-31.90034799
Epochs 200	0.110091746	11.11111111	3.731343284	91.66666667	54.16666667	45.86466165	91.66666667	821.0266996	1576.179166	0.287671238	9.85915493	10.89108911	95.74468085	45.07042254	52	82.9787234	405.3060098	-31.90034799
American Axle (small cap) Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.215596333	3.076923077	6.25	92.68292683	41.53846154	44.14414414	85.36585366	-84.24292372	-40.19620025	0.214611873	9.090909091	7.142857143	86.84210526	46.2962963	49.20634921	86.84210526	-54.60490066	-32.50977019
Epochs 40	0.068807341	2.941176471	6.422018349	71.42857143	41.17647059	48.14814815	71.42857143	-83.87901277	-40.19620025	0.127853885	11.36363636	7.438016529	90	54.02298851	52.89256198	90	286.8411114	-32.50977019
Epochs 60	0.146788985	4.444444444	6.730769231	87.5	41.11111111	50	86.95652174	-62.14473635	-40.19620025	0.210045666	10.52631579	8.108108108	90.625	52	56.75675676	84.375	295.4941647	-32.50977019
Epochs 80	0.133027524	4.651162791	6.306306306	85.71428571	43.02325581	48.64864865	85	-57.34245305	-40.19620025	0.219178081	7.692307692	7.894736842	85	53.125	56.14035088	80	2164.208086	-32.50977019
Epochs 100	0.133027524	6.52173913	7.207207207	100	43.47826087	49.54954955	100	-46.16213351	-40.19620025	0.214611873	9.85915493	7.207207207	86.48648649	54.28571429	54.95495495	81.08108108	216.2616475	-32.50977019

Epochs 120	0.16055046	5.617977528	6.730769231	92	44.94382022	49.03846154	87.5	-67.41767489	-40.19620025	0.200913236	5.797101449	7.272727273	80	50	53.63636364	75	232.1667564	-32.50977019
Epochs 140	0.224770635	5.555555556	7.954545455	92.5	45.55555556	55.68181818	84.61538462	-43.90109862	-40.19620025	0.260273963	4.6875	8.080808081	82.14285714	50.79365079	54.54545455	78.57142857	213.6642433	-32.50977019
Epochs 160	0.142201841	4.494382022	7.407407407	90.47619048	44.94382022	51.85185185	85	-39.42357088	-40.19620025	0.205479458	7.352941176	7.142857143	82.05128205	52.23880597	52.67857143	76.92307692	687.8242665	-32.50977019
Epochs 180	0.165137619	5.617977528	7.619047619	95.83333333	48.31460674	53.33333333	86.95652174	-48.21357737	-40.19620025	0.219178081	7.142857143	7.407407407	85.36585366	50.72463768	51.85185185	75.6097561	488.0975897	-32.50977019
Epochs 200	0.133027524	6	6.930693069	94.11764706	45	51.48514851	93.75	-41.59571726	-40.19620025	0.196347028	6.41025641	7.619047619	83.33333333	49.35064935	51.42857143	72.22222222	368.7222514	-32.50977019

Table 13-11 Results of 50 Percent More Sell Class CNN Models , Cyclic Stocks

Kweichow Moutai Co., Ltd. Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.086956523	10.97560976	7.2	0	50	45.96774194	0	2234.791704	1666.892281	0.072115384	10.16949153	6.040268456	0	50.84745763	46.62162162	0	435.2939104	678.7940879
Epochs 40	0.115942031	12.08791209	8.035714286	100	54.94505495	50.45045045	100	1929.993914	1666.892281	0.11057692	11.11111111	6.201550388	100	51.38888889	51.5625	71.42857143	321.554316	678.7940879
Epochs 60	0.111111112	12.67605634	7.633587786	80	53.52112676	46.92307692	60	1614.409347	1666.892281	0.125	13.55932203	7.092198582	100	55.93220339	50	62.5	176.6129152	678.7940879
Epochs 80	0.178743958	14.28571429	8.333333333	100	54.28571429	47.89915966	82.35294118	716.0780229	1666.892281	0.15384616	12.6984127	7.633587786	100	56.4516129	51.14503817	71.42857143	170.7214641	678.7940879
Epochs 100	0.193236709	13.23529412	7.826086957	91.66666667	54.41176471	49.12280702	75	840.6489171	1666.892281	0.177884609	12.90322581	7.874015748	100	55.73770492	51.96850394	78.94736842	228.5750542	678.7940879
Epochs 120	0.280193239	14.75409836	7.920792079	91.11111111	57.37704918	48.51485149	81.81818182	735.7421016	1666.892281	0.206730768	13.79310345	7.317073171	96.2962963	57.89473684	52.03252033	81.48148148	223.6352605	678.7940879
Epochs 140	0.231884062	15.15151515	8.108108108	96.66666667	56.92307692	47.74774775	86.66666667	816.0174461	1666.892281	0.182692304	14.03508772	7.633587786	100	53.57142857	51.90839695	90	182.9853451	678.7940879
Epochs 160	0.275362313	14.0625	8.080808081	90.90909091	57.14285714	47.47474747	81.81818182	1189.212066	1666.892281	0.240384609	15.68627451	8	100	58	52	87.5	168.934011	678.7940879
Epochs 180	0.280193239	13.55932203	7.920792079	89.36170213	58.62068966	44.55445545	80.85106383	236.4403686	1666.892281	0.25	15.2173913	7.2	97.2972973	60	50.4	86.48648649	166.9583016	678.7940879
Epochs 200	0.275362313	16.92307692	8.653846154	97.36842105	57.8125	45.19230769	89.47368421	563.8508546	1666.892281	0.22115384	15.09433962	6.451612903	96.77419355	55.76923077	51.61290323	83.87096774	137.1268182	678.7940879
Midea Group Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.077294685	7.777777778	7.692307692	0	55.55555556	46.55172414	0	8971.748351	1245.275482	0.057692308	7.792207792	4.580152672	0	54.54545455	49.23076923	0	85.57418046	468.5733088
Epochs 40	0.135265693	9.473684211	8.823529412	100	61.05263158	51.48514851	90	16798.86634	1245.275482	0.086538464	7.407407407	4.237288136	77.77777778	56.79012346	52.13675214	77.77777778	106.4464649	468.5733088
Epochs 60	0.159420297	10	8.108108108	100	61.25	50.90909091	81.25	33157.13619	1245.275482	0.096153848	8	5.555555556	100	58.66666667	53.6	85.71428571	178.0220573	468.5733088
Epochs 80	0.207729474	11.39240506	8.737864078	100	62.02531646	51.96078431	80	99323.10302	1245.275482	0.139423072	8.219178082	4.347826087	90	58.90410959	52.63157895	85	159.2328055	468.5733088
Epochs 100	0.256038636	12	9.278350515	100	61.33333333	54.16666667	77.14285714	99323.10302	1245.275482	0.182692304	8.695652174	4.545454545	93.10344828	60.86956522	53.63636364	85.71428571	129.1461251	468.5733088
Epochs 120	0.333333343	13.23529412	10.34482759	98.07692308	64.70588235	55.81395349	80.76923077	99845.47424	1245.275482	0.235576928	7.692307692	4.95049505	92.85714286	60	54.45544554	85.36585366	44.56454331	468.5733088
Epochs 140	0.270531386	13.51351351	9.375	100	63.51351351	54.73684211	81.08108108	78377.93084	1245.275482	0.168269232	7.042253521	5.405405405	92.30769231	57.74647887	52.25225225	92	16.33145251	468.5733088
Epochs 160	0.328502417	14.08450704	9.411764706	98.03921569	60.56338028	54.76190476	80.39215686	37642.65508	1245.275482	0.211538464	7.142857143	5.825242718	94.28571429	57.14285714	53.39805825	94.11764706	79.16338572	468.5733088
Epochs 180	0.318840593	13.84615385	8.695652174	98	63.07692308	53.84615385	82	75820.06178	1245.275482	0.211538464	5.970149254	5.769230769	91.89189189	56.71641791	54.80769231	91.66666667	60.27635953	468.5733088

Epochs 200	0.304347813	12.67605634	8.988764045	97.87234043	63.38028169	56.81818182	82.9787234	75739.52791	1245.275482	0.168269232	5.555555556	5.555555556	89.28571429	55.55555556	52.77777778	88.88888889	17.50266561	468.5733088
Walmart Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.059633028	5.617977528	6.201550388	0	51.68539326	43.75	0	385.3586712	9380.979094	0.059360731	4.545454545	7.339449541	0	51.37614679	47.70642202	0	349.1146074	255.7316817
Epochs 40	0.082568809	5.154639175	6.140350877	85.71428571	49.48453608	43.36283186	85.71428571	171.4676466	9380.979094	0.091324203	4.464285714	7.291666667	72.72727273	51.35135135	47.91666667	63.63636364	160.9199659	255.7316817
Epochs 60	0.096330278	3.797468354	6.25	90.90909091	51.89873418	44.88188976	90.90909091	258.413729	9380.979094	0.127853885	5.102040816	9.259259259	100	55.10204082	47.22222222	91.66666667	300.1131361	255.7316817
Epochs 80	0.151376143	2.631578947	6.140350877	85.71428571	51.31578947	47.36842105	85.18518519	859.9552389	9380.979094	0.182648405	5.263157895	8.510638298	90	55.31914894	46.80851064	80	406.6777166	255.7316817
Epochs 100	0.183486238	2.777777778	6.363636364	86.11111111	51.38888889	48.18181818	80	808.5966033	9380.979094	0.219178081	5.494505495	7.954545455	90	52.22222222	44.31818182	80	315.6860855	255.7316817
Epochs 120	0.261467904	1.612903226	7	87.5	50	45	80	390.1581496	9380.979094	0.305936068	6.172839506	8.974358974	91.66666667	53.75	44.87179487	81.66666667	369.6075631	255.7316817
Epochs 140	0.174311921	1.538461538	5.982905983	83.33333333	49.23076923	46.15384615	74.28571429	315.5388825	9380.979094	0.255707771	6.172839506	9.677419355	93.33333333	55	45.16129032	80	215.9472768	255.7316817
Epochs 160	0.252293587	1.694915254	5.825242718	85.71428571	49.15254237	45.63106796	80	249.2599775	9380.979094	0.333333343	6.493506494	8	92.53731343	56.57894737	45.33333333	80.59701493	228.8775706	255.7316817
Epochs 180	0.261467904	1.960784314	5.504587156	86.20689655	43.1372549	46.78899083	78.94736842	334.3585979	9380.979094	0.315068483	5.479452055	8.43373494	92.06349206	56.16438356	46.98795181	79.03225806	253.7604276	255.7316817
Epochs 200	0.229357794	1.754385965	6.25	85.71428571	45.61403509	47.74774775	79.59183673	320.8413164	9380.979094	0.296803653	6.41025641	9.302325581	94.54545455	56.41025641	44.18604651	79.62962963	201.2226164	255.7316817
Fresh Del Monte Produce Inc (small cap)Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.077981651	7.619047619	7.96460177	0	40	42.85714286	0	1177.900353	5.320148705	0.06849315	7.865168539	6.153846154	0	55.68181818	45.38461538	0	140.7039905	-65.97131265
Epochs 40	0.151376143	8.653846154	10.1010101	93.33333333	44.23076923	45.91836735	93.33333333	286.7862013	5.320148705	0.118721463	7.368421053	6.363636364	85.71428571	55.31914894	46.36363636	85.71428571	537.8135651	-65.97131265
Epochs 60	0.169724777	10.22727273	9.009009009	94.73684211	46.59090909	47.27272727	89.47368421	489.4805249	5.320148705	0.127853885	7.407407407	6.504065041	93.33333333	55	47.15447154	93.33333333	179.9473745	-65.97131265
Epochs 80	0.229357794	9.87654321	8.910891089	91.66666667	49.38271605	46.53465347	82.85714286	317.1601522	5.320148705	0.182648405	7.407407407	6.542056075	87.09677419	55	48.59813084	87.09677419	375.2166515	-65.97131265
Epochs 100	0.229357794	10	9.615384615	94.11764706	50	47.11538462	87.87878788	482.6532426	5.320148705	0.223744288	7.792207792	6.862745098	90	51.31578947	49.01960784	85	187.486639	-65.97131265
Epochs 120	0.288990825	9.85915493	8.510638298	90.56603774	47.88732394	47.87234043	86.53846154	429.2767683	5.320148705	0.305936068	8.450704225	7.865168539	91.52542373	55.71428571	51.68539326	86.44067797	252.2526759	-65.97131265
Epochs 140	0.24311927	9.722222222	9.259259259	94.73684211	45.83333333	47.22222222	89.18918919	235.925182	5.320148705	0.223744288	8.333333333	6.603773585	87.80487805	54.92957746	50.94339623	80.48780488	223.6073182	-65.97131265
Epochs 160	0.311926603	10.29411765	9.473684211	94.54545455	48.52941176	48.42105263	88.88888889	172.6204216	5.320148705	0.296803653	8.333333333	7.777777778	91.22807018	54.92957746	51.11111111	80.70175439	216.9554334	-65.97131265
Epochs 180	0.316513747	10.60606061	9.375	94.64285714	50	47.91666667	89.09090909	217.8130582	5.320148705	0.324200898	9.523809524	7.52688172	92.06349206	61.29032258	51.61290323	82.53968254	710.3876982	-65.97131265
Epochs 200	0.298165143	10.44776119	9.090909091	94.23076923	47.76119403	46.46464646	86.2745098	166.4137029	5.320148705	0.283105016	8.450704225	7.446808511	90.74074074	57.14285714	52.12765957	79.62962963	329.3835502	-65.97131265

Table 13-12 Results of 50 Percent More Sell Class CNN Models , Non-Cyclic Stocks

Singapore Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.077981651	8.888888889	4.8	100	53.33333333	44.35483871	66.66666667	18.57138065	-64.15459983	0.079069771	6.25	7	100	48.21428571	54.54545455	100	-91.70292228	-78.23835547
Epochs 40	0.087155961	7.368421053	7.5	100	54.73684211	51.2605042	100	-90.403267	-55.90202866	0.097674422	6.194690265	8.333333333	100	46.90265487	57.89473684	83.33333333	-85.92172305	-78.23835547
Epochs 60	0.133027524	9.473684211	8.035714286	100	51.06382979	45.53571429	90.90909091	-89.13270151	-64.15459983	0.130232558	5.882352941	9.638554217	100	46.21848739	59.75609756	84.61538462	-85.11124133	-78.23835547
Epochs 80	0.211009175	9.473684211	8.602150538	96.66666667	53.19148936	44.08602151	83.33333333	-84.97393941	-64.15459983	0.186046511	6.25	8.108108108	93.10344828	45.53571429	60.2739726	89.65517241	-81.94554867	-78.23835547
Epochs 100	0.344036698	7.936507937	8.139534884	91.30434783	55.55555556	45.34883721	83.82352941	-22.24778452	-64.15459983	0.325581402	7.142857143	9.85915493	95	48.80952381	58.57142857	86.66666667	-69.78305526	-78.23835547
Epochs 120	0.316513747	10	8.641975309	94.73684211	56.96202532	46.91358025	82.45614035	278.6389976	-64.15459983	0.288372099	6.18556701	9.375	92.59259259	48.45360825	58.73015873	85.18518519	-72.32321721	-78.23835547
Epochs 140	0.311926603	9.411764706	9.090909091	94.64285714	54.76190476	45.45454545	83.92857143	214.7613587	-64.15459983	0.297674417	6.382978723	9.375	91.22807018	50	58.73015873	84.21052632	-24.53134158	-78.23835547
Epochs 160	0.275229365	9.302325581	8.333333333	93.75	52.94117647	47.61904762	85.41666667	280.1970623	-64.15459983	0.265116274	6	10.44776119	91.66666667	49	59.09090909	85.41666667	-79.29237092	-78.23835547
Epochs 180	0.32110092	8.571428571	8.139534884	91.93548387	56.52173913	50	82.25806452	-1.220285654	-64.15459983	0.302325577	4.761904762	8.571428571	90.16393443	50	59.42028986	81.96721311	-79.60928878	-78.23835547
Epochs 200	0.366972476	8	9.85915493	93.05555556	52.7027027	43.66197183	83.33333333	-81.20635229	-64.15459983	0.306976736	6.451612903	6.666666667	90.32258065	50.53763441	62.71186441	82.25806452	-29.89072045	-78.23835547

OCBC Bank Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.068807341	7	6.779661017	0	53	49.57264957	0	-92.70826134	-55.90202866	0.08372093	8.571428571	8.256880734	0	50.47619048	50.92592593	0	-33.52982064	-24.56291964
Epochs 40	0.087155961	7.368421053	7.5	100	54.73684211	51.2605042	100	-90.403267	-55.90202866	0.106976748	6.730769231	8.823529412	77.77777778	50.96153846	56.43564356	77.77777778	-14.07207365	-24.56291964
Epochs 60	0.110091746	7	8.181818182	100	54	54.12844037	87.5	-92.28249014	-55.90202866	0.130232558	6.730769231	9.278350515	85.71428571	51.92307692	56.25	78.57142857	-9.687502692	-24.56291964
Epochs 80	0.146788985	6.315789474	7.843137255	85.71428571	54.73684211	55.44554455	80.95238095	-98.2884229	-55.90202866	0.200000003	7.070707071	9.302325581	93.33333333	52.52525253	55.29411765	86.66666667	-11.41479587	-24.56291964
Epochs 100	0.211009175	6.493506494	6.862745098	87.17948718	57.14285714	53.92156863	76.31578947	-93.5703834	-55.90202866	0.330232561	5.405405405	8.333333333	88.4057971	52.7027027	53.52112676	85.50724638	-4.958102002	-24.56291964
Epochs 120	0.224770635	8.139534884	7.446808511	92.10526316	56.97674419	54.25531915	81.08108108	-97.36266326	-55.90202866	0.330232561	8.235294118	8.955223881	92.06349206	56.47058824	54.54545455	88.88888889	0.289075167	-24.56291964
Epochs 140	0.215596333	7.954545455	7.446808511	91.66666667	54.54545455	52.12765957	80	-94.66199003	-55.90202866	0.330232561	7.317073171	8.823529412	90.76923077	56.09756098	56.71641791	87.69230769	10.88010092	-24.56291964
Epochs 160	0.197247714	7.608695652	7.446808511	90.625	54.34782609	52.12765957	80.64516129	-95.39910556	-55.90202866	0.293023258	7.142857143	8	91.07142857	54.76190476	54.05405405	87.5	-7.944435679	-24.56291964
Epochs 180	0.229357794	7.407407407	7.291666667	90.24390244	54.32098765	51.04166667	80	-93.64548273	-55.90202866	0.33488372	5.405405405	8.219178082	91.17647059	54.05405405	51.38888889	88.23529412	-13.67635008	-24.56291964
Epochs 200	0.261467904	6.172839506	8.045977011	90	54.32098765	52.87356322	81.63265306	-97.1308681	-55.90202866	0.344186038	6.493506494	7.8125	86.48648649	54.54545455	57.14285714	83.78378378	19.21392069	-24.56291964

CNOOC Limited Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.04265403	2.941176471	4.62962963	100	47.05882353	50.46728972	100	-15.54839521	-54.68960087	0.093896717	6.666666667	7.766990291	100	42.85714286	50	80	-60.24206218	-84.2898875
Epochs 40	0.0521327	2.857142857	5.825242718	66.66666667	51.42857143	53.92156863	66.66666667	1.803011688	-54.68960087	0.079812206	6.862745098	7.339449541	100	48.03921569	55.55555556	100	-75.44129079	-84.2898875
Epochs 60	0.066350713	2.777777778	6.315789474	62.5	51.85185185	54.25531915	50	38.22259221	-54.68960087	0.112676054	6.603773585	8.163265306	100	48.11320755	55.67010309	77.77777778	-77.72628731	-84.2898875
Epochs 80	0.146919429	4.761904762	7.228915663	86.95652174	54.28571429	54.87804878	69.56521739	56.06223179	-54.68960087	0.17840375	7.843137255	8.045977011	95.83333333	47.05882353	52.3255814	87.5	-73.85053513	-84.2898875

Epochs 100	0.241706163	3.571428571	7.594936709	87.5	58.33333333	55.12820513	70.83333333	183.8279852	-54.68960087	0.267605633	8.333333333	8.43373494	93.47826087	48.80952381	48.7804878	86.95652174	-63.16910584	-84.2898875
Epochs 120	0.236966819	4.255319149	8.333333333	88.88888889	56.38297872	57.74647887	73.33333333	190.6520237	-54.68960087	0.28638497	8.24742268	10.14492754	97.87234043	47.42268041	48.52941176	87.23404255	-81.05303576	-84.2898875
Epochs 140	0.241706163	4.347826087	7.042253521	87.5	56.52173913	55.71428571	75	175.0288223	-54.68960087	0.253521115	8.24742268	6.944444444	93.18181818	47.42268041	49.29577465	81.81818182	-72.7552425	-84.2898875
Epochs 160	0.246445492	4.301075269	9.589041096	91.11111111	55.91397849	56.94444444	80	229.2355749	-54.68960087	0.258215964	8.080808081	9.459459459	100	48.48484848	50.68493151	87.5	-78.28889953	-84.2898875
Epochs 180	0.289099514	5	9.090909091	92.59259259	57.5	56.57894737	81.48148148	64.22048404	-54.68960087	0.272300482	9.756097561	7.142857143	93.61702128	47.56097561	45.78313253	80.85106383	-72.18796192	-84.2898875
Epochs 200	0.322274894	4.597701149	9.836065574	92.06349206	57.47126437	55	80.95238095	31.61996621	-54.68960087	0.328638494	9.090909091	8.955223881	96.55172414	50	50	86.20689655	-76.77963462	-84.2898875
JP Morgan Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.073394492	10.46511628	3.846153846	100	47.6744186	45.73643411	100	5476.121382	1576.179166	0.091324203	8.791208791	9.375	0	47.77777778	48.4375	0	151.3035802	-31.90034799
Epochs 40	0.073394492	12.5	2.962962963	66.66666667	51.25	45.52238806	66.66666667	820.7883473	1576.179166	0.12328767	9.375	9.482758621	100	49.47368421	51.72413793	100	-40.97589309	-31.90034799
Epochs 60	0.068807341	12.04819277	2.985074627	100	50.60240964	45.86466165	100	679.4202894	1576.179166	0.141552508	8.653846154	10.57692308	100	51.92307692	54.80769231	100	-14.4817029	-31.90034799
Epochs 80	0.105504587	12.04819277	3.174603175	100	50.60240964	45.6	100	539.9077597	1576.179166	0.214611873	8.080808081	12.08791209	96.55172414	50.50505051	57.14285714	92.85714286	784.1752668	-31.90034799
Epochs 100	0.174311921	13.04347826	4.032258065	96	55.07246377	47.15447154	92	793.1497812	1576.179166	0.374429226	10.60606061	11.76470588	95.58823529	51.51515152	56.47058824	86.56716418	524.3347259	-31.90034799
Epochs 120	0.128440365	10.84337349	3.361344538	93.75	50.60240964	47.45762712	87.5	806.6471197	1576.179166	0.342465758	8.75	11.84210526	93.65079365	50	55.26315789	82.25806452	553.1288481	-31.90034799
Epochs 140	0.151376143	10.84337349	3.50877193	95.23809524	51.80722892	49.55752212	85.71428571	2530.556328	1576.179166	0.324200898	8.536585366	12.5	94.73684211	50	55	82.14285714	227.7035651	-31.90034799
Epochs 160	0.128440365	11.25	4.06504065	93.33333333	51.25	45.90163934	80	214.0857939	1576.179166	0.319634706	8.860759494	12.94117647	94.54545455	48.10126582	56.47058824	85.18518519	325.7426786	-31.90034799
Epochs 180	0.151376143	12.16216216	4.032258065	95	52.7027027	46.34146341	85	416.4070225	1576.179166	0.337899536	9.85915493	12.35955056	94.91525424	49.29577465	55.05617978	82.75862069	158.0151014	-31.90034799
Epochs 200	0.183486238	11.25	4.504504505	96.2962963	51.25	47.27272727	85.18518519	685.7497752	1576.179166	0.374429226	9.459459459	13.15789474	94.20289855	47.2972973	55.26315789	82.35294118	406.4134968	-31.90034799
American Axle (small cap) Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.059633028	4.807692308	6.194690265	100	44.23076923	47.32142857	100	-58.59109413	-40.19620025	0.091324203	10.41666667	7.37704918	100	53.68421053	53.27868852	100	174.5106524	-32.50977019
Epochs 40	0.073394492	5.263157895	5.93220339	80	43.15789474	49.57264957	80	-66.99283879	-40.19620025	0.127853885	10.71428571	7.2	100	56.62650602	52.8	90	121.6558213	-32.50977019
Epochs 60	0.073394492	5.154639175	6.086956522	66.66666667	43.29896907	50	66.66666667	-63.9756708	-40.19620025	0.155251145	10.46511628	7.01754386	89.47368421	55.29411765	52.63157895	78.94736842	189.8997537	-32.50977019
Epochs 80	0.151376143	5.263157895	7.843137255	95.23809524	47.36842105	51.48514851	80.95238095	-28.02454043	-40.19620025	0.232876718	11.11111111	7.920792079	91.89189189	56.25	53.46534653	86.48648649	251.0517165	-32.50977019
Epochs 100	0.229357794	4.761904762	8.510638298	95	45.23809524	51.61290323	87.5	-7.689606041	-40.19620025	0.278538823	9.375	7.070707071	85.71428571	57.8125	51.51515152	80	57.95554457	-32.50977019
Epochs 120	0.220183492	5.319148936	8.139534884	94.73684211	46.80851064	54.11764706	86.84210526	-4.043532258	-40.19620025	0.283105016	8.219178082	7.692307692	89.09090909	56.16438356	53.84615385	81.48148148	14.17446138	-32.50977019
Epochs 140	0.211009175	5.154639175	6.172839506	90	45.36082474	51.85185185	82.05128205	4.411180945	-40.19620025	0.287671238	8	6.976744186	87.93103448	56	55.81395349	80.70175439	36.35004493	-32.50977019
Epochs 160	0.183486238	6.18556701	6.666666667	90.32258065	45.36082474	51.68539326	83.87096774	-5.030652232	-40.19620025	0.264840186	9.090909091	6.593406593	88.23529412	54.54545455	53.84615385	80	77.12330291	-32.50977019
Epochs 180	0.220183492	4.705882353	5.681818182	86.66666667	45.88235294	49.42528736	82.22222222	-3.603780902	-40.19620025	0.287671238	8.571428571	6.666666667	86.44067797	55.71428571	54.44444444	79.31034483	108.3189657	-32.50977019
Epochs 200	0.220183492	6.52173913	4.87804878	86.36363636	47.82608696	50.61728395	81.81818182	-14.5269612	-40.19620025	0.301369876	8.219178082	7.142857143	87.09677419	54.79452055	58.33333333	78.68852459	110.0328174	-32.50977019

Table 13-13 Results of Balanced Class Ratio CNN Models , Cyclic Stocks

Kweichow Moutai Co., Ltd. Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.207729474	10.78431373	7.792207792	92.85714286	53.92156863	47.36842105	89.28571429	18528.47197	1666.892281	0.1875	9.782608696	4.597701149	89.65517241	46.73913043	49.42528736	85.71428571	569.4409682	678.7940879
Epochs 40	0.159420297	11.45833333	8.333333333	93.33333333	55.20833333	51.04166667	92.85714286	2557.740547	1666.892281	0.115384616	10.84337349	6.779661017	100	52.43902439	51.69491525	100	335.4720353	678.7940879
Epochs 60	0.212560385	12.5	9	92.59259259	53.75	49	92.30769231	6310.19714	1666.892281	0.1875	10.9375	6.837606838	88.88888889	53.96825397	51.28205128	74.07407407	209.8238995	678.7940879
Epochs 80	0.212560385	12.65822785	8.910891089	92.59259259	55.12820513	48.51485149	92.59259259	5859.90959	1666.892281	0.182692304	11.29032258	6.611570248	92	54.83870968	50.41322314	70.83333333	213.7757827	678.7940879
Epochs 100	0.280193239	12.98701299	9.195402299	93.02325581	53.24675325	49.42528736	90.47619048	3114.906806	1666.892281	0.240384609	11.29032258	6.542056075	92.30769231	54.83870968	52.3364486	73.68421053	293.387376	678.7940879
Epochs 120	0.342995167	14.49275362	9.756097561	94.64285714	55.07246377	43.90243902	90.90909091	984.5229265	1666.892281	0.302884609	13.46153846	6.796116505	92.45283019	57.69230769	50.48543689	78.84615385	108.8031154	678.7940879
Epochs 140	0.347826093	14.0625	7.5	90.47619048	53.125	41.25	85.48387097	133.7362511	1666.892281	0.3125	9.803921569	7.142857143	89.83050847	54.90196078	49.48453608	79.66101695	113.9526162	678.7940879
Epochs 160	0.342995167	15	7.058823529	90.32258065	55	40	85.24590164	197.2235993	1666.892281	0.326923072	10.63829787	7.920792079	91.66666667	55.31914894	50	81.66666667	172.7166051	678.7940879
Epochs 180	0.400966197	15.51724138	8	91.89189189	53.44827586	40	86.30136986	162.2511546	1666.892281	0.341346145	10.63829787	7.291666667	90.76923077	57.44680851	46.31578947	81.53846154	177.7178584	678.7940879
Epochs 200	0.391304344	15.51724138	7.792207792	91.66666667	55.17241379	42.85714286	87.32394366	183.4923069	1666.892281	0.331730783	10	6.382978723	90.625	58	46.23655914	81.25	253.3359493	678.7940879
Midea Group Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.164251208	7.826086957	8.695652174	82.60869565	53.91304348	55.07246377	72.72727273	47442.161	1245.275482	0.144230768	6.862745098	2.43902439	87.5	50.98039216	53.08641975	79.16666667	53.94124164	468.5733088
Epochs 40	0.135265693	8.928571429	10.46511628	100	58.55855856	61.62790698	77.77777778	137304.4851	1245.275482	0.11057692	6.451612903	4.95049505	85.71428571	53.76344086	53.46534653	76.92307692	59.14565541	468.5733088
Epochs 60	0.246376812	11.23595506	10.46511628	100	59.5505618	61.17647059	84.375	102619.4979	1245.275482	0.182692304	7.407407407	6	96.2962963	61.72839506	54	92.30769231	123.8715888	468.5733088
Epochs 80	0.207729474	10.86956522	9.89010989	100	59.7826087	58.88888889	83.33333333	240667.3598	1245.275482	0.125	7.058823529	4.716981132	88.23529412	57.14285714	54.71698113	88.23529412	63.51440502	468.5733088
Epochs 100	0.251207739	10.75268817	10.12658228	97.14285714	60.21505376	58.97435897	82.85714286	369125.6047	1245.275482	0.177884609	7.594936709	4.04040404	90	56.41025641	56.56565657	86.66666667	148.3280371	468.5733088
Epochs 120	0.280193239	10.38961039	8.43373494	91.4893617	59.74025974	57.31707317	74.46808511	3277.516553	1245.275482	0.201923072	6.944444444	4.081632653	86.84210526	57.74647887	56.12244898	84.21052632	79.22514384	468.5733088
Epochs 140	0.32367149	11.26760563	8.75	92.85714286	60.56338028	58.2278481	78.57142857	8342.596399	1245.275482	0.197115391	7.142857143	3.96039604	86.48648649	56.52173913	54.45544554	83.78378378	43.13569863	468.5733088
Epochs 160	0.32367149	11.94029851	8.333333333	92.85714286	58.20895522	55.42168675	76.78571429	6464.158166	1245.275482	0.211538464	7.462686567	3.96039604	87.5	56.06060606	53.46534653	82.5	38.79525483	468.5733088
Epochs 180	0.347826093	11.94029851	8.860759494	93.44262295	58.20895522	52.56410256	78.68852459	7582.330993	1245.275482	0.235576928	7.352941176	4.210526316	88.88888889	55.2238806	56.84210526	84.44444444	59.26413284	468.5733088
Epochs 200	0.314009666	10.95890411	8.75	92.59259259	59.72222222	55	75.92592593	7486.449959	1245.275482	0.230769232	7.352941176	4.166666667	88.63636364	55.2238806	57.29166667	84.09090909	59.26413284	468.5733088
Walmart Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.142201841	5.691056911	6.849315068	86.36363636	47.96747967	37.5	81.81818182	180.8560659	9380.979094	0.146118715	4.511278195	8.064516129	87.5	50.75757576	56.4516129	79.16666667	236.3974598	255.7316817
Epochs 40	0.091743119	6.086956522	6.25	100	51.30434783	46.31578947	100	227.8835231	9380.979094	0.08219178	3.731343284	6.578947368	88.88888889	46.61654135	44.73684211	88.88888889	46.35239418	255.7316817

Epochs 60	0.183486238	6.741573034	6.060606061	93.33333333	56.17977528	45.91836735	93.33333333	300.8055188	9380.979094	0.200913236	4.854368932	7.594936709	89.18918919	51.96078431	48.10126582	86.48648649	259.939005	255.7316817
Epochs 80	0.16055046	6.741573034	5.825242718	88.46153846	52.80898876	44.11764706	84.61538462	255.847673	9380.979094	0.182648405	4.807692308	8.333333333	90.32258065	49.51456311	47.61904762	87.09677419	262.0527476	255.7316817
Epochs 100	0.188073397	6.741573034	6.25	87.87878788	50.56179775	44.21052632	75.75757576	222.1088686	9380.979094	0.242009133	5.940594059	10.52631579	92.85714286	53	48.68421053	90.47619048	6366.440621	255.7316817
Epochs 120	0.24311927	7.692307692	7.216494845	93.02325581	50	42.70833333	83.72093023	138.5412669	9380.979094	0.269406378	4.444444444	10.38961039	90.38461538	52.80898876	48.05194805	88.46153846	397.7222078	255.7316817
Epochs 140	0.25688073	6.493506494	7.446808511	93.61702128	48.05194805	40.86021505	85.10638298	175.2313317	9380.979094	0.287671238	3.529411765	10.52631579	89.65517241	53.57142857	47.36842105	87.93103448	517.2278065	255.7316817
Epochs 160	0.275229365	5.714285714	7.368421053	92.45283019	48.57142857	41.4893617	83.01886792	154.2345327	9380.979094	0.310502291	4.054054054	9.87654321	89.0625	50.68493151	46.91358025	82.8125	512.3414773	255.7316817
Epochs 180	0.316513747	7.246376812	5.882352941	92.1875	47.82608696	40.47619048	82.8125	273.2463897	9380.979094	0.347031951	4.166666667	10.66666667	90.27777778	50.70422535	49.33333333	84.72222222	564.4736055	255.7316817
Epochs 200	0.279816508	5.405405405	6.818181818	91.07142857	44.59459459	41.37931034	80.35714286	131.8654636	9380.979094	0.337899536	4.109589041	9.333333333	90.14084507	51.38888889	49.33333333	85.91549296	577.1655763	255.7316817
Fresh Del Monte Produce Inc (small cap)Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.169724777	7.8125	8.955223881	91.30434783	40.15748031	49.25373134	91.30434783	-29.69081402	5.320148705	0.205479458	6.666666667	7.575757576	96.96969697	47.89915966	42.42424242	81.81818182	49.0226539	-65.97131265
Epochs 40	0.142201841	8.928571429	8.791208791	86.66666667	45.04504505	45.05494505	86.66666667	206.8694331	5.320148705	0.114155248	6.896551724	7.52688172	100	51.30434783	46.23655914	80	77.35383089	-65.97131265
Epochs 60	0.206422016	8.888888889	8.24742268	93.5483871	44.94382022	45.36082474	83.87096774	57.89484065	5.320148705	0.187214613	8.823529412	6.741573034	92.85714286	52.47524752	49.43820225	82.14285714	37.20861341	-65.97131265
Epochs 80	0.229357794	9.782608696	8.791208791	94.28571429	48.35164835	49.45054945	85.71428571	146.9775849	5.320148705	0.173515975	9.615384615	6.52173913	95.65217391	54.36893204	51.08695652	82.60869565	731.531762	-65.97131265
Epochs 100	0.261467904	8.510638298	8.974358974	91.30434783	47.31182796	50	78.26086957	52.1201537	5.320148705	0.200913236	6.730769231	8.641975309	88.23529412	52.42718447	54.32098765	73.52941176	-2.923006063	-65.97131265
Epochs 120	0.330275238	10.25641026	6.666666667	90.76923077	48.71794872	52	82.8125	-16.06528229	5.320148705	0.255707771	8.791208791	8.333333333	93.18181818	55.55555556	55.95238095	79.54545455	193.4705057	-65.97131265
Epochs 140	0.357798159	10.52631579	5.797101449	90.4109589	50	50.72463768	81.94444444	-19.37390571	5.320148705	0.264840186	8.045977011	7.317073171	90	54.65116279	56.09756098	80	96.79215095	-65.97131265
Epochs 160	0.376146793	10.29411765	5.633802817	89.87341772	51.47058824	50.70422535	83.33333333	0.299868677	5.320148705	0.273972601	8.536585366	7.058823529	90.38461538	54.32098765	55.29411765	80.76923077	118.1195188	-65.97131265
Epochs 180	0.38532111	10.29411765	5.797101449	90.12345679	51.47058824	47.82608696	83.75	-11.86527049	5.320148705	0.292237431	8.333333333	7.692307692	89.47368421	53.01204819	53.84615385	80.70175439	91.74699195	-65.97131265
Epochs 200	0.376146793	10.14492754	5.714285714	89.87341772	52.17391304	48.57142857	83.33333333	-46.93662886	5.320148705	0.264840186	7.865168539	7.594936709	88.23529412	56.81818182	55.69620253	78.43137255	91.64038197	-65.97131265

Table 13-14 Results of Balanced Class Ratio CNN Models , Non-Cyclic Stocks

14 Appendix 9

Singapore Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.422018349	6.382978723	9.090909091	91.20879121	47.87234043	39.39393939	78.88888889	-84.6327087	-64.15459983	0.353488386	5.833333333	15.38461538	94.20289855	43.33333333	57.69230769	88.23529412	-71.19096756	-78.23835547
Epochs 40	0.247706428	8.333333333	8.75	92.85714286	48.95833333	41.25	85.36585366	49.31499606	-64.15459983	0.237209305	5.555555556	12.24489796	95	42.06349206	56.25	90	-90.2400834	-78.23835547
Epochs 60	0.24311927	8.163265306	8.860759494	92.68292683	48.97959184	44.30379747	87.5	6.687599462	-64.15459983	0.265116274	6.306306306	11.47540984	100	44.14414414	55.73770492	90.47619048	-82.68899631	-78.23835547
Epochs 80	0.266055048	8.602150538	8.860759494	93.47826087	49.46236559	41.7721519	88.88888889	35.7127188	-64.15459983	0.260465115	6.422018349	9.677419355	97.72727273	44.95412844	58.06451613	88.37209302	-81.04625002	-78.23835547
Epochs 100	0.284403682	8	7.692307692	92.45283019	50	43.07692308	86.53846154	-87.03917265	-64.15459983	0.251162797	6.194690265	10	97.61904762	46.90265487	60	85.36585366	-73.70599842	-78.23835547
Epochs 120	0.288990825	7.766990291	6.779661017	91.07142857	50.48543689	40.6779661	87.27272727	-81.9880849	-64.15459983	0.246511623	5.982905983	10.52631579	97.56097561	46.15384615	61.40350877	85	-83.55414065	-78.23835547
Epochs 140	0.288990825	8	6.451612903	91.07142857	51	43.5483871	87.27272727	-81.9880849	-64.15459983	0.260465115	6.140350877	10.52631579	97.72727273	46.49122807	57.89473684	86.04651163	-80.99906858	-78.23835547
Epochs 160	0.275229365	7	6.349206349	89.09090909	50	44.44444444	85.18518519	-84.57282306	-64.15459983	0.241860464	6.25	9.523809524	97.5	44.64285714	57.14285714	84.61538462	-81.49858893	-78.23835547
Epochs 180	0.247706428	6.862745098	5.970149254	87.75510204	49.01960784	43.28358209	81.25	-85.97268017	-64.15459983	0.227906972	6.194690265	9.230769231	97.2972973	45.13274336	58.46153846	83.33333333	-82.29374188	-78.23835547
Epochs 200	0.25688073	6.930693069	6.060606061	88.23529412	49.5049505	43.93939394	82	-82.93781967	-64.15459983	0.237209305	7.079646018	8.064516129	95	45.13274336	56.4516129	82.05128205	-88.00371641	-78.23835547
OCBC Bank Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.270642191	7.619047619	5.084745763	88.88888889	54.28571429	50.84745763	84.90566038	-77.05370317	-55.90202866	0.353488386	9.183673469	6.818181818	87.67123288	47.95918367	54.54545455	80.55555556	-63.49713228	-24.56291964
Epochs 40	0.110091746	7.766990291	5	73.33333333	57.2815534	54.54545455	73.33333333	-82.98565797	-55.90202866	0.218604654	8.411214953	8.571428571	84.21052632	50.46728972	57.97101449	76.31578947	-30.40293064	-24.56291964
Epochs 60	0.133027524	7.920792079	6.060606061	83.33333333	57.42574257	55.10204082	77.77777778	-78.43874059	-55.90202866	0.204651162	8.849557522	7.462686567	82.85714286	51.32743363	59.09090909	77.14285714	-39.5901533	-24.56291964
Epochs 80	0.142201841	7.920792079	5.263157895	81.81818182	56.43564356	54.25531915	77.27272727	-86.92498533	-55.90202866	0.195348844	7.692307692	9.230769231	81.81818182	52.13675214	58.46153846	78.125	-56.14140282	-24.56291964
Epochs 100	0.169724777	7.766990291	6.741573034	88.46153846	57.2815534	55.68181818	80.76923077	-71.06024816	-55.90202866	0.209302321	7.317073171	11.86440678	87.87878788	49.59349593	55.93220339	84.375	-63.19960114	-24.56291964
Epochs 120	0.169724777	7.619047619	6.896551724	88.46153846	57.14285714	56.97674419	84.61538462	-61.05537892	-55.90202866	0.200000003	8.130081301	11.11111111	89.65517241	50.40650407	58.06451613	86.20689655	-64.93452712	-24.56291964
Epochs 140	0.165137619	7.920792079	5.555555556	85.18518519	58.41584158	55.05617978	81.48148148	-63.22166583	-55.90202866	0.204651162	8.333333333	10.9375	87.09677419	50.83333333	57.14285714	83.87096774	-58.12417905	-24.56291964
Epochs 160	0.174311921	7.843137255	5.747126437	86.20689655	57.84313725	55.81395349	82.75862069	-61.90927633	-55.90202866	0.19069767	7.56302521	10.44776119	86.20689655	48.7394958	56.06060606	82.75862069	-60.1961404	-24.56291964
Epochs 180	0.165137619	7.619047619	5.747126437	88.46153846	57.14285714	55.81395349	84.61538462	-46.15839985	-55.90202866	0.158139542	7.317073171	8.695652174	82.60869565	47.96747967	54.41176471	78.26086957	-57.82651494	-24.56291964
Epochs 200	0.17889908	7.619047619	5.952380952	89.65517241	57.14285714	55.42168675	86.20689655	-56.42740015	-55.90202866	0.16744186	7.37704918	8.823529412	84	48.36065574	53.73134328	80	-15.40404343	-24.56291964
CNOOC Limited Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.293838859	4.854368932	9.615384615	92.85714286	50.48543689	58.82352941	87.5	-69.30048459	-54.68960087	0.352112681	6.481481481	8.823529412	91.54929577	48.14814815	61.76470588	85.71428571	-55.4448147	-84.2898875

Epochs 40	0.180094793	5.714285714	8.75	96.15384615	52.38095238	60.75949367	84.61538462	357.7495413	-54.68960087	0.291079819	7.079646018	14	94	46.01769912	61.2244898	84	-56.48646214	-84.2898875
Epochs 60	0.175355449	5.607476636	8.860759494	96	52.3364486	62.82051282	88	397.3826708	-54.68960087	0.305164307	7.407407407	13.20754717	96.15384615	49.07407407	58.49056604	86.2745098	-82.64742843	-84.2898875
Epochs 80	0.180094793	5.555555556	8.974358974	100	52.77777778	59.74025974	96	309.5253112	-54.68960087	0.28169015	7.01754386	13.7254902	93.75	46.49122807	56.8627451	82.9787234	-77.86783108	-84.2898875
Epochs 100	0.189573467	5.405405405	9.589041096	100	53.15315315	63.88888889	96.2962963	718.8959851	-54.68960087	0.305164307	7.01754386	15.2173913	94.33962264	48.24561404	52.17391304	82.69230769	-83.73848825	-84.2898875
Epochs 120	0.180094793	5.263157895	9.722222222	100	53.50877193	64.78873239	100	2040.111182	-54.68960087	0.295774639	7.079646018	14.28571429	94.11764706	49.55752212	51.02040816	82	-84.60971297	-84.2898875
Epochs 140	0.194312796	5.309734513	10	100	53.09734513	63.76811594	100	2084.712451	-54.68960087	0.300469488	7.272727273	13.7254902	94.23076923	47.27272727	52.94117647	82.35294118	-87.15800531	-84.2898875
Epochs 160	0.175355449	5.263157895	9.589041096	100	52.63157895	66.66666667	100	2020.75786	-54.68960087	0.28169015	7.079646018	11.76470588	93.87755102	47.78761062	49.01960784	81.25	-84.07101849	-84.2898875
Epochs 180	0.165876776	5.172413793	8.450704225	95.83333333	53.44827586	64.28571429	95.83333333	1924.762379	-54.68960087	0.28638497	7.207207207	13.20754717	93.87755102	48.64864865	56.60377358	79.16666667	-85.80821417	-84.2898875
Epochs 200	0.194312796	5.217391304	9.090909091	96.66666667	53.04347826	66.15384615	96.66666667	2286.027531	-54.68960087	0.291079819	7.272727273	13.20754717	94	50.90909091	54.71698113	79.59183673	-67.97474518	-84.2898875
JP Morgan Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.247706428	8.888888889	2.5	91.66666667	48.88888889	46.83544304	85.41666667	4767.406398	1576.179166	0.456620991	7.5	10.52631579	89.10891089	48.10126582	65.78947368	84.15841584	89.72453121	-31.90034799
Epochs 40	0.128440365	10.84337349	3.361344538	93.75	46.98795181	45.76271186	81.25	4174.235644	1576.179166	0.278538823	9.183673469	13.15789474	93.33333333	49.48453608	59.21052632	84.44444444	-4.614575938	-31.90034799
Epochs 60	0.123853214	10	3.333333333	83.33333333	51.25	45.37815126	77.77777778	1158.490819	1576.179166	0.273972601	8.421052632	10.81081081	88	51.06382979	59.45945946	82	-26.32013724	-31.90034799
Epochs 80	0.137614682	10	3.418803419	85.71428571	50	46.55172414	80.95238095	1559.009692	1576.179166	0.305936068	8.695652174	13.51351351	92.45283019	49.45054945	60.81081081	84.90566038	-0.888763051	-31.90034799
Epochs 100	0.155963302	11.49425287	3.669724771	90.90909091	49.42528736	47.22222222	81.81818182	714.6773904	1576.179166	0.283105016	6.862745098	14.92537313	90	48.51485149	64.17910448	86	-6.268984966	-31.90034799
Epochs 120	0.17889908	11.36363636	3.883495146	92.59259259	48.86363636	48.03921569	81.48148148	785.7814383	1576.179166	0.260273963	7.692307692	11.76470588	87.23404255	49.51456311	60.29411765	80.85106383	-7.960960218	-31.90034799
Epochs 140	0.188073397	11.76470588	3.846153846	93.10344828	49.41176471	48.54368932	86.20689655	1051.821361	1576.179166	0.260273963	8.653846154	10.29411765	87.23404255	49.51456311	60.29411765	80.85106383	51.22234816	-31.90034799
Epochs 160	0.17889908	11.11111111	3.03030303	89.65517241	48.88888889	47.95918367	82.75862069	1020.186235	1576.179166	0.251141548	8.490566038	10.29411765	86.66666667	48.57142857	57.35294118	82.22222222	-1.613244214	-31.90034799
Epochs 180	0.169724777	11.36363636	2.912621359	88.88888889	51.13636364	48.03921569	81.48148148	761.7069828	1576.179166	0.242009133	7.547169811	10.14492754	86.36363636	48.57142857	55.07246377	81.81818182	-20.58280155	-31.90034799
Epochs 200	0.155963302	11.11111111	2.857142857	91.30434783	50	48.07692308	86.95652174	732.0577648	1576.179166	0.237442926	6.603773585	10.29411765	84.44444444	47.61904762	54.41176471	80	-10.97002569	-31.90034799
American Axle (small cap) Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.284403682	5.217391304	6.976744186	88.33333333	46.95652174	55.81395349	84.74576271	-9.04405811	-40.19620025	0.474885851	9.523809524	13.51351351	92.85714286	53.01204819	62.16216216	85.71428571	3.233567885	-32.50977019
Epochs 40	0.165137619	6.363636364	8.333333333	91.66666667	46.36363636	54.76190476	86.95652174	3.129026925	-40.19620025	0.269406378	11.57894737	10.71428571	97.5	58.5106383	63.0952381	90	392.0796973	-32.50977019
Epochs 60	0.169724777	6.542056075	8.139534884	92	45.79439252	54.65116279	87.5	23.62864579	-40.19620025	0.278538823	11.95652174	10.58823529	97.61904762	58.24175824	63.52941176	92.85714286	118.2333242	-32.50977019
Epochs 80	0.192660555	5.607476636	8.75	93.5483871	43.92523364	53.75	90	5.224971912	-40.19620025	0.283105016	11.34020619	10.25641026	97.72727273	58.33333333	65.38461538	93.18181818	114.9606464	-32.50977019
Epochs 100	0.206422016	7.339449541	8.974358974	96.77419355	45.87155963	52.56410256	93.33333333	94.9485112	-40.19620025	0.273972601	10.67961165	10.81081081	97.61904762	56.8627451	62.16216216	92.85714286	79.60517235	-32.50977019
Epochs 120	0.215596333	7.407407407	8	94.28571429	46.2962963	53.33333333	88.23529412	57.47350215	-40.19620025	0.283105016	11.34020619	10.25641026	97.72727273	57.29166667	62.82051282	90.90909091	107.1183339	-32.50977019
Epochs 140	0.220183492	6.666666667	7.894736842	94.59459459	44.76190476	52.63157895	83.33333333	55.28819193	-40.19620025	0.273972601	11.11111111	10.25641026	97.61904762	58.16326531	61.53846154	90.47619048	120.0278409	-32.50977019

Epochs 160	0.229357794	6.862745098	6.666666667	92.68292683	46.07843137	50.66666667	87.5	88.21524054	-40.19620025	0.246575341	11.34020619	8.333333333	94.73684211	58.33333333	58.33333333	86.84210526	141.0284317	-32.50977019
Epochs 180	0.247706428	6.930693069	6.944444444	93.33333333	46.53465347	50	86.36363636	97.53401288	-40.19620025	0.228310496	11.11111111	8.139534884	94.11764706	58.16326531	56.97674419	88.23529412	148.3764221	-32.50977019
Epochs 200	0.266055048	6.862745098	7.462686567	93.87755102	47.05882353	50.74626866	87.5	162.4833878	-40.19620025	0.228310496	10.89108911	8.333333333	94.11764706	59	57.14285714	85.29411765	168.4095096	-32.50977019

Table 14-1 Results of 25 Percent More Buy Class LSTM Models , Cyclic Stocks

Kweichow Moutai Co., Ltd. Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.086956523	7.692307692	6.849315068	75	44.96124031	41.09589041	50	3451.614918	1666.892281	0.11057692	8.163265306	5	100	45.36082474	50	100	686.8249926	678.7940879
Epochs 40	0.178743958	11.84210526	7.476635514	83.33333333	54.66666667	46.72897196	83.33333333	1959.203467	1666.892281	0.173076928	11.76470588	7.438016529	100	55.88235294	50	89.47368421	220.8254589	678.7940879
Epochs 60	0.198067635	10.95890411	7.619047619	86.20689655	52.77777778	47.61904762	86.20689655	1665.045444	1666.892281	0.163461536	10.76923077	7.317073171	90	53.84615385	48.36065574	80	160.2792546	678.7940879
Epochs 80	0.198067635	10.95890411	7.619047619	86.20689655	54.16666667	46.66666667	86.20689655	1228.059593	1666.892281	0.144230768	10.76923077	7.03125	93.33333333	55.38461538	48.03149606	86.66666667	159.8090745	678.7940879
Epochs 100	0.246376812	13.04347826	8	89.47368421	55.88235294	48	89.47368421	1587.992434	1666.892281	0.177884609	11.29032258	7.258064516	95.45454545	56.4516129	47.15447154	90.90909091	184.3990506	678.7940879
Epochs 120	0.241545901	11.42857143	8.080808081	89.47368421	53.62318841	46.46464646	89.47368421	962.4054798	1666.892281	0.1875	12.5	7.37704918	100	56.25	48.76033058	90.90909091	165.1601211	678.7940879
Epochs 140	0.251207739	11.11111111	8.421052632	90	54.92957746	47.36842105	90	2051.682006	1666.892281	0.201923072	12.30769231	6.896551724	96.2962963	55.38461538	49.56521739	85.18518519	207.7540815	678.7940879
Epochs 160	0.246376812	10.81081081	8.510638298	89.74358974	54.79452055	47.87234043	89.74358974	1943.64433	1666.892281	0.206730768	12.30769231	6.956521739	96.42857143	55.38461538	47.36842105	85.71428571	215.356935	678.7940879
Epochs 180	0.260869563	11.11111111	8.602150538	90.47619048	53.52112676	47.31182796	90.47619048	2149.476433	1666.892281	0.211538464	10.9375	6.306306306	90.90909091	56.25	48.18181818	78.78787879	167.8100493	678.7940879
Epochs 200	0.260869563	10	8.602150538	88.63636364	53.62318841	47.31182796	86.36363636	1674.313413	1666.892281	0.230769232	10.76923077	6.603773585	91.89189189	55.38461538	47.61904762	81.08108108	176.5884769	678.7940879
Midea Group Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.144927531	5.223880597	10.90909091	94.44444444	47.01492537	51.85185185	94.44444444	17414.35168	1245.275482	0.072115384	5.6	2.597402597	100	41.93548387	42.85714286	83.33333333	-27.91280851	468.5733088
Epochs 40	0.270531386	9.85915493	8.791208791	91.11111111	63.38028169	56.66666667	77.77777778	80008.15095	1245.275482	0.206730768	7.692307692	5.504587156	94.11764706	55.38461538	51.85185185	88.23529412	26.01632076	468.5733088
Epochs 60	0.285024166	12	7.058823529	93.61702128	64	58.33333333	82.9787234	48522.71651	1245.275482	0.168269232	7.575757576	5.982905983	92	54.54545455	52.13675214	91.66666667	4.356666239	468.5733088
Epochs 80	0.217391297	10.84337349	8.421052632	96.55172414	61.44578313	59.57446809	79.31034483	26069.55203	1245.275482	0.134615391	6.944444444	5.93220339	88.88888889	58.33333333	52.13675214	88.88888889	123.3506335	468.5733088
Epochs 100	0.299516916	12.32876712	7.142857143	94	65.75342466	61.44578313	84	56247.5114	1245.275482	0.177884609	7.8125	6.034482759	89.28571429	59.375	53.04347826	89.28571429	63.16189036	468.5733088
Epochs 120	0.251207739	11.11111111	6.451612903	90.47619048	65.27777778	59.7826087	80.95238095	70516.17477	1245.275482	0.15384616	6.25	5.833333333	87.5	56.25	52.10084034	87.5	28.28257075	468.5733088
Epochs 140	0.280193239	10.14492754	6.741573034	91.83673469	63.76811594	59.09090909	85.71428571	55617.78638	1245.275482	0.192307696	7.692307692	6.25	90.32258065	60	54.05405405	90.32258065	95.89513289	468.5733088
Epochs 160	0.265700489	9.85915493	6.741573034	89.36170213	60.56338028	59.09090909	82.9787234	42374.49327	1245.275482	0.177884609	7.8125	6.034482759	89.28571429	57.8125	52.17391304	89.28571429	72.6555464	468.5733088
Epochs 180	0.29468599	10	7.142857143	90.56603774	61.42857143	61.44578313	84.90566038	12820.93898	1245.275482	0.163461536	4.615384615	5.263157895	86.20689655	58.46153846	52.21238938	86.20689655	98.89831768	468.5733088
Epochs 200	0.299516916	10	7.228915663	90.74074074	60	62.19512195	83.33333333	12820.93898	1245.275482	0.182692304	6.25	5.357142857	87.5	59.375	53.15315315	87.5	94.17599916	468.5733088
Walmart Test Set	Non-Recession									Recession								

	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.073394492	4.895104895	5.714285714	100	47.55244755	47.82608696	80	6515.201367	9380.979094	0.10958904	4.487179487	11.53846154	100	47.09677419	55.76923077	100	641.7731819	255.7316817
Epochs 40	0.16055046	8.536585366	6.896551724	100	57.31707317	48.69565217	95	839.4249331	9380.979094	0.232876718	5.882352941	9.677419355	90.24390244	50	48.38709677	80.48780488	66.65256783	255.7316817
Epochs 60	0.151376143	9.333333333	6.4	100	53.33333333	46.77419355	100	461.310272	9380.979094	0.242009133	6.024096386	10.52631579	92.68292683	52.43902439	48.42105263	80.48780488	76.89547394	255.7316817
Epochs 80	0.137614682	9.722222222	6.106870229	100	52.77777778	47.69230769	100	472.975068	9380.979094	0.214611873	6.097560976	9.803921569	91.42857143	50.61728395	45.09803922	77.14285714	51.99170356	255.7316817
Epochs 100	0.165137619	8.333333333	6.451612903	100	51.38888889	48.7804878	90.90909091	208.8836223	9380.979094	0.223744288	6.25	9.803921569	91.89189189	51.89873418	45.09803922	78.37837838	55.83437537	255.7316817
Epochs 120	0.165137619	8.571428571	6.349206349	100	51.42857143	48	95.45454545	140.2109508	9380.979094	0.228310496	6.25	10.67961165	94.44444444	51.89873418	45.63106796	80.55555556	133.1993915	255.7316817
Epochs 140	0.169724777	8.108108108	6.611570248	100	50.68493151	49.58677686	95.65217391	236.1047434	9380.979094	0.237442926	5.063291139	10.20408163	90.47619048	51.28205128	47.95918367	78.57142857	177.6115237	255.7316817
Epochs 160	0.169724777	8.108108108	6.611570248	100	50.68493151	49.58677686	95.65217391	182.3366322	9380.979094	0.237442926	5	10.30927835	90.47619048	50.63291139	48.45360825	78.57142857	100.1574338	255.7316817
Epochs 180	0.174311921	9.589041096	6.557377049	100	50	49.18032787	95.65217391	71.90480482	9380.979094	0.242009133	5.194805195	10.1010101	90.69767442	51.31578947	47.47474747	79.06976744	88.13497508	255.7316817
Epochs 200	0.174311921	7.894736842	6.837606838	96	52	51.28205128	92	277.6130937	9380.979094	0.251141548	5.128205128	11.2244898	93.02325581	50.64935065	50	81.39534884	89.34419249	255.7316817
Fresh Del Monte Produce Inc (small cap)Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.105504587	5.797101449	8.571428571	90	36.23188406	46.37681159	80	52.29061547	5.320148705	0.086757988	5.960264901	8.064516129	83.33333333	49.33333333	46.77419355	83.33333333	277.7031702	-65.97131265
Epochs 40	0.220183492	10.86956522	10.20408163	100	51.08695652	48.45360825	82.14285714	585.7375535	5.320148705	0.178082198	8.988764045	5.825242718	92.59259259	52.27272727	48.54368932	85.18518519	-74.82609923	-65.97131265
Epochs 60	0.197247714	9.89010989	9	92.59259259	50.54945055	47	80.76923077	441.6639697	5.320148705	0.196347028	8.333333333	6.796116505	90.625	55.42168675	49.51456311	81.25	-79.58052601	-65.97131265
Epochs 80	0.183486238	10	8.571428571	95.65217391	52.22222222	49.03846154	86.95652174	655.9789063	5.320148705	0.19178082	9.090909091	6.862745098	93.10344828	54.02298851	46.07843137	82.75862069	-85.30954154	-65.97131265
Epochs 100	0.211009175	11.25	8.256880734	96.55172414	55	47.22222222	86.20689655	499.741594	5.320148705	0.246575341	10.66666667	6.796116505	95.12195122	55.40540541	46.60194175	87.80487805	-85.70581625	-65.97131265
Epochs 120	0.192660555	10.66666667	6.956521739	92.85714286	54.66666667	46.49122807	75	225.1156153	5.320148705	0.214611873	10.12658228	6.603773585	94.11764706	56.41025641	46.22641509	85.29411765	-49.74044498	-65.97131265
Epochs 140	0.201834857	9.210526316	7.272727273	90.625	52.63157895	46.36363636	74.19354839	210.2658509	5.320148705	0.246575341	11.25	7	97.43589744	56.96202532	46	89.74358974	-75.712667	-65.97131265
Epochs 160	0.192660555	9.090909091	7.207207207	90	54.54545455	45.94594595	75.86206897	209.662091	5.320148705	0.242009133	11.11111111	7	97.36842105	57.5	46	89.47368421	-81.91530824	-65.97131265
Epochs 180	0.206422016	9.459459459	6.422018349	88.57142857	55.40540541	45.87155963	73.52941176	336.0755625	5.320148705	0.273972601	11.68831169	7.216494845	97.77777778	57.89473684	47.42268041	91.11111111	-85.84507602	-65.97131265
Epochs 200	0.229357794	9.333333333	6.796116505	90	54.66666667	44.66019417	76.92307692	180.4017242	5.320148705	0.273972601	11.68831169	7.216494845	97.77777778	57.89473684	48.45360825	93.33333333	-18.64539691	-65.97131265

Table 14-2 Results of 25 Percent More Buy Class LSTM Models , Non-Cyclic Stocks

Singapore Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.490825683	6.756756757	6.060606061	90.09009009	47.2972973	39.39393939	80.90909091	-82.77596839	-64.15459983	0.409302324	6.25	11.11111111	93.97590361	41.66666667	52.77777778	87.80487805	-86.87107217	-78.23835547
Epochs 40	0.298165143	9.195402299	10	96.07843137	50	50	84.31372549	-76.3799681	-64.15459983	0.251162797	6.837606838	10.34482759	100	45.2991453	62.06896552	94.87179487	-73.17003873	-78.23835547
Epochs 60	0.334862381	8.888888889	10.44776119	95.08196721	50.56179775	55.2238806	83.60655738	-83.31826482	-64.15459983	0.288372099	7.207207207	10.71428571	100	46.84684685	60.71428571	93.61702128	-90.60384058	-78.23835547
Epochs 80	0.330275238	9.523809524	8.333333333	93.5483871	49.39759036	45.83333333	83.87096774	-58.85333312	-64.15459983	0.316279083	7.216494845	9.523809524	100	44.32989691	59.67741935	96.36363636	-76.4899222	-78.23835547
Epochs 100	0.316513747	8.139534884	9.589041096	93.22033898	50.58823529	46.57534247	81.3559322	-77.84530441	-64.15459983	0.288372099	5.825242718	8.333333333	98.07692308	44.66019417	55.93220339	94.23076923	-65.19035365	-78.23835547
Epochs 120	0.288990825	7.777777778	9.333333333	92.45283019	51.68539326	40	81.13207547	-48.25180108	-64.15459983	0.28372094	6.542056075	8.620689655	98	44.85981308	56.14035088	92	-43.97610861	-78.23835547
Epochs 140	0.279816508	7.446808511	10.66666667	93.87755102	50.53763441	38.66666667	83.67346939	-54.8300354	-64.15459983	0.297674417	5.882352941	8.474576271	98.14814815	44.11764706	56.89655172	90.74074074	-78.23811614	-78.23835547
Epochs 160	0.284403682	7.608695652	10.52631579	94	51.64835165	39.47368421	82	-88.04301174	-64.15459983	0.28372094	5	8.064516129	96.22641509	45	57.37704918	90.56603774	-33.90197062	-78.23835547
Epochs 180	0.302752286	6.896551724	9.589041096	91.37931034	50	39.7260274	81.03448276	-89.48265634	-64.15459983	0.306976736	6.25	6.779661017	93.33333333	46.875	56.89655172	86.66666667	-20.94082652	-78.23835547
Epochs 200	0.316513747	7.058823529	8.571428571	90.47619048	51.19047619	40	80.95238095	-80.81053793	-64.15459983	0.311627895	4.301075269	6.896551724	92.1875	45.16129032	56.14035088	84.375	-38.83087308	-78.23835547
OCBC Bank Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.247706428	7.619047619	5.970149254	91.30434783	54.28571429	54.54545455	84.7826087	-74.13657318	-55.90202866	0.390697688	10.46511628	8.163265306	88.75	50	55.10204082	82.27848101	7.131693242	-24.56291964
Epochs 40	0.137614682	7.920792079	7	88.23529412	58.41584158	57.57575758	88.23529412	-92.53394022	-55.90202866	0.241860464	8.737864078	10.95890411	89.74358974	52.42718447	61.11111111	82.05128205	-11.12828879	-24.56291964
Epochs 60	0.133027524	7.619047619	5.319148936	84.21052632	57.14285714	55.91397849	84.21052632	-90.94143548	-55.90202866	0.237209305	8.737864078	8.450704225	87.80487805	50.48543689	60	80.48780488	-39.82630153	-24.56291964
Epochs 80	0.165137619	7.920792079	5.494505495	88.46153846	57.42574257	54.44444444	88.46153846	-91.02813744	-55.90202866	0.246511623	7.216494845	8.333333333	86.95652174	49.48453608	57.74647887	82.60869565	-63.4916008	-24.56291964
Epochs 100	0.211009175	8.421052632	5.747126437	91.66666667	57.89473684	55.81395349	91.66666667	-85.99722356	-55.90202866	0.260465115	8.080808081	8.823529412	87.5	48.48484848	58.20895522	83.33333333	-62.33604537	-24.56291964
Epochs 120	0.215596333	8.333333333	5.882352941	91.89189189	58.33333333	55.95238095	91.89189189	-91.19029404	-55.90202866	0.246511623	8.823529412	9.85915493	88.0952381	50	54.28571429	83.33333333	-67.15018428	-24.56291964
Epochs 140	0.211009175	8.333333333	5.813953488	91.66666667	58.33333333	55.29411765	91.66666667	-91.02813744	-55.90202866	0.232558146	8.653846154	9.722222222	87.17948718	50.96153846	54.16666667	81.57894737	-55.55235873	-24.56291964
Epochs 160	0.211009175	8.24742268	5.882352941	91.66666667	58.7628866	57.14285714	91.66666667	-85.98899203	-55.90202866	0.251162797	8.737864078	10	90.47619048	50.48543689	54.28571429	82.92682927	-58.73593377	-24.56291964
Epochs 180	0.229357794	8.421052632	6.097560976	90.24390244	60	58.02469136	90.24390244	-82.80167666	-55.90202866	0.274418592	8	10.60606061	89.79591837	52	51.51515152	83.33333333	-39.82429677	-24.56291964
Epochs 200	0.275229365	8.988764045	6.41025641	92.15686275	64.04494382	55.84415584	90.19607843	-83.94085126	-55.90202866	0.297674417	8.080808081	10	89.28571429	50.50505051	53.33333333	83.63636364	-45.89898404	-24.56291964
CNOOC Limited Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.364928901	5.813953488	7.843137255	91.89189189	54.65116279	66	83.78378378	198.7655974	-54.68960087	0.417840362	8.421052632	9.090909091	91.76470588	46.31578947	54.54545455	83.33333333	-61.62805272	-84.2898875
Epochs 40	0.17061612	5.940594059	8.045977011	100	52.47524752	60.46511628	91.30434783	367.0206084	-54.68960087	0.309859157	8.653846154	10.71428571	96.22641509	50.96153846	56.36363636	83.01886792	-39.20957331	-84.2898875
Epochs 60	0.175355449	5.825242718	8.333333333	100	54.36893204	62.65060241	95.83333333	2.555868885	-54.68960087	0.295774639	8.737864078	10	96	49.51456311	54.23728814	86	-69.45017542	-84.2898875
Epochs 80	0.19905214	6.12244898	8.333333333	100	55.10204082	60.24096386	96.55172414	-0.64427016	-54.68960087	0.300469488	8.737864078	10.34482759	94.23076923	51.45631068	56.14035088	84.61538462	-69.55978956	-84.2898875

Epochs 100	0.222748816	6.25	6.41025641	97.2972973	54.16666667	59.74025974	89.18918919	-58.76433691	-54.68960087	0.347417831	8	12.24489796	93.75	48	52.08333333	82.8125	-81.36123507	-84.2898875
Epochs 120	0.218009472	6.060606061	8.860759494	100	56.56565657	61.53846154	96.96969697	20.8107397	-54.68960087	0.361502349	8	13.04347826	94.02985075	49	52.17391304	84.84848485	-85.94286447	-84.2898875
Epochs 140	0.246445492	6.12244898	8.219178082	100	55.10204082	59.72222222	97.5	-11.61470647	-54.68960087	0.352112681	8	15.68627451	95.16129032	49	56	85.48387097	-78.85792069	-84.2898875
Epochs 160	0.246445492	6.18556701	9.333333333	100	55.67010309	60.81081081	97.43589744	6.128308398	-54.68960087	0.3568075	8.080808081	15.38461538	96.77419355	49.49494949	55.76923077	86.8852459	-60.73175085	-84.2898875
Epochs 180	0.289099514	5.555555556	10	96.07843137	56.66666667	59.42028986	94.11764706	40.15383376	-54.68960087	0.389671355	8.333333333	16.66666667	97.10144928	48.95833333	56.25	85.29411765	-80.39587675	-84.2898875
Epochs 200	0.303317547	5.617977528	7.692307692	94.73684211	57.30337079	59.375	91.22807018	16.83822032	-54.68960087	0.417840362	8.988764045	16.32653061	97.33333333	51.68539326	55.10204082	85.13513514	-74.29178945	-84.2898875
JP Morgan Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.252293587	9.87654321	3.370786517	91.66666667	49.38271605	46.59090909	87.5	6537.026616	1576.179166	0.488584489	8.823529412	9.302325581	89.81481481	49.25373134	60.46511628	84.25925926	222.1469713	-31.90034799
Epochs 40	0.137614682	10.25641026	3.333333333	90	48.71794872	43.69747899	85	1424.676258	1576.179166	0.273972601	8.421052632	11.68831169	91.4893617	47.87234043	57.14285714	87.23404255	-46.84120178	-31.90034799
Epochs 60	0.155963302	10.52631579	3.389830508	91.66666667	48.68421053	45.2991453	87.5	1797.269251	1576.179166	0.264840186	8.163265306	10.81081081	89.36170213	48.45360825	59.45945946	85.10638298	64.77180595	-31.90034799
Epochs 80	0.197247714	10.44776119	3.418803419	94.11764706	44.7761194	43.96551724	91.17647059	1668.321557	1576.179166	0.310502291	7.777777778	11.42857143	89.83050847	47.19101124	60	84.74576271	-9.169002451	-31.90034799
Epochs 100	0.211009175	10.60606061	3.47826087	94.59459459	46.96969697	43.85964912	89.18918919	2142.712473	1576.179166	0.333333343	7.777777778	12.30769231	90.625	47.77777778	57.8125	84.375	39.38376303	-31.90034799
Epochs 120	0.192660555	10	3.50877193	91.17647059	45.71428571	46.01769912	88.23529412	1729.570083	1576.179166	0.305936068	8.421052632	10.60606061	89.65517241	47.87234043	57.57575758	84.48275862	13.19365143	-31.90034799
Epochs 140	0.206422016	10.60606061	3.448275862	94.44444444	48.48484848	46.08695652	88.88888889	1289.269682	1576.179166	0.315068483	8.888888889	7.692307692	87.5	47.77777778	57.8125	84.375	51.47534717	-31.90034799
Epochs 160	0.206422016	10.44776119	3.50877193	91.89189189	44.7761194	46.90265487	89.18918919	1309.422517	1576.179166	0.315068483	8.421052632	9.677419355	88.70967742	47.87234043	59.67741935	85.48387097	23.69037293	-31.90034799
Epochs 180	0.233944952	11.47540984	3.50877193	93.02325581	45.90163934	46.90265487	90.69767442	1830.654735	1576.179166	0.310502291	7.608695652	9.375	87.3015873	49.45054945	59.375	84.12698413	26.43671102	-31.90034799
Epochs 200	0.25688073	12.06896552	3.603603604	91.83673469	48.27586207	49.09090909	87.75510204	2800.233671	1576.179166	0.315068483	8.235294118	7.352941176	86.36363636	50.58823529	55.88235294	83.07692308	-7.676747849	-31.90034799
American Axle (small cap) Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.302752286	4.081632653	5.769230769	86.76470588	43.87755102	55.76923077	82.08955224	-21.73076743	-40.19620025	0.506849289	10	10	91.74311927	60.86956522	65	86.23853211	52.95234559	-32.50977019
Epochs 40	0.169724777	3.883495146	8.235294118	86.66666667	45.63106796	54.11764706	86.20689655	-61.50555167	-40.19620025	0.283105016	10.86956522	10.97560976	95.55555556	54.94505495	60.97560976	91.11111111	245.8696996	-32.50977019
Epochs 60	0.192660555	3.883495146	8.75	88.57142857	45.63106796	52.5	88.23529412	6.029011032	-40.19620025	0.269406378	10.52631579	9.87654321	95.34883721	56.84210526	61.72839506	92.85714286	274.9076395	-32.50977019
Epochs 80	0.220183492	3.191489362	8.641975309	88.37209302	45.74468085	53.08641975	85.71428571	47.35083193	-40.19620025	0.273972601	11.36363636	8.235294118	93.47826087	56.81818182	60	91.11111111	60.94534336	-32.50977019
Epochs 100	0.24311927	4.255319149	8	87.75510204	44.68085106	52	83.33333333	58.54676609	-40.19620025	0.292237431	11.95652174	9.87654321	97.82608696	54.34782609	59.25925926	93.33333333	25.06619407	-32.50977019
Epochs 120	0.215596333	4	8	86.04651163	44	50.66666667	80.95238095	-4.626280061	-40.19620025	0.273972601	12.64367816	8.888888889	97.61904762	55.17241379	58.88888889	95.12195122	-36.87098281	-32.50977019
Epochs 140	0.224770635	6.315789474	6.25	88.37209302	46.31578947	51.25	83.33333333	99.89725069	-40.19620025	0.287671238	11.49425287	10.46511628	95.65217391	53.48837209	60.46511628	89.13043478	117.6944039	-32.50977019
Epochs 160	0.215596333	6.451612903	5.952380952	87.80487805	46.23655914	50	82.5	99.89725069	-40.19620025	0.260273963	11.36363636	9.89010989	95	54.02298851	60.43956044	90	85.47950229	-32.50977019
Epochs 180	0.247706428	4.651162791	6.25	86.53846154	45.34883721	50	80.39215686	14.66257973	-40.19620025	0.283105016	11.36363636	10.46511628	95.55555556	55.17241379	60.46511628	88.88888889	105.159515	-32.50977019
Epochs 200	0.279816508	4.87804878	6.493506494	88.13559322	45.12195122	50.64935065	79.31034483	28.45843467	-40.19620025	0.296803653	12.04819277	9.302325581	94	54.87804878	56.97674419	88	56.5635834	-32.50977019

Table 14-3 Results of 25 Percent More Hold Class LSTM Models , Cyclic Stocks

Kweichow Moutai Co., Ltd. Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.541062772	10.44776119	0	89.74358974	53.03030303	34.7826087	85.47008547	1323.791921	1666.892281	0.629807711	6.976744186	4.166666667	90.07092199	46.51162791	41.66666667	82.85714286	4457.555702	678.7940879
Epochs 40	0.231884062	13.33333333	9	90.625	56.75675676	47	90.625	916.1212762	1666.892281	0.211538464	11.76470588	7.272727273	93.33333333	54.41176471	50	86.20689655	227.4004499	678.7940879
Epochs 60	0.29468599	14.08450704	8.988764045	91.4893617	57.14285714	47.19101124	91.4893617	1207.118428	1666.892281	0.245192304	11.29032258	7.476635514	92.30769231	51.61290323	51.40186916	86.84210526	217.2992426	678.7940879
Epochs 80	0.289855063	13.23529412	8.791208791	89.58333333	56.71641791	48.35164835	89.58333333	1021.572188	1666.892281	0.259615391	10.9375	6.930693069	93.02325581	54.6875	52.47524752	83.33333333	188.0121595	678.7940879
Epochs 100	0.304347813	12.5	9.677419355	92	53.96825397	48.38709677	90	451.6323717	1666.892281	0.259615391	11.11111111	6.862745098	93.02325581	55.55555556	51.96078431	83.33333333	196.0556939	678.7940879
Epochs 120	0.32367149	12.5	9.195402299	91.07142857	53.96825397	49.42528736	89.28571429	704.306041	1666.892281	0.293269217	10.16949153	7.216494845	92.30769231	54.23728814	51.54639175	78.43137255	178.9759832	678.7940879
Epochs 140	0.333333343	12.90322581	8.235294118	90	54.09836066	50.58823529	88.33333333	386.3892468	1666.892281	0.293269217	11.66666667	7.216494845	92.15686275	53.33333333	51.54639175	82	232.8030719	678.7940879
Epochs 160	0.386473417	12.90322581	10.52631579	92.75362319	52.45901639	53.94736842	89.85507246	324.4127888	1666.892281	0.3125	12.06896552	7.368421053	92.72727273	53.44827586	53.68421053	85.18518519	313.1721122	678.7940879
Epochs 180	0.36714977	12.90322581	10	92.30769231	52.45901639	51.25	90.76923077	572.2090447	1666.892281	0.3125	12.06896552	7.368421053	92.72727273	51.72413793	52.63157895	85.18518519	265.1696274	678.7940879
Epochs 200	0.38164252	14.51612903	10.25641026	92.53731343	54.09836066	52.56410256	91.04477612	588.6552383	1666.892281	0.302884609	11.86440678	7.291666667	92.45283019	52.54237288	53.125	84.61538462	255.117901	678.7940879
Midea Group Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.415458947	6.172839506	11.9047619	90.47619048	54.32098765	61.9047619	81.92771084	335.5056534	1245.275482	0.552884638	5.970149254	0	94.06779661	39.39393939	43.47826087	85.59322034	-48.24485125	468.5733088
Epochs 40	0.231884062	8.43373494	7.228915663	85.36585366	56.62650602	56.09756098	78.04878049	8516.522454	1245.275482	0.22115384	8.695652174	4.854368932	97.22222222	57.97101449	53.39805825	94.28571429	172.8818308	468.5733088
Epochs 60	0.280193239	10.12658228	7.594936709	89.79591837	56.96202532	58.97435897	79.59183673	8031.368229	1245.275482	0.22115384	8.064516129	5.454545455	97.22222222	58.06451613	52.72727273	97.14285714	65.47001524	468.5733088
Epochs 80	0.314009666	9.722222222	6.578947368	89.83050847	59.72222222	57.33333333	81.3559322	11271.24983	1245.275482	0.206730768	7.8125	5.504587156	91.42857143	57.8125	55.04587156	91.17647059	93.47483331	468.5733088
Epochs 100	0.29468599	9.333333333	6.493506494	89.09090909	58.66666667	59.21052632	81.81818182	68025.9631	1245.275482	0.225961536	8.333333333	7.079646018	97.14285714	60	55.75221239	94.11764706	54.14471817	468.5733088
Epochs 120	0.304347813	9.589041096	6.493506494	89.47368421	61.64383562	57.89473684	82.45614035	35282.71736	1245.275482	0.235576928	8.771929825	6.25	94.87179487	59.64912281	57.14285714	92.10526316	57.97744455	468.5733088
Epochs 140	0.32367149	10	7.792207792	90	61.42857143	57.89473684	81.66666667	118636.5905	1245.275482	0.245192304	8.928571429	5.504587156	93.02325581	57.14285714	56.88073394	90.47619048	62.2853319	468.5733088
Epochs 160	0.318840593	8.955223881	6.41025641	88.70967742	59.70149254	57.14285714	82.25806452	50187.28399	1245.275482	0.25	8.620689655	5.660377358	93.18181818	58.62068966	56.60377358	90.69767442	79.57042828	468.5733088
Epochs 180	0.30917874	8.695652174	6.41025641	88.33333333	59.42028986	57.14285714	81.66666667	52713.49933	1245.275482	0.259615391	8.771929825	5.714285714	93.47826087	56.14035088	55.23809524	91.11111111	-11.31867088	468.5733088
Epochs 200	0.347826093	9.230769231	7.894736842	90.90909091	61.53846154	57.33333333	81.81818182	60168.82305	1245.275482	0.254807681	9.259259259	4.62962963	93.47826087	55.55555556	54.62962963	88.88888889	-2.4649953	468.5733088
Walmart Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.477064222	7.317073171	8.333333333	95	47.56097561	54.28571429	88	7464.044746	9380.979094	0.347031951	4.504504505	11.42857143	91.78082192	48.18181818	54.28571429	90.4109589	1426.928437	255.7316817
Epochs 40	0.183486238	6.172839506	7.407407407	93.10344828	55.55555556	49.07407407	85.71428571	247.5518071	9380.979094	0.273972601	6.41025641	10.75268817	93.75	51.94805195	48.38709677	79.16666667	64.63451696	255.7316817

Epochs 60	0.188073397	5.128205128	7.476635514	87.87878788	53.84615385	49.53271028	87.5	60.3880401	9380.979094	0.273972601	6.097560976	11.23595506	93.75	51.85185185	48.31460674	83.33333333	163.6987669	255.7316817
Epochs 80	0.17889908	5.555555556	6.194690265	84.84848485	54.92957746	47.78761062	84.84848485	165.152173	9380.979094	0.264840186	6.024096386	10.22727273	91.66666667	52.43902439	47.72727273	83.33333333	299.8462625	255.7316817
Epochs 100	0.188073397	5.633802817	6.194690265	88.23529412	55.71428571	48.67256637	88.23529412	144.8318821	9380.979094	0.260273963	6.41025641	9.574468085	91.4893617	49.35064935	44.68085106	80.85106383	221.0670498	255.7316817
Epochs 120	0.206422016	7.142857143	6.25	91.66666667	55.07246377	49.10714286	91.66666667	121.9444108	9380.979094	0.287671238	6.493506494	9.195402299	90.90909091	51.31578947	45.97701149	83.63636364	201.6370678	255.7316817
Epochs 140	0.233944952	8.571428571	6.481481481	95	55.07246377	50	95	232.1774497	9380.979094	0.292237431	6.493506494	9.302325581	91.07142857	51.31578947	46.51162791	82.14285714	181.1794021	255.7316817
Epochs 160	0.229357794	8.695652174	6.363636364	94.87179487	54.41176471	50	94.87179487	376.3785406	9380.979094	0.287671238	6.756756757	8.888888889	90.90909091	50.68493151	44.44444444	83.63636364	221.1995031	255.7316817
Epochs 180	0.220183492	8.955223881	5.309734513	94.73684211	51.51515152	49.55752212	92.10526316	587.9422529	9380.979094	0.305936068	7.142857143	9.782608696	92.98245614	52.17391304	47.82608696	84.21052632	153.2756683	255.7316817
Epochs 200	0.247706428	9.090909091	5.555555556	95.45454545	52.30769231	51.85185185	90.90909091	587.9422529	9380.979094	0.310502291	5.797101449	10	91.66666667	50	48.88888889	83.33333333	151.4311167	255.7316817
Fresh Del Monte Produce Inc (small cap)Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.344036698	5.714285714	13.63636364	91.30434783	40.95238095	47.72727273	85.29411765	169.3052931	5.320148705	0.283105016	6.956521739	7.843137255	94.33962264	51.75438596	52.94117647	88.67924528	1670.362812	-65.97131265
Epochs 40	0.224770635	10	8.602150538	91.42857143	52.22222222	49.46236559	76.47058824	845.7913615	5.320148705	0.187214613	7.142857143	7.777777778	87.09677419	50.51546392	51.11111111	77.41935484	103.4885125	-65.97131265
Epochs 60	0.224770635	10.86956522	7.692307692	91.42857143	54.34782609	48.88888889	80	609.7362551	5.320148705	0.182648405	7.446808511	7.368421053	86.66666667	51.61290323	49.47368421	73.33333333	0.778375333	-65.97131265
Epochs 80	0.220183492	11.11111111	7.446808511	91.17647059	52.22222222	48.38709677	79.41176471	524.483296	5.320148705	0.214611873	8.791208791	8.421052632	93.93939394	53.33333333	51.57894737	84.84848485	190.0096908	-65.97131265
Epochs 100	0.192660555	10	7.070707071	89.65517241	53.33333333	48.97959184	79.31034483	484.1713612	5.320148705	0.205479458	9.090909091	8.823529412	96.55172414	51.72413793	50.98039216	93.10344828	198.3373732	-65.97131265
Epochs 120	0.201834857	10.22727273	6.18556701	87.87878788	52.27272727	46.875	78.78787879	409.4984721	5.320148705	0.205479458	8.888888889	8.163265306	93.5483871	52.80898876	50	90.32258065	50.44453922	-65.97131265
Epochs 140	0.238532111	9.87654321	6.382978723	88.37209302	53.08641975	48.93617021	78.57142857	303.9017001	5.320148705	0.196347028	9.782608696	8	96.2962963	53.84615385	50	96.2962963	74.07361613	-65.97131265
Epochs 160	0.252293587	10	6.52173913	89.13043478	53.75	48.91304348	80	285.9169473	5.320148705	0.19178082	9.89010989	7.843137255	96.15384615	54.44444444	49.01960784	96.15384615	134.5671193	-65.97131265
Epochs 180	0.252293587	10	6.52173913	89.13043478	55	48.91304348	80	180.2514789	5.320148705	0.19178082	10.11235955	7.692307692	96.15384615	54.54545455	48.07692308	96.15384615	127.5187032	-65.97131265
Epochs 200	0.25688073	10	7.52688172	91.11111111	56.25	48.38709677	81.81818182	464.8458848	5.320148705	0.210045666	10.46511628	7.766990291	96.66666667	52.94117647	47.57281553	96.66666667	-70.57483035	-65.97131265

Table 14-4 Results of 25 Percent More Hold Class LSTM Models , Non-Cyclic Stocks

Singapore Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.458715588	7.228915663	3.225806452	89.42307692	49.39759036	38.70967742	78.6407767	-80.18213766	-64.15459983	0.413953483	7.070707071	11.76470588	95.12195122	44.44444444	55.88235294	90.12345679	-76.69797023	-78.23835547
Epochs 40	0.325688064	9.722222222	8.235294118	93.44262295	51.38888889	45.88235294	85	-45.00355286	-64.15459983	0.297674417	7.446808511	8.695652174	98.07692308	50	59.42028986	90.19607843	-44.754807	-78.23835547
Epochs 60	0.238532111	7.792207792	7.216494845	88.63636364	46.75324675	46.39175258	88.37209302	-81.3358534	-64.15459983	0.293023258	7.216494845	10.14492754	100	49.48453608	57.97101449	91.66666667	-69.56639663	-78.23835547
Epochs 80	0.24311927	9.411764706	7.608695652	92.68292683	47.05882353	44.56521739	90	64.76981865	-64.15459983	0.269767433	7.070707071	9.722222222	100	49.49494949	58.33333333	93.02325581	-64.41834505	-78.23835547
Epochs 100	0.252293587	8.791208791	8.333333333	93.02325581	50.54945055	48.80952381	88.0952381	58.20943232	-64.15459983	0.232558146	6.796116505	6.944444444	95	47.57281553	58.33333333	89.74358974	-36.03224338	-78.23835547
Epochs 120	0.266055048	8.510638298	10	95.45454545	50	48.75	88.37209302	-81.93800977	-64.15459983	0.260465115	7.142857143	9.459459459	97.6744186	48.97959184	56.75675676	92.85714286	-74.58050174	-78.23835547

Epochs 140	0.25688073	7.368421053	9.090909091	91.30434783	49.47368421	46.75324675	84.44444444	-83.44794834	-64.15459983	0.251162797	6.862745098	7.246376812	95.45454545	48.03921569	57.97101449	88.37209302	-79.12176948	-78.23835547
Epochs 160	0.25688073	7.142857143	7.042253521	89.79591837	47.95918367	47.88732394	83.33333333	-84.9397749	-64.15459983	0.255813956	6.730769231	7.575757576	95.55555556	47.11538462	56.06060606	88.63636364	-77.78693834	-78.23835547
Epochs 180	0.261467904	7	8.571428571	91.66666667	47	47.14285714	80.85106383	-86.12645296	-64.15459983	0.265116274	6.603773585	8.064516129	95.74468085	47.16981132	58.06451613	89.13043478	-76.19323927	-78.23835547
Epochs 200	0.233944952	6.730769231	8.333333333	90.47619048	47.11538462	45.83333333	78.04878049	-85.58631903	-64.15459983	0.274418592	6.666666667	8.333333333	94	48.57142857	58.33333333	87.75510204	-49.31833023	-78.23835547
OCBC Bank Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.311926603	7.766990291	5.660377358	91.93548387	55.33980583	45.28301887	90.16393443	-66.77847	-55.90202866	0.404651165	8.139534884	11.36363636	88.23529412	51.1627907	54.54545455	82.14285714	15.00586618	-24.56291964
Epochs 40	0.146788985	8.791208791	4.807692308	82.60869565	60.43956044	53.39805825	78.26086957	-90.11847277	-55.90202866	0.302325577	10	10.97560976	90.56603774	53.75	60.49382716	83.01886792	18.36162352	-24.56291964
Epochs 60	0.165137619	8.045977011	6.603773585	88	58.62068966	53.33333333	76	-80.82506709	-55.90202866	0.255813956	8.333333333	10.46511628	86.66666667	58.33333333	60	80	1.557185091	-24.56291964
Epochs 80	0.155963302	7.692307692	5.882352941	84	59.34065934	53.46534653	72	-79.87755543	-55.90202866	0.227906972	9.278350515	9.756097561	88.88888889	57.73195876	60.49382716	83.33333333	-17.85386242	-24.56291964
Epochs 100	0.165137619	8.333333333	6.18556701	88	59.375	53.125	84	-87.82816011	-55.90202866	0.237209305	7.920792079	10.95890411	85.36585366	54.45544554	61.11111111	78.04878049	-58.00182323	-24.56291964
Epochs 120	0.137614682	7.291666667	5.882352941	85	58.33333333	51.48514851	75	-90.62632143	-55.90202866	0.232558146	8.571428571	11.11111111	86.84210526	54.28571429	56.94444444	83.78378378	-49.51567674	-24.56291964
Epochs 140	0.151376143	6.382978723	6.060606061	84	58.5106383	52.04081633	76	-91.85877461	-55.90202866	0.255813956	7.920792079	10.44776119	85.10638298	53.46534653	55.2238806	78.26086957	-63.60637782	-24.56291964
Epochs 160	0.146788985	6.382978723	6	83.33333333	58.5106383	51.51515152	75	-92.79019572	-55.90202866	0.232558146	7.766990291	10	83.33333333	54.36893204	57.14285714	78.04878049	-62.32564969	-24.56291964
Epochs 180	0.165137619	5.434782609	6.25	83.33333333	57.60869565	50.52631579	76.66666667	-89.05516853	-55.90202866	0.232558146	7.766990291	10	83.33333333	52.42718447	57.14285714	75.6097561	-36.55295109	-24.56291964
Epochs 200	0.151376143	5.434782609	6.060606061	81.48148148	56.52173913	51.02040816	74.07407407	-76.65497758	-55.90202866	0.204651162	7.766990291	9.090909091	82.85714286	52.42718447	56.57894737	77.14285714	-54.98211015	-24.56291964
CNOOC Limited Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.322274894	5.263157895	7.843137255	90.76923077	53.68421053	62	81.53846154	169.4244816	-54.68960087	0.413145542	8.571428571	10.71428571	95	45.71428571	64.28571429	87.34177215	-62.86843345	-84.2898875
Epochs 40	0.189573467	6.451612903	7.692307692	100	54.83870968	58.88888889	92.59259259	410.3961571	-54.68960087	0.352112681	8.75	10.14492754	95.3125	48.75	60.29411765	87.5	-76.59811951	-84.2898875
Epochs 60	0.218009472	6.976744186	7.608695652	100	54.65116279	56.04395604	93.93939394	250.6821533	-54.68960087	0.314553976	7.692307692	8	91.66666667	48.71794872	58.10810811	81.66666667	-77.78575034	-84.2898875
Epochs 80	0.218009472	5.494505495	8.235294118	97.14285714	54.94505495	57.14285714	91.42857143	178.4047116	-54.68960087	0.28169015	9.090909091	7.894736842	93.87755102	52.27272727	57.33333333	83.67346939	-84.01843635	-84.2898875
Epochs 100	0.227488145	5.376344086	8.641975309	97.2972973	54.83870968	62.5	91.89189189	654.0183061	-54.68960087	0.28638497	8.602150538	8.571428571	94	50.53763441	56.52173913	84	-82.90572412	-84.2898875
Epochs 120	0.213270143	5.102040816	8.860759494	97.05882353	53.06122449	62.82051282	91.17647059	708.6197824	-54.68960087	0.28169015	7.608695652	8.450704225	94	47.82608696	57.14285714	88	-87.28533665	-84.2898875
Epochs 140	0.251184821	5.263157895	9.459459459	97.61904762	52.63157895	63.01369863	92.85714286	581.8145494	-54.68960087	0.305164307	7.692307692	8.955223881	94.54545455	48.35164835	54.54545455	87.27272727	-87.22212602	-84.2898875
Epochs 160	0.251184821	5.050505051	10	97.61904762	52.52525253	62.31884058	92.85714286	507.5594472	-54.68960087	0.295774639	8.510638298	7.692307692	92.59259259	50	56.92307692	84.90566038	-87.26536565	-84.2898875
Epochs 180	0.255924165	5.050505051	10.14492754	97.6744186	52.52525253	60.29411765	88.37209302	584.6555323	-54.68960087	0.319248825	9.183673469	8.771929825	93.10344828	50	56.14035088	82.45614035	-83.21925047	-84.2898875
Epochs 200	0.227488145	4.901960784	9.722222222	97.2972973	51.96078431	63.38028169	89.18918919	569.1212804	-54.68960087	0.309859157	8.910891089	8.928571429	92.85714286	50.4950495	57.14285714	83.63636364	-82.9716887	-84.2898875
JP Morgan Test Set	Non-Recession									Recession								

	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.275229365	9.195402299	2.631578947	90.90909091	48.27586207	52	83.63636364	7497.878125	1576.179166	0.493150681	4.411764706	15	89.18918919	44.7761194	65	81.08108108	4.289411024	-31.90034799
Epochs 40	0.165137619	10.16949153	3.787878788	92.59259259	50.84745763	45.80152672	88.88888889	2095.540144	1576.179166	0.296803653	10.12658228	11.23595506	92.15686275	50.63291139	53.93258427	84	-4.234858063	-31.90034799
Epochs 60	0.192660555	11.32075472	3.816793893	91.17647059	50.94339623	45.38461538	88.23529412	3571.98588	1576.179166	0.260273963	10.71428571	9.782608696	90.69767442	53.57142857	55.43478261	80.95238095	-72.04561613	-31.90034799
Epochs 80	0.188073397	12.06896552	3.875968992	93.5483871	50	46.09375	90.32258065	6480.340646	1576.179166	0.292237431	9.756097561	11.49425287	92	53.65853659	56.32183908	89.79591837	-43.12116587	-31.90034799
Epochs 100	0.17889908	10.29411765	3.389830508	87.5	47.05882353	46.15384615	78.125	6909.408391	1576.179166	0.255707771	8.602150538	8.860759494	87.23404255	50.53763441	50.63291139	80.43478261	-30.4487	-31.90034799
Epochs 120	0.169724777	10.14492754	2.542372881	87.09677419	47.82608696	45.2991453	80.64516129	6039.36726	1576.179166	0.269406378	8.888888889	8.75	89.79591837	52.22222222	51.25	81.25	-18.38931651	-31.90034799
Epochs 140	0.183486238	9.85915493	2.654867257	88.23529412	50.70422535	44.64285714	79.41176471	1748.680925	1576.179166	0.260273963	8.695652174	8.860759494	87.5	52.17391304	53.16455696	78.72340426	-27.10357336	-31.90034799
Epochs 160	0.188073397	10.25641026	2.803738318	90.90909091	51.28205128	47.16981132	81.81818182	587.879984	1576.179166	0.269406378	8.695652174	8	86.53846154	51.08695652	50.66666667	80.39215686	-21.81574719	-31.90034799
Epochs 180	0.192660555	10.12658228	2.857142857	91.17647059	50.63291139	48.07692308	82.35294118	507.3051336	1576.179166	0.269406378	8.510638298	8.219178082	86.53846154	51.06382979	53.42465753	80.39215686	-9.237206161	-31.90034799
Epochs 200	0.183486238	10	2.830188679	90.625	48.75	46.66666667	81.25	499.4653024	1576.179166	0.251141548	8.510638298	7.792207792	85.41666667	50	53.24675325	78.72340426	-25.3487051	-31.90034799
American Axle (small cap) Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.344036698	4.95049505	7.142857143	89.33333333	44.55445545	50	82.43243243	-21.31831632	-40.19620025	0.529680371	10.14492754	13.15789474	92.85714286	57.97101449	65.78947368	87.38738739	113.4748783	-32.50977019
Epochs 40	0.192660555	5.376344086	7.608695652	90.90909091	48.38709677	51.08695652	87.5	116.7207165	-40.19620025	0.333333343	13.51351351	10.11235955	96.42857143	60.2739726	60.6741573	91.07142857	16.16538276	-32.50977019
Epochs 60	0.211009175	4.705882353	7.446808511	89.74358974	47.05882353	51.06382979	86.84210526	-44.37790549	-40.19620025	0.278538823	12.19512195	9.677419355	95.45454545	58.02469136	56.98924731	88.63636364	-45.83877576	-32.50977019
Epochs 80	0.206422016	3.488372093	7.52688172	89.74358974	44.18604651	51.61290323	84.21052632	-68.3291817	-40.19620025	0.283105016	12.34567901	9.782608696	93.47826087	57.5	56.52173913	86.95652174	-31.81655837	-32.50977019
Epochs 100	0.197247714	6.382978723	6.666666667	91.17647059	46.80851064	50	87.87878788	937.6045301	-40.19620025	0.278538823	12.79069767	8.988764045	95.45454545	57.64705882	59.5505618	88.63636364	-84.01370364	-32.50977019
Epochs 120	0.169724777	5.319148936	6.315789474	89.65517241	44.68085106	50.52631579	82.14285714	66.14198478	-40.19620025	0.269406378	12.64367816	9.782608696	97.5	58.13953488	59.7826087	92.5	-77.6696887	-32.50977019
Epochs 140	0.192660555	5.154639175	6.896551724	91.17647059	45.36082474	48.27586207	78.78787879	84.98744251	-40.19620025	0.260273963	12.35955056	7.954545455	92.85714286	56.81818182	57.95454545	88.0952381	-86.68254002	-32.50977019
Epochs 160	0.197247714	5.102040816	7.142857143	88.88888889	44.89795918	48.80952381	77.14285714	297.1003868	-40.19620025	0.246575341	12.08791209	6.818181818	92.5	55.55555556	57.95454545	87.5	-73.25039246	-32.50977019
Epochs 180	0.211009175	6	7.5	89.47368421	45	47.5	81.08108108	190.1423157	-40.19620025	0.246575341	10.63829787	7.228915663	90.47619048	55.91397849	59.03614458	85.71428571	-73.63269287	-32.50977019
Epochs 200	0.211009175	5.940594059	7.594936709	89.47368421	44.55445545	46.83544304	81.08108108	190.1423157	-40.19620025	0.223744288	10.1010101	7.228915663	89.18918919	54.08163265	60.24096386	83.78378378	-71.88057146	-32.50977019

Table 14-5 Results of 25 Percent More Hold Class LSTM Models , Cyclic Stocks

Kweichow Moutai Co., Ltd. Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.072463766	7.8125	3.947368421	66.66666667	45.3125	38.66666667	66.66666667	5675.542072	1666.892281	0.105769232	8.256880734	6.52173913	100	46.2962963	51.08695652	85.71428571	461.5678354	678.7940879
Epochs 40	0.202898547	11.26760563	7.692307692	81.25	54.28571429	48.07692308	78.125	1386.079027	1666.892281	0.22115384	11.76470588	7.339449541	96.77419355	54.41176471	51.85185185	90.32258065	405.2161933	678.7940879
Epochs 60	0.275362313	13.23529412	10.20408163	92.68292683	50.74626866	50	90.24390244	850.1837865	1666.892281	0.197115391	9.090909091	7.826086957	96.2962963	53.03030303	50.87719298	85.18518519	253.1745351	678.7940879
Epochs 80	0.280193239	14.92537313	10	95	54.54545455	49	92.5	1202.674827	1666.892281	0.22115384	9.677419355	7.142857143	94.11764706	56.4516129	50.45045045	88.23529412	180.8353951	678.7940879
Epochs 100	0.270531386	14.08450704	10.20408163	94.73684211	55.71428571	48.97959184	92.10526316	2163.506855	1666.892281	0.230769232	9.523809524	7.339449541	94.44444444	55.55555556	51.85185185	88.88888889	180.8353951	678.7940879
Epochs 120	0.30917874	15.94202899	10.63829787	97.72727273	55.88235294	50	95.45454545	3115.409184	1666.892281	0.25	9.375	6.796116505	95.12195122	51.5625	50.98039216	92.68292683	29.70527124	678.7940879
Epochs 140	0.299516916	15.49295775	10.63829787	97.61904762	54.28571429	50	90.47619048	1377.484712	1666.892281	0.269230783	9.677419355	6.930693069	95.55555556	51.61290323	51.48514851	90.90909091	30.43169888	678.7940879
Epochs 160	0.270531386	14.86486486	10.30927835	97.22222222	53.42465753	48.45360825	88.88888889	1631.635799	1666.892281	0.230769232	9.375	6.542056075	94.59459459	51.5625	49.53271028	88.88888889	21.79611244	678.7940879
Epochs 180	0.275362313	15.27777778	11	100	52.11267606	48	91.42857143	961.2213067	1666.892281	0.22115384	9.523809524	6.363636364	94.28571429	50.79365079	50.4587156	88.57142857	37.16818045	678.7940879
Epochs 200	0.251207739	13.51351351	10.89108911	96.875	53.42465753	47.52475248	93.75	609.5031209	1666.892281	0.211538464	9.375	7.079646018	96.77419355	50	49.10714286	90.32258065	21.09996205	678.7940879
Midea Group Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.115942031	5.303030303	9.523809524	91.66666667	48.48484848	51.61290323	83.33333333	60618.07184	1245.275482	0.048076924	5.384615385	2.597402597	100	42.63565891	45.45454545	100	-41.30032021	468.5733088
Epochs 40	0.29468599	9.85915493	9.302325581	92	56.33802817	58.82352941	80	204277.432	1245.275482	0.225961536	9.523809524	6.363636364	97.14285714	58.73015873	51.37614679	88.57142857	173.2355963	468.5733088
Epochs 60	0.314009666	11.26760563	8.536585366	92.59259259	59.15492958	59.25925926	83.33333333	92092.12291	1245.275482	0.206730768	8.196721311	6.140350877	93.93939394	57.37704918	52.21238938	78.78787879	146.6784518	468.5733088
Epochs 80	0.29468599	11.26760563	8.139534884	92	57.74647887	57.64705882	84	59178.59862	1245.275482	0.21634616	8.474576271	6.140350877	94.28571429	59.3220339	51.32743363	80	214.5874019	468.5733088
Epochs 100	0.29468599	11.11111111	8.139534884	93.87755102	56.94444444	58.82352941	85.71428571	99877.88194	1245.275482	0.206730768	7.936507937	6.25	93.93939394	57.14285714	51.35135135	87.87878788	213.4169333	468.5733088
Epochs 120	0.304347813	11.42857143	8.139534884	94.11764706	60	61.17647059	82.35294118	65771.72781	1245.275482	0.192307696	8.620689655	5.084745763	90.625	58.62068966	51.28205128	84.375	379.4161992	468.5733088
Epochs 140	0.280193239	11.11111111	6.976744186	89.79591837	59.72222222	60	75.51020408	51493.92384	1245.275482	0.182692304	8.196721311	5.128205128	90	57.37704918	50.86206897	86.66666667	307.1181741	468.5733088
Epochs 160	0.256038636	10.66666667	7.777777778	90.47619048	60	60.6741573	78.57142857	61827.00293	1245.275482	0.173076928	7.462686567	5.263157895	92.59259259	58.20895522	53.98230088	88.88888889	340.806216	468.5733088
Epochs 180	0.270531386	10.95890411	7.865168539	91.11111111	61.64383562	60.22727273	80	91062.46946	1245.275482	0.15384616	7.462686567	5.084745763	91.30434783	58.20895522	52.99145299	86.95652174	252.9631758	468.5733088
Epochs 200	0.265700489	9.85915493	7.777777778	89.13043478	61.97183099	60.6741573	80.43478261	87278.53228	1245.275482	0.149038464	7.352941176	5.084745763	90.90909091	58.82352941	53.84615385	86.36363636	273.65031	468.5733088
Walmart Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.087155961	5.714285714	5.633802817	100	47.85714286	51.42857143	85.71428571	10329.18572	9380.979094	0.10958904	4.697986577	13.1147541	100	48.64864865	55.73770492	100	613.7184664	255.7316817
Epochs 40	0.16055046	5	7.079646018	92	55	49.10714286	88	288.9260329	9380.979094	0.223744288	7.407407407	9.708737864	94.28571429	55	49.51456311	85.71428571	115.891638	255.7316817
Epochs 60	0.165137619	6.578947368	6.837606838	92	55.26315789	49.13793103	88	411.6517526	9380.979094	0.246575341	6.666666667	9.803921569	92.85714286	58.10810811	51.96078431	83.33333333	123.1979087	255.7316817
Epochs 80	0.165137619	7.792207792	6.779661017	95.65217391	55.84415584	48.71794872	95.65217391	458.0452525	9380.979094	0.278538823	5.797101449	10.1010101	92.15686275	60.29411765	51.51515152	82.35294118	186.339663	255.7316817

Epochs 100	0.128440365	7.407407407	6.504065041	100	54.32098765	47.54098361	100	119.8210068	9380.979094	0.246575341	5.263157895	10.1010101	90.90909091	56	50.50505051	81.81818182	85.24634908	255.7316817
Epochs 120	0.128440365	7.5	6.451612903	100	52.5	45.96774194	100	147.0227592	9380.979094	0.255707771	5.405405405	10.1010101	91.30434783	54.79452055	50.50505051	82.60869565	83.98027274	255.7316817
Epochs 140	0.133027524	7.407407407	6.557377049	100	51.25	45.90163934	93.33333333	156.8804699	9380.979094	0.260273963	5.479452055	10.1010101	91.4893617	54.16666667	49.49494949	82.9787234	25.71893859	255.7316817
Epochs 160	0.114678897	6.493506494	6.201550388	100	51.31578947	42.63565891	100	0.017819768	9380.979094	0.232876718	5.405405405	9.615384615	90.24390244	52.05479452	47.11538462	82.92682927	16.2282071	255.7316817
Epochs 180	0.119266056	6.578947368	6.201550388	100	49.33333333	43.41085271	100	77.18404629	9380.979094	0.232876718	5.333333333	9.708737864	90.24390244	52.7027027	47.57281553	85.36585366	18.87812498	255.7316817
Epochs 200	0.114678897	6.666666667	6.106870229	100	50	43.51145038	100	46.34453444	9380.979094	0.219178081	5.333333333	9.433962264	89.47368421	52.7027027	47.16981132	84.21052632	36.1889274	255.7316817
Fresh Del Monte Produce Inc (small cap)Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.119266056	6.569343066	10	90.90909091	37.95620438	46.37681159	90.90909091	-52.83613694	5.320148705	0.086757988	5.369127517	7.936507937	85.71428571	48.64864865	47.61904762	85.71428571	275.7926783	-65.97131265
Epochs 40	0.247706428	9.411764706	9.574468085	94.87179487	54.11764706	45.74468085	81.57894737	180.9665244	5.320148705	0.223744288	9.722222222	7.96460177	97.05882353	56.33802817	50.44247788	94.11764706	60.37644403	-65.97131265
Epochs 60	0.238532111	8.43373494	6.593406593	88.63636364	54.21686747	42.85714286	81.39534884	313.0853619	5.320148705	0.205479458	9.210526316	7.96460177	96.66666667	56	50.44247788	86.66666667	4.44653372	-65.97131265
Epochs 80	0.229357794	8.43373494	8.24742268	92.10526316	56.62650602	44.79166667	84.21052632	269.3399588	5.320148705	0.251141548	9.589041096	8.490566038	97.5	58.33333333	50.94339623	90	33.92479853	-65.97131265
Epochs 100	0.215596333	8.139534884	8.24742268	91.42857143	55.81395349	43.75	80	40.95495317	5.320148705	0.237442926	9.589041096	8.256880734	97.2972973	61.11111111	50.4587156	86.48648649	-18.89140156	-65.97131265
Epochs 120	0.220183492	8.139534884	8.333333333	91.66666667	55.81395349	43.15789474	80.55555556	100.4810721	5.320148705	0.237442926	8.108108108	8.490566038	94.87179487	57.53424658	50.94339623	87.17948718	-64.58132863	-65.97131265
Epochs 140	0.215596333	7.058823529	7.446808511	87.17948718	55.29411765	43.01075269	76.92307692	98.42860636	5.320148705	0.246575341	8.108108108	8.653846154	95.12195122	57.53424658	50.96153846	87.80487805	-62.06657946	-65.97131265
Epochs 160	0.183486238	6.741573034	8	89.65517241	51.68539326	42.42424242	82.75862069	99.57597708	5.320148705	0.19178082	9.090909091	7.826086957	96.2962963	57.89473684	50.43478261	92.59259259	-71.14279289	-65.97131265
Epochs 180	0.183486238	6.896551724	7.920792079	86.66666667	51.72413793	44	76.66666667	122.0472407	5.320148705	0.182648405	9.638554217	8.035714286	95.83333333	58.53658537	50.89285714	91.66666667	-52.51488367	-65.97131265
Epochs 200	0.169724777	8.045977011	6.730769231	85.18518519	52.87356322	42.7184466	77.77777778	15.25823855	5.320148705	0.187214613	10	7.894736842	96	59.49367089	50.87719298	92	-45.44600769	-65.97131265

Table 14-6 Results of 25 Percent More Hold Class LSTM Models , Non-Cyclic Stocks

Singapore Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.458715588	7.228915663	3.225806452	89.42307692	49.39759036	38.70967742	78.6407767	-80.18213766	-64.15459983	0.413953483	7.070707071	11.76470588	95.12195122	44.44444444	55.88235294	90.12345679	-76.69797023	-78.23835547
Epochs 40	0.325688064	9.722222222	8.235294118	93.44262295	51.38888889	45.88235294	85	-45.00355286	-64.15459983	0.297674417	7.446808511	8.695652174	98.07692308	50	59.42028986	90.19607843	-44.754807	-78.23835547
Epochs 60	0.238532111	7.792207792	7.216494845	88.63636364	46.75324675	46.39175258	88.37209302	-81.3358534	-64.15459983	0.293023258	7.216494845	10.14492754	100	49.48453608	57.97101449	91.66666667	-69.56639663	-78.23835547
Epochs 80	0.24311927	9.411764706	7.608695652	92.68292683	47.05882353	44.56521739	90	64.76981865	-64.15459983	0.269767433	7.070707071	9.722222222	100	49.49494949	58.33333333	93.02325581	-64.41834505	-78.23835547
Epochs 100	0.252293587	8.791208791	8.333333333	93.02325581	50.54945055	48.80952381	88.0952381	58.20943232	-64.15459983	0.232558146	6.796116505	6.944444444	95	47.57281553	58.33333333	89.74358974	-36.03224338	-78.23835547
Epochs 120	0.266055048	8.510638298	10	95.45454545	50	48.75	88.37209302	-81.93800977	-64.15459983	0.260465115	7.142857143	9.459459459	97.6744186	48.97959184	56.75675676	92.85714286	-74.58050174	-78.23835547
Epochs 140	0.25688073	7.368421053	9.090909091	91.30434783	49.47368421	46.75324675	84.44444444	-83.44794834	-64.15459983	0.251162797	6.862745098	7.246376812	95.45454545	48.03921569	57.97101449	88.37209302	-79.12176948	-78.23835547
Epochs 160	0.25688073	7.142857143	7.042253521	89.79591837	47.95918367	47.88732394	83.33333333	-84.9397749	-64.15459983	0.255813956	6.730769231	7.575757576	95.55555556	47.11538462	56.06060606	88.63636364	-77.78693834	-78.23835547

Epochs 180	0.261467904	7	8.571428571	91.66666667	47	47.14285714	80.85106383	-86.12645296	-64.15459983	0.265116274	6.603773585	8.064516129	95.74468085	47.16981132	58.06451613	89.13043478	-76.19323927	-78.23835547
Epochs 200	0.233944952	6.730769231	8.333333333	90.47619048	47.11538462	45.83333333	78.04878049	-85.58631903	-64.15459983	0.274418592	6.666666667	8.333333333	94	48.57142857	58.33333333	87.75510204	-49.31833023	-78.23835547
OCBC Bank Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.311926603	7.766990291	5.660377358	91.93548387	55.33980583	45.28301887	90.16393443	-66.77847	-55.90202866	0.404651165	8.139534884	11.36363636	88.23529412	51.1627907	54.54545455	82.14285714	15.00586618	-24.56291964
Epochs 40	0.146788985	8.791208791	4.807692308	82.60869565	60.43956044	53.39805825	78.26086957	-90.11847277	-55.90202866	0.302325577	10	10.97560976	90.56603774	53.75	60.49382716	83.01886792	18.36162352	-24.56291964
Epochs 60	0.165137619	8.045977011	6.603773585	88	58.62068966	53.33333333	76	-80.82506709	-55.90202866	0.255813956	8.333333333	10.46511628	86.66666667	58.33333333	60	80	1.557185091	-24.56291964
Epochs 80	0.155963302	7.692307692	5.882352941	84	59.34065934	53.46534653	72	-79.87755543	-55.90202866	0.227906972	9.278350515	9.756097561	88.88888889	57.73195876	60.49382716	83.33333333	-17.85386242	-24.56291964
Epochs 100	0.165137619	8.333333333	6.18556701	88	59.375	53.125	84	-87.82816011	-55.90202866	0.237209305	7.920792079	10.95890411	85.36585366	54.45544554	61.11111111	78.04878049	-58.00182323	-24.56291964
Epochs 120	0.137614682	7.291666667	5.882352941	85	58.33333333	51.48514851	75	-90.62632143	-55.90202866	0.232558146	8.571428571	11.11111111	86.84210526	54.28571429	56.94444444	83.78378378	-49.51567674	-24.56291964
Epochs 140	0.151376143	6.382978723	6.060606061	84	58.5106383	52.04081633	76	-91.85877461	-55.90202866	0.255813956	7.920792079	10.44776119	85.10638298	53.46534653	55.2238806	78.26086957	-63.60637782	-24.56291964
Epochs 160	0.146788985	6.382978723	6	83.33333333	58.5106383	51.51515152	75	-92.79019572	-55.90202866	0.232558146	7.766990291	10	83.33333333	54.36893204	57.14285714	78.04878049	-62.32564969	-24.56291964
Epochs 180	0.165137619	5.434782609	6.25	83.33333333	57.60869565	50.52631579	76.66666667	-89.05516853	-55.90202866	0.232558146	7.766990291	10	83.33333333	52.42718447	57.14285714	75.6097561	-36.55295109	-24.56291964
Epochs 200	0.151376143	5.434782609	6.060606061	81.48148148	56.52173913	51.02040816	74.07407407	-76.65497758	-55.90202866	0.204651162	7.766990291	9.090909091	82.85714286	52.42718447	56.57894737	77.14285714	-54.98211015	-24.56291964
CNOOC Limited Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.322274894	5.263157895	7.843137255	90.76923077	53.68421053	62	81.53846154	169.4244816	-54.68960087	0.413145542	8.571428571	10.71428571	95	45.71428571	64.28571429	87.34177215	-62.86843345	-84.2898875
Epochs 40	0.189573467	6.451612903	7.692307692	100	54.83870968	58.88888889	92.59259259	410.3961571	-54.68960087	0.352112681	8.75	10.14492754	95.3125	48.75	60.29411765	87.5	-76.59811951	-84.2898875
Epochs 60	0.218009472	6.976744186	7.608695652	100	54.65116279	56.04395604	93.93939394	250.6821533	-54.68960087	0.314553976	7.692307692	8	91.66666667	48.71794872	58.10810811	81.66666667	-77.78575034	-84.2898875
Epochs 80	0.218009472	5.494505495	8.235294118	97.14285714	54.94505495	57.14285714	91.42857143	178.4047116	-54.68960087	0.28169015	9.090909091	7.894736842	93.87755102	52.27272727	57.33333333	83.67346939	-84.01843635	-84.2898875
Epochs 100	0.227488145	5.376344086	8.641975309	97.2972973	54.83870968	62.5	91.89189189	654.0183061	-54.68960087	0.28638497	8.602150538	8.571428571	94	50.53763441	56.52173913	84	-82.90572412	-84.2898875
Epochs 120	0.213270143	5.102040816	8.860759494	97.05882353	53.06122449	62.82051282	91.17647059	708.6197824	-54.68960087	0.28169015	7.608695652	8.450704225	94	47.82608696	57.14285714	88	-87.28533665	-84.2898875
Epochs 140	0.251184821	5.263157895	9.459459459	97.61904762	52.63157895	63.01369863	92.85714286	581.8145494	-54.68960087	0.305164307	7.692307692	8.955223881	94.54545455	48.35164835	54.54545455	87.27272727	-87.22212602	-84.2898875
Epochs 160	0.251184821	5.050505051	10	97.61904762	52.52525253	62.31884058	92.85714286	507.5594472	-54.68960087	0.295774639	8.510638298	7.692307692	92.59259259	50	56.92307692	84.90566038	-87.26536565	-84.2898875
Epochs 180	0.255924165	5.050505051	10.14492754	97.6744186	52.52525253	60.29411765	88.37209302	584.6555323	-54.68960087	0.319248825	9.183673469	8.771929825	93.10344828	50	56.14035088	82.45614035	-83.21925047	-84.2898875
Epochs 200	0.227488145	4.901960784	9.722222222	97.2972973	51.96078431	63.38028169	89.18918919	569.1212804	-54.68960087	0.309859157	8.910891089	8.928571429	92.85714286	50.4950495	57.14285714	83.63636364	-82.9716887	-84.2898875
JP Morgan Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.275229365	9.195402299	2.631578947	90.90909091	48.27586207	52	83.63636364	7497.878125	1576.179166	0.493150681	4.411764706	15	89.18918919	44.7761194	65	81.08108108	4.289411024	-31.90034799
Epochs 40	0.165137619	10.16949153	3.787878788	92.59259259	50.84745763	45.80152672	88.88888889	2095.540144	1576.179166	0.296803653	10.12658228	11.23595506	92.15686275	50.63291139	53.93258427	84	-4.234858063	-31.90034799

Epochs 60	0.192660555	11.32075472	3.816793893	91.17647059	50.94339623	45.38461538	88.23529412	3571.98588	1576.179166	0.260273963	10.71428571	9.782608696	90.69767442	53.57142857	55.43478261	80.95238095	-72.04561613	-31.90034799
Epochs 80	0.188073397	12.06896552	3.875968992	93.5483871	50	46.09375	90.32258065	6480.340646	1576.179166	0.292237431	9.756097561	11.49425287	92	53.65853659	56.32183908	89.79591837	-43.12116587	-31.90034799
Epochs 100	0.17889908	10.29411765	3.389830508	87.5	47.05882353	46.15384615	78.125	6909.408391	1576.179166	0.255707771	8.602150538	8.860759494	87.23404255	50.53763441	50.63291139	80.43478261	-30.4487	-31.90034799
Epochs 120	0.169724777	10.14492754	2.542372881	87.09677419	47.82608696	45.2991453	80.64516129	6039.36726	1576.179166	0.269406378	8.888888889	8.75	89.79591837	52.22222222	51.25	81.25	-18.38931651	-31.90034799
Epochs 140	0.183486238	9.85915493	2.654867257	88.23529412	50.70422535	44.64285714	79.41176471	1748.680925	1576.179166	0.260273963	8.695652174	8.860759494	87.5	52.17391304	53.16455696	78.72340426	-27.10357336	-31.90034799
Epochs 160	0.188073397	10.25641026	2.803738318	90.90909091	51.28205128	47.16981132	81.81818182	587.879984	1576.179166	0.269406378	8.695652174	8	86.53846154	51.08695652	50.66666667	80.39215686	-21.81574719	-31.90034799
Epochs 180	0.192660555	10.12658228	2.857142857	91.17647059	50.63291139	48.07692308	82.35294118	507.3051336	1576.179166	0.269406378	8.510638298	8.219178082	86.53846154	51.06382979	53.42465753	80.39215686	-9.237206161	-31.90034799
Epochs 200	0.183486238	10	2.830188679	90.625	48.75	46.66666667	81.25	499.4653024	1576.179166	0.251141548	8.510638298	7.792207792	85.41666667	50	53.24675325	78.72340426	-25.3487051	-31.90034799
American Axle (small cap) Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.344036698	4.95049505	7.142857143	89.33333333	44.55445545	50	82.43243243	-21.31831632	-40.19620025	0.529680371	10.14492754	13.15789474	92.85714286	57.97101449	65.78947368	87.38738739	113.4748783	-32.50977019
Epochs 40	0.192660555	5.376344086	7.608695652	90.90909091	48.38709677	51.08695652	87.5	116.7207165	-40.19620025	0.333333343	13.51351351	10.11235955	96.42857143	60.2739726	60.6741573	91.07142857	16.16538276	-32.50977019
Epochs 60	0.211009175	4.705882353	7.446808511	89.74358974	47.05882353	51.06382979	86.84210526	-44.37790549	-40.19620025	0.278538823	12.19512195	9.677419355	95.45454545	58.02469136	56.98924731	88.63636364	-45.83877576	-32.50977019
Epochs 80	0.206422016	3.488372093	7.52688172	89.74358974	44.18604651	51.61290323	84.21052632	-68.3291817	-40.19620025	0.283105016	12.34567901	9.782608696	93.47826087	57.5	56.52173913	86.95652174	-31.81655837	-32.50977019
Epochs 100	0.197247714	6.382978723	6.666666667	91.17647059	46.80851064	50	87.87878788	937.6045301	-40.19620025	0.278538823	12.79069767	8.988764045	95.45454545	57.64705882	59.5505618	88.63636364	-84.01370364	-32.50977019
Epochs 120	0.169724777	5.319148936	6.315789474	89.65517241	44.68085106	50.52631579	82.14285714	66.14198478	-40.19620025	0.269406378	12.64367816	9.782608696	97.5	58.13953488	59.7826087	92.5	-77.6696887	-32.50977019
Epochs 140	0.192660555	5.154639175	6.896551724	91.17647059	45.36082474	48.27586207	78.78787879	84.98744251	-40.19620025	0.260273963	12.35955056	7.954545455	92.85714286	56.81818182	57.95454545	88.0952381	-86.68254002	-32.50977019
Epochs 160	0.197247714	5.102040816	7.142857143	88.88888889	44.89795918	48.80952381	77.14285714	297.1003868	-40.19620025	0.246575341	12.08791209	6.818181818	92.5	55.55555556	57.95454545	87.5	-73.25039246	-32.50977019
Epochs 180	0.211009175	6	7.5	89.47368421	45	47.5	81.08108108	190.1423157	-40.19620025	0.246575341	10.63829787	7.228915663	90.47619048	55.91397849	59.03614458	85.71428571	-73.63269287	-32.50977019
Epochs 200	0.211009175	5.940594059	7.594936709	89.47368421	44.55445545	46.83544304	81.08108108	190.1423157	-40.19620025	0.223744288	10.1010101	7.228915663	89.18918919	54.08163265	60.24096386	83.78378378	-71.88057146	-32.50977019

Table 14-7 Results of 25 Percent More Sell Class LSTM Models , Cyclic Stocks

Kweichow Moutai Co., Ltd. Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.072463766	7.8125	3.947368421	66.66666667	45.3125	38.66666667	66.66666667	5675.542072	1666.892281	0.105769232	8.256880734	6.52173913	100	46.2962963	51.08695652	85.71428571	461.5678354	678.7940879
Epochs 40	0.202898547	11.26760563	7.692307692	81.25	54.28571429	48.07692308	78.125	1386.079027	1666.892281	0.22115384	11.76470588	7.339449541	96.77419355	54.41176471	51.85185185	90.32258065	405.2161933	678.7940879
Epochs 60	0.275362313	13.23529412	10.20408163	92.68292683	50.74626866	50	90.24390244	850.1837865	1666.892281	0.197115391	9.090909091	7.826086957	96.2962963	53.03030303	50.87719298	85.18518519	253.1745351	678.7940879
Epochs 80	0.280193239	14.92537313	10	95	54.54545455	49	92.5	1202.674827	1666.892281	0.22115384	9.677419355	7.142857143	94.11764706	56.4516129	50.45045045	88.23529412	180.8353951	678.7940879
Epochs 100	0.270531386	14.08450704	10.20408163	94.73684211	55.71428571	48.97959184	92.10526316	2163.506855	1666.892281	0.230769232	9.523809524	7.339449541	94.44444444	55.55555556	51.85185185	88.88888889	180.8353951	678.7940879
Epochs 120	0.30917874	15.94202899	10.63829787	97.72727273	55.88235294	50	95.45454545	3115.409184	1666.892281	0.25	9.375	6.796116505	95.12195122	51.5625	50.98039216	92.68292683	29.70527124	678.7940879

Epochs 140	0.299516916	15.49295775	10.63829787	97.61904762	54.28571429	50	90.47619048	1377.484712	1666.892281	0.269230783	9.677419355	6.930693069	95.55555556	51.61290323	51.48514851	90.90909091	30.43169888	678.7940879
Epochs 160	0.270531386	14.86486486	10.30927835	97.22222222	53.42465753	48.45360825	88.88888889	1631.635799	1666.892281	0.230769232	9.375	6.542056075	94.59459459	51.5625	49.53271028	88.88888889	21.79611244	678.7940879
Epochs 180	0.275362313	15.27777778	11	100	52.11267606	48	91.42857143	961.2213067	1666.892281	0.22115384	9.523809524	6.363636364	94.28571429	50.79365079	50.4587156	88.57142857	37.16818045	678.7940879
Epochs 200	0.251207739	13.51351351	10.89108911	96.875	53.42465753	47.52475248	93.75	609.5031209	1666.892281	0.211538464	9.375	7.079646018	96.77419355	50	49.10714286	90.32258065	21.09996205	678.7940879
Midea Group Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.115942031	5.303030303	9.523809524	91.66666667	48.48484848	51.61290323	83.33333333	60618.07184	1245.275482	0.048076924	5.384615385	2.597402597	100	42.63565891	45.45454545	100	-41.30032021	468.5733088
Epochs 40	0.29468599	9.85915493	9.302325581	92	56.33802817	58.82352941	80	204277.432	1245.275482	0.225961536	9.523809524	6.363636364	97.14285714	58.73015873	51.37614679	88.57142857	173.2355963	468.5733088
Epochs 60	0.314009666	11.26760563	8.536585366	92.59259259	59.15492958	59.25925926	83.33333333	92092.12291	1245.275482	0.206730768	8.196721311	6.140350877	93.93939394	57.37704918	52.21238938	78.78787879	146.6784518	468.5733088
Epochs 80	0.29468599	11.26760563	8.139534884	92	57.74647887	57.64705882	84	59178.59862	1245.275482	0.21634616	8.474576271	6.140350877	94.28571429	59.3220339	51.32743363	80	214.5874019	468.5733088
Epochs 100	0.29468599	11.11111111	8.139534884	93.87755102	56.94444444	58.82352941	85.71428571	99877.88194	1245.275482	0.206730768	7.936507937	6.25	93.93939394	57.14285714	51.35135135	87.87878788	213.4169333	468.5733088
Epochs 120	0.304347813	11.42857143	8.139534884	94.11764706	60	61.17647059	82.35294118	65771.72781	1245.275482	0.192307696	8.620689655	5.084745763	90.625	58.62068966	51.28205128	84.375	379.4161992	468.5733088
Epochs 140	0.280193239	11.11111111	6.976744186	89.79591837	59.72222222	60	75.51020408	51493.92384	1245.275482	0.182692304	8.196721311	5.128205128	90	57.37704918	50.86206897	86.66666667	307.1181741	468.5733088
Epochs 160	0.256038636	10.66666667	7.777777778	90.47619048	60	60.6741573	78.57142857	61827.00293	1245.275482	0.173076928	7.462686567	5.263157895	92.59259259	58.20895522	53.98230088	88.88888889	340.806216	468.5733088
Epochs 180	0.270531386	10.95890411	7.865168539	91.11111111	61.64383562	60.22727273	80	91062.46946	1245.275482	0.15384616	7.462686567	5.084745763	91.30434783	58.20895522	52.99145299	86.95652174	252.9631758	468.5733088
Epochs 200	0.265700489	9.85915493	7.777777778	89.13043478	61.97183099	60.6741573	80.43478261	87278.53228	1245.275482	0.149038464	7.352941176	5.084745763	90.90909091	58.82352941	53.84615385	86.36363636	273.65031	468.5733088
Walmart Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.087155961	5.714285714	5.633802817	100	47.85714286	51.42857143	85.71428571	10329.18572	9380.979094	0.10958904	4.697986577	13.1147541	100	48.64864865	55.73770492	100	613.7184664	255.7316817
Epochs 40	0.16055046	5	7.079646018	92	55	49.10714286	88	288.9260329	9380.979094	0.223744288	7.407407407	9.708737864	94.28571429	55	49.51456311	85.71428571	115.891638	255.7316817
Epochs 60	0.165137619	6.578947368	6.837606838	92	55.26315789	49.13793103	88	411.6517526	9380.979094	0.246575341	6.666666667	9.803921569	92.85714286	58.10810811	51.96078431	83.33333333	123.1979087	255.7316817
Epochs 80	0.165137619	7.792207792	6.779661017	95.65217391	55.84415584	48.71794872	95.65217391	458.0452525	9380.979094	0.278538823	5.797101449	10.1010101	92.15686275	60.29411765	51.51515152	82.35294118	186.339663	255.7316817
Epochs 100	0.128440365	7.407407407	6.504065041	100	54.32098765	47.54098361	100	119.8210068	9380.979094	0.246575341	5.263157895	10.1010101	90.90909091	56	50.50505051	81.81818182	85.24634908	255.7316817
Epochs 120	0.128440365	7.5	6.451612903	100	52.5	45.96774194	100	147.0227592	9380.979094	0.255707771	5.405405405	10.1010101	91.30434783	54.79452055	50.50505051	82.60869565	83.98027274	255.7316817
Epochs 140	0.133027524	7.407407407	6.557377049	100	51.25	45.90163934	93.33333333	156.8804699	9380.979094	0.260273963	5.479452055	10.1010101	91.4893617	54.16666667	49.49494949	82.9787234	25.71893859	255.7316817
Epochs 160	0.114678897	6.493506494	6.201550388	100	51.31578947	42.63565891	100	0.017819768	9380.979094	0.232876718	5.405405405	9.615384615	90.24390244	52.05479452	47.11538462	82.92682927	16.2282071	255.7316817
Epochs 180	0.119266056	6.578947368	6.201550388	100	49.33333333	43.41085271	100	77.18404629	9380.979094	0.232876718	5.333333333	9.708737864	90.24390244	52.7027027	47.57281553	85.36585366	18.87812498	255.7316817
Epochs 200	0.114678897	6.666666667	6.106870229	100	50	43.51145038	100	46.34453444	9380.979094	0.219178081	5.333333333	9.433962264	89.47368421	52.7027027	47.16981132	84.21052632	36.1889274	255.7316817
Fresh Del Monte Produce Inc (small cap)Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit

Epochs 20	0.119266056	6.569343066	10	90.90909091	37.95620438	46.37681159	90.90909091	-52.83613694	5.320148705	0.086757988	5.369127517	7.936507937	85.71428571	48.64864865	47.61904762	85.71428571	275.7926783	-65.97131265
Epochs 40	0.247706428	9.411764706	9.574468085	94.87179487	54.11764706	45.74468085	81.57894737	180.9665244	5.320148705	0.223744288	9.722222222	7.96460177	97.05882353	56.33802817	50.44247788	94.11764706	60.37644403	-65.97131265
Epochs 60	0.238532111	8.43373494	6.593406593	88.63636364	54.21686747	42.85714286	81.39534884	313.0853619	5.320148705	0.205479458	9.210526316	7.96460177	96.66666667	56	50.44247788	86.66666667	4.44653372	-65.97131265
Epochs 80	0.229357794	8.43373494	8.24742268	92.10526316	56.62650602	44.79166667	84.21052632	269.3399588	5.320148705	0.251141548	9.589041096	8.490566038	97.5	58.33333333	50.94339623	90	33.92479853	-65.97131265
Epochs 100	0.215596333	8.139534884	8.24742268	91.42857143	55.81395349	43.75	80	40.95495317	5.320148705	0.237442926	9.589041096	8.256880734	97.2972973	61.11111111	50.4587156	86.48648649	-18.89140156	-65.97131265
Epochs 120	0.220183492	8.139534884	8.333333333	91.66666667	55.81395349	43.15789474	80.55555556	100.4810721	5.320148705	0.237442926	8.108108108	8.490566038	94.87179487	57.53424658	50.94339623	87.17948718	-64.58132863	-65.97131265
Epochs 140	0.215596333	7.058823529	7.446808511	87.17948718	55.29411765	43.01075269	76.92307692	98.42860636	5.320148705	0.246575341	8.108108108	8.653846154	95.12195122	57.53424658	50.96153846	87.80487805	-62.06657946	-65.97131265
Epochs 160	0.183486238	6.741573034	8	89.65517241	51.68539326	42.42424242	82.75862069	99.57597708	5.320148705	0.19178082	9.090909091	7.826086957	96.2962963	57.89473684	50.43478261	92.59259259	-71.14279289	-65.97131265
Epochs 180	0.183486238	6.896551724	7.920792079	86.66666667	51.72413793	44	76.66666667	122.0472407	5.320148705	0.182648405	9.638554217	8.035714286	95.83333333	58.53658537	50.89285714	91.66666667	-52.51488367	-65.97131265
Epochs 200	0.169724777	8.045977011	6.730769231	85.18518519	52.87356322	42.7184466	77.77777778	15.25823855	5.320148705	0.187214613	10	7.894736842	96	59.49367089	50.87719298	92	-45.44600769	-65.97131265

Table 14-8 Results of 25 Percent More Sell Class LSTM Models , Non-Cyclic Stocks

Singapore Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.426605493	6.306306306	7.142857143	91.39784946	49.54954955	57.14285714	77.17391304	-80.21920496	-64.15459983	0.288372099	5.426356589	7.407407407	89.83050847	43.41085271	59.25925926	86.20689655	-74.78448911	-78.23835547
Epochs 40	0.302752286	5.952380952	10.52631579	91.37931034	47.61904762	47.36842105	84.21052632	-76.22720055	-64.15459983	0.306976736	7.619047619	11.86440678	100	49.52380952	59.3220339	96	-74.34929892	-78.23835547
Epochs 60	0.270642191	5.952380952	10.58823529	91.83673469	47.61904762	47.05882353	87.5	-69.83032234	-64.15459983	0.302325577	8.163265306	10.60606061	98.03921569	53.06122449	61.53846154	96.07843137	-61.30976114	-78.23835547
Epochs 80	0.279816508	6.976744186	10.84337349	93.87755102	48.8372093	49.39759036	87.5	107.4944278	-64.15459983	0.320930243	8.333333333	10.9375	98.18181818	55.20833333	59.375	96.2962963	-62.7386672	-78.23835547
Epochs 100	0.238532111	7.446808511	10.46511628	94.73684211	46.80851064	50	86.48648649	188.1866962	-64.15459983	0.320930243	8.421052632	9.523809524	96.49122807	53.68421053	57.14285714	94.64285714	-62.23955205	-78.23835547
Epochs 120	0.233944952	7.446808511	10.34482759	94.59459459	46.80851064	49.42528736	86.11111111	115.4912496	-64.15459983	0.302325577	7.368421053	9.090909091	96.2962963	52.63157895	57.57575758	94.33962264	-72.41035364	-78.23835547
Epochs 140	0.261467904	7.608695652	10.84337349	95.34883721	47.82608696	44.57831325	85.71428571	76.21725043	-64.15459983	0.297674417	8.333333333	8.955223881	96.15384615	53.125	59.70149254	94.11764706	-64.42802157	-78.23835547
Epochs 160	0.24311927	7.368421053	10.71428571	94.87179487	48.42105263	44.04761905	84.21052632	-90.88996391	-64.15459983	0.288372099	8.163265306	10.29411765	95.91836735	51.02040816	60.29411765	91.66666667	-56.32526091	-78.23835547
Epochs 180	0.25688073	7.368421053	10.12658228	93.18181818	49.47368421	44.30379747	83.72093023	120.7091808	-64.15459983	0.306976736	8.163265306	10.9375	96.22641509	50	59.375	92.30769231	-44.62426115	-78.23835547
Epochs 200	0.247706428	7.291666667	10	92.85714286	50	42.5	85.36585366	-89.34122499	-64.15459983	0.297674417	7.216494845	10.60606061	96.15384615	48.45360825	59.09090909	92.15686275	-70.5972425	-78.23835547
OCBC Bank Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.275229365	6.106870229	0	89.65517241	50	51.72413793	89.65517241	-66.92370058	-55.90202866	0.297674417	7.438016529	11.11111111	87.93103448	49.58677686	58.33333333	80.70175439	-28.66008194	-24.56291964
Epochs 40	0.17889908	8.333333333	6.382978723	89.28571429	60.41666667	55.91397849	89.28571429	-90.97484134	-55.90202866	0.274418592	9.375	10	87.75510204	54.16666667	58.57142857	87.5	-21.87508367	-24.56291964
Epochs 60	0.123853214	8.421052632	5.607476636	81.25	57.89473684	53.77358491	81.25	-94.51182683	-55.90202866	0.218604654	8.421052632	9.523809524	86.11111111	53.68421053	57.14285714	82.85714286	-72.3366635	-24.56291964
Epochs 80	0.192660555	8.695652174	6.315789474	90.32258065	59.7826087	55.31914894	87.09677419	-89.43580551	-55.90202866	0.195348844	8.421052632	8.988764045	83.87096774	54.73684211	56.17977528	80	-69.16317067	-24.56291964

Epochs 100	0.17889908	8.510638298	6.25	89.28571429	58.5106383	55.78947368	89.28571429	-91.78326361	-55.90202866	0.19069767	8.333333333	8.988764045	83.33333333	53.125	56.17977528	79.31034483	-72.99282573	-24.56291964
Epochs 120	0.206422016	9.090909091	6.18556701	93.93939394	59.09090909	55.20833333	90.90909091	-89.31581271	-55.90202866	0.176744193	8.333333333	8.602150538	84.61538462	52.08333333	56.98924731	80	-66.22579078	-24.56291964
Epochs 140	0.192660555	8.888888889	6.12244898	93.33333333	57.77777778	54.63917526	90	-92.41225174	-55.90202866	0.204651162	7.608695652	8.988764045	85.29411765	54.34782609	57.30337079	81.81818182	-64.3317968	-24.56291964
Epochs 160	0.206422016	8.791208791	6.382978723	93.93939394	57.14285714	54.83870968	90.90909091	-93.54026879	-55.90202866	0.200000003	7.291666667	9.302325581	84.84848485	53.125	56.97674419	81.25	-38.21749374	-24.56291964
Epochs 180	0.215596333	8.602150538	6.666666667	94.28571429	58.06451613	55.05617978	91.42857143	-82.15238504	-55.90202866	0.209302321	7.368421053	9.411764706	85.71428571	53.68421053	57.64705882	85.29411765	-33.50853814	-24.56291964
Epochs 200	0.220183492	8.695652174	6.666666667	94.44444444	57.60869565	56.17977528	91.66666667	-83.28916539	-55.90202866	0.213953495	7.216494845	9.756097561	86.11111111	53.60824742	58.53658537	85.71428571	-47.95234625	-24.56291964
CNOOC Limited Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.293838859	4.347826087	5.882352941	88.70967742	50.43478261	60.60606061	79.03225806	-64.86699856	-54.68960087	0.328638494	6.504065041	8.333333333	90.90909091	43.08943089	50	81.53846154	-72.97457066	-84.2898875
Epochs 40	0.222748816	5.319148936	8.641975309	97.22222222	56.38297872	61.25	91.66666667	426.7276158	-54.68960087	0.347417831	7.52688172	10.90909091	93.84615385	46.23655914	52.72727273	85.9375	-42.23906533	-84.2898875
Epochs 60	0.19905214	6.451612903	7.865168539	100	55.91397849	59.09090909	93.10344828	111.9636756	-54.68960087	0.272300482	8	9.230769231	91.66666667	48	53.125	83.33333333	-66.70025712	-84.2898875
Epochs 80	0.189573467	5.208333333	8.139534884	96.55172414	54.16666667	62.35294118	89.65517241	262.7639548	-54.68960087	0.28638497	7.446808511	10.29411765	92.15686275	46.80851064	55.2238806	82.35294118	-82.7172512	-84.2898875
Epochs 100	0.165876776	5.102040816	7.865168539	95.83333333	56.12244898	61.36363636	87.5	264.9522655	-54.68960087	0.253521115	7.291666667	9.589041096	90.90909091	47.91666667	56.94444444	81.81818182	-72.6426994	-84.2898875
Epochs 120	0.17061612	5.882352941	7.058823529	100	54.90196078	57.14285714	95.83333333	-67.16352684	-54.68960087	0.258215964	7.291666667	9.722222222	91.11111111	46.875	56.94444444	84.09090909	-91.36325689	-84.2898875
Epochs 140	0.189573467	5.102040816	8.333333333	96.55172414	55.10204082	56.62650602	93.10344828	-59.74222927	-54.68960087	0.253521115	7.216494845	9.722222222	90.90909091	46.39175258	55.55555556	83.72093023	-91.29740975	-84.2898875
Epochs 160	0.17061612	5	8.139534884	96	55	57.64705882	92	-66.0314839	-54.68960087	0.267605633	7.216494845	10.14492754	91.4893617	48.45360825	59.42028986	84.7826087	-85.61299268	-84.2898875
Epochs 180	0.184834123	5.050505051	8.333333333	96.42857143	55.55555556	56.62650602	89.28571429	-87.10364874	-54.68960087	0.28638497	6.52173913	10.29411765	90.56603774	50	61.76470588	80.76923077	-85.2555879	-84.2898875
Epochs 200	0.189573467	5.050505051	7.407407407	93.5483871	56.56565657	58.75	87.09677419	-80.97621306	-54.68960087	0.300469488	6.593406593	9.375	89.65517241	47.25274725	57.8125	82.45614035	-86.14758684	-84.2898875
JP Morgan Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.30733946	8.928571429	6.12244898	94.73684211	45.53571429	41.66666667	89.47368421	214.8446575	1576.179166	0.447488576	7.339449541	12.5	93.61702128	43.11926606	62.5	84.94623656	88.86430248	-31.90034799
Epochs 40	0.123853214	9.090909091	4.032258065	88.23529412	50.64935065	47.15447154	82.35294118	2286.747834	1576.179166	0.296803653	8.988764045	12.5	94	51.13636364	55	88	53.3655959	-31.90034799
Epochs 60	0.133027524	9.589041096	3.968253968	89.47368421	52.05479452	45.6	78.94736842	1629.185625	1576.179166	0.305936068	7.407407407	12.19512195	91.07142857	49.38271605	59.75609756	83.63636364	15.79292332	-31.90034799
Epochs 80	0.155963302	9.333333333	4.201680672	91.66666667	50.66666667	47.45762712	83.33333333	1603.470221	1576.179166	0.292237431	5.747126437	10.81081081	87.93103448	47.12643678	60.81081081	80.70175439	-36.87091825	-31.90034799
Epochs 100	0.151376143	9.722222222	4.06504065	91.30434783	52.77777778	45.90163934	82.60869565	1960.600017	1576.179166	0.255707771	6.315789474	9.333333333	87.75510204	48.42105263	57.33333333	81.25	5.790439739	-31.90034799
Epochs 120	0.146788985	9.589041096	4.06504065	90.90909091	52.05479452	46.72131148	86.36363636	3465.417244	1576.179166	0.237442926	8.080808081	8.974358974	88.0952381	50	53.84615385	80.95238095	-49.35844094	-31.90034799
Epochs 140	0.151376143	10.25641026	4.201680672	95.23809524	52.56410256	46.61016949	90.47619048	3879.668535	1576.179166	0.214611873	6.796116505	9.090909091	84.61538462	49.01960784	54.54545455	76.92307692	7.453929067	-31.90034799
Epochs 160	0.142201841	10.12658228	3.389830508	90.47619048	51.89873418	46.15384615	85.71428571	4176.095834	1576.179166	0.19178082	7.619047619	8.43373494	87.09677419	50.96153846	55.42168675	80.64516129	-44.84532837	-31.90034799
Epochs 180	0.142201841	9.090909091	3.389830508	86.95652174	51.94805195	46.15384615	82.60869565	3154.772462	1576.179166	0.210045666	6.796116505	10	86.11111111	50	56.25	77.77777778	-39.19379547	-31.90034799
Epochs 200	0.16055046	9.210526316	3.50877193	85.71428571	52.63157895	46.01769912	82.14285714	2745.026056	1576.179166	0.237442926	7	9.210526316	88.37209302	52.52525253	57.89473684	81.39534884	-13.35219704	-31.90034799

American Axle (small cap) Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.247706428	5.223880597	3.03030303	90.19607843	43.28358209	60.60606061	84	-33.62784719	-40.19620025	0.442922384	8.411214953	5.555555556	92.55319149	50.94339623	50	84.04255319	-39.40208166	-32.50977019
Epochs 40	0.146788985	2.803738318	9.195402299	87.5	42.99065421	52.3255814	83.33333333	-56.50620919	-40.19620025	0.273972601	11.11111111	8.43373494	93.47826087	53.93258427	57.8313253	86.95652174	29.35925532	-32.50977019
Epochs 60	0.146788985	3.846153846	8.695652174	90.90909091	40.38461538	53.84615385	81.81818182	-92.65816109	-40.19620025	0.251141548	11.49425287	8.510638298	97.36842105	54.65116279	55.31914894	89.47368421	170.6054897	-32.50977019
Epochs 80	0.16055046	5.405405405	9.411764706	95.45454545	42.34234234	55.95238095	86.36363636	-72.72317627	-40.19620025	0.264840186	11.62790698	8.695652174	97.56097561	55.29411765	56.52173913	90.24390244	54.98688124	-32.50977019
Epochs 100	0.188073397	4.716981132	9.638554217	96.55172414	44.33962264	57.8313253	89.28571429	-66.72955005	-40.19620025	0.237442926	10.34482759	7.52688172	92.30769231	54.65116279	56.98924731	87.17948718	37.63786527	-32.50977019
Epochs 120	0.197247714	4.807692308	9.638554217	96.77419355	44.23076923	57.8313253	86.66666667	-66.32339862	-40.19620025	0.242009133	11.49425287	8.421052632	94.59459459	53.48837209	58.94736842	89.18918919	96.42503309	-32.50977019
Epochs 140	0.192660555	4.854368932	9.411764706	96.66666667	44.66019417	56.47058824	89.65517241	-65.58656028	-40.19620025	0.237442926	11.36363636	9.375	94.28571429	55.17241379	59.375	88.57142857	150.6213121	-32.50977019
Epochs 160	0.183486238	4.854368932	9.090909091	100	45.63106796	56.81818182	92.30769231	-66.47304223	-40.19620025	0.223744288	11.70212766	9.473684211	96.66666667	53.76344086	58.94736842	90	276.0757388	-32.50977019
Epochs 180	0.201834857	5.154639175	8.888888889	100	47.42268041	55.55555556	93.33333333	-71.21657001	-40.19620025	0.232876718	11.95652174	9.473684211	96.875	53.84615385	57.89473684	90.625	112.309574	-32.50977019
Epochs 200	0.211009175	5.102040816	9.302325581	97.05882353	45.91836735	55.81395349	90.90909091	-70.7610359	-40.19620025	0.223744288	10.75268817	8.602150538	93.93939394	53.26086957	58.06451613	87.87878788	93.01021132	-32.50977019

Table 14-9 Results of 50 Percent More Buy Class LSTM Models , Cyclic Stocks

Kweichow Moutai Co., Ltd. Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.062801935	5.847953216	5.882352941	50	42.94117647	38.23529412	50	2986.467537	1666.892281	0.0625	5.521472393	6.818181818	100	42.59259259	43.18181818	100	544.8465408	678.7940879
Epochs 40	0.212560385	10.97560976	8.510638298	87.09677419	53.08641975	46.80851064	87.09677419	1969.570742	1666.892281	0.1875	11.26760563	7.142857143	92	54.92957746	53.15315315	88	652.5222361	678.7940879
Epochs 60	0.231884062	11.11111111	10.52631579	93.5483871	53.75	49.47368421	93.5483871	2109.23292	1666.892281	0.182692304	8.823529412	6.25	89.28571429	50	50	74.07407407	324.5617959	678.7940879
Epochs 80	0.202898547	10.84337349	8.421052632	86.20689655	53.65853659	49.47368421	86.20689655	1618.219543	1666.892281	0.201923072	8.823529412	6.422018349	93.5483871	50	49.5412844	76.66666667	300.8121556	678.7940879
Epochs 100	0.251207739	11.53846154	7.865168539	90	53.24675325	48.31460674	87.5	1663.608003	1666.892281	0.230769232	9.090909091	5.882352941	90	50	49.01960784	76.92307692	288.2412374	678.7940879
Epochs 120	0.246376812	11.11111111	7.954545455	92.10526316	52.5	47.72727273	89.47368421	1619.883201	1666.892281	0.211538464	8.571428571	6.666666667	93.93939394	48.57142857	49.52380952	81.25	138.3588611	678.7940879
Epochs 140	0.236714974	11.11111111	7.777777778	91.66666667	53.75	48.88888889	88.88888889	1309.459105	1666.892281	0.22115384	8.823529412	6.666666667	94.28571429	48.52941176	48.57142857	82.35294118	112.6557665	678.7940879
Epochs 160	0.227053136	12.19512195	7.52688172	93.75	53.08641975	47.31182796	90.625	1082.303211	1666.892281	0.1875	9.090909091	6.730769231	92.59259259	48.05194805	50	80.76923077	115.561012	678.7940879
Epochs 180	0.222222224	11.62790698	7.692307692	96.66666667	51.76470588	48.35164835	93.33333333	1197.416741	1666.892281	0.192307696	8.974358974	6.796116505	96.2962963	47.43589744	48.54368932	88.46153846	103.3215325	678.7940879
Epochs 200	0.217391297	10.58823529	7.692307692	93.5483871	51.19047619	48.35164835	90.32258065	1197.416741	1666.892281	0.197115391	10	6.930693069	96.2962963	46.25	50.4950495	88.46153846	196.5169349	678.7940879
Midea Group Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.077294685	5.325443787	11.42857143	100	46.15384615	47.05882353	100	1972.138669	1245.275482	0.03846154	3.95480226	3.225806452	0	44.31818182	48.38709677	0	284.6191141	468.5733088
Epochs 40	0.212560385	10	8.988764045	96.42857143	57.77777778	56.81818182	82.14285714	58959.70288	1245.275482	0.144230768	7.228915663	5.714285714	90	55.42168675	50	80	58.3264501	468.5733088

Epochs 60	0.280193239	10.95890411	8.045977011	91.4893617	58.90410959	56.97674419	78.72340426	41859.25793	1245.275482	0.201923072	7.042253521	5.825242718	91.17647059	54.92957746	50.48543689	81.81818182	-15.51005671	468.5733088
Epochs 80	0.275362313	10.25641026	8.43373494	91.30434783	57.69230769	56.09756098	78.26086957	30558.60692	1245.275482	0.192307696	6.493506494	7	90.32258065	54.54545455	52	83.33333333	19.74188953	468.5733088
Epochs 100	0.318840593	10.81081081	8.974358974	92.72727273	59.45945946	58.44155844	80	62781.95462	1245.275482	0.21634616	6.25	6.666666667	89.47368421	56.25	53.33333333	81.08108108	127.8538331	468.5733088
Epochs 120	0.32367149	11.68831169	9.210526316	94.44444444	62.33766234	58.66666667	81.48148148	12425.15655	1245.275482	0.22115384	6.493506494	6.52173913	89.74358974	57.14285714	55.43478261	81.57894737	112.8337864	468.5733088
Epochs 140	0.30917874	10.97560976	9.459459459	94.11764706	60.97560976	60.2739726	82.35294118	16624.89908	1245.275482	0.259615391	5.797101449	6.666666667	89.79591837	60.86956522	53.93258427	79.59183673	160.2804359	468.5733088
Epochs 160	0.270531386	10.34482759	9.090909091	93.02325581	58.62068966	59.21052632	76.74418605	24745.24988	1245.275482	0.201923072	6.756756757	6.060606061	88.57142857	60.81081081	54.08163265	77.14285714	83.99820916	468.5733088
Epochs 180	0.270531386	10.46511628	8.974358974	93.02325581	58.82352941	60.25641026	76.74418605	4862.357918	1245.275482	0.1875	6.666666667	5.940594059	87.5	60	55	78.125	77.71019936	468.5733088
Epochs 200	0.265700489	10.46511628	8.860759494	92.85714286	60	60.75949367	73.80952381	4756.967065	1245.275482	0.1875	7.894736842	5.882352941	90	59.21052632	54.45544554	80	75.83820252	468.5733088
Walmart Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.055045873	4.469273743	5.405405405	100	46.06741573	62.16216216	100	10006.79366	9380.979094	0.063926943	3.664921466	16	100	45.78947368	60	100	308.7220467	255.7316817
Epochs 40	0.183486238	6.52173913	7.216494845	93.10344828	53.26086957	52.57731959	85.71428571	2407.595648	9380.979094	0.210045666	5.217391304	10.29411765	91.66666667	50	55.88235294	86.11111111	801.3273146	255.7316817
Epochs 60	0.220183492	6.578947368	6	88.0952381	51.31578947	54	85.36585366	495.1824898	9380.979094	0.246575341	5.319148936	11.11111111	90.90909091	52.68817204	54.32098765	84.09090909	91.18119985	255.7316817
Epochs 80	0.197247714	5.813953488	7.216494845	88.57142857	48.8372093	53.60824742	85.29411765	484.5397294	9380.979094	0.251141548	6.18556701	11.39240506	93.02325581	52.08333333	49.36708861	86.04651163	182.733402	255.7316817
Epochs 100	0.206422016	5.747126437	6.451612903	89.47368421	47.12643678	54.83870968	86.48648649	452.7891224	9380.979094	0.278538823	5.208333333	11.26760563	92.30769231	49.47368421	52.11267606	84.61538462	220.6464079	255.7316817
Epochs 120	0.197247714	5.813953488	6.25	88.88888889	50	53.125	85.71428571	267.3323185	9380.979094	0.264840186	5.050505051	12.32876712	93.61702128	48.97959184	50.68493151	87.23404255	205.4937294	255.7316817
Epochs 140	0.192660555	5.617977528	6.315789474	91.17647059	50	51.57894737	88.23529412	68.09672888	9380.979094	0.228310496	4.672897196	12.32876712	92.30769231	50	50.68493151	84.61538462	248.5144399	255.7316817
Epochs 160	0.155963302	5.208333333	6.25	88.46153846	49.47368421	52.08333333	88.46153846	42.41324413	9380.979094	0.200913236	4.545454545	11.68831169	93.75	47.70642202	48.05194805	87.5	134.685501	255.7316817
Epochs 180	0.155963302	5.263157895	6.12244898	92	50	51.02040816	92	8.819833549	9380.979094	0.200913236	4.545454545	11.68831169	93.75	47.70642202	48.05194805	87.5	57.71082577	255.7316817
Epochs 200	0.16055046	5.208333333	6.18556701	96	49.47368421	50.51546392	96	18.45140216	9380.979094	0.196347028	4.545454545	11.53846154	93.5483871	47.70642202	47.43589744	87.09677419	57.71082577	255.7316817
Fresh Del Monte Produce Inc (small cap)Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.087155961	5.454545455	6.666666667	87.5	32.92682927	37.77777778	87.5	23.3442294	5.320148705	0.059360731	5.376344086	9.090909091	0	47.02702703	54.54545455	0	-72.05941348	-65.97131265
Epochs 40	0.206422016	9.090909091	10.86956522	96.2962963	47.47474747	50.54945055	85.18518519	37.29149245	5.320148705	0.187214613	6.862745098	7.954545455	93.10344828	53.46534653	52.27272727	86.20689655	152.4954102	-65.97131265
Epochs 60	0.298165143	8.641975309	10.71428571	92.45283019	53.08641975	50.60240964	81.13207547	160.3219914	5.320148705	0.264840186	8.988764045	8.235294118	95.55555556	47.72727273	49.41176471	84.44444444	-82.71932691	-65.97131265
Epochs 80	0.247706428	7.52688172	10.84337349	90.47619048	51.61290323	50	78.57142857	787.5273815	5.320148705	0.264840186	8.888888889	8.333333333	95.55555556	51.68539326	51.19047619	86.66666667	-73.92474685	-65.97131265
Epochs 100	0.266055048	8.510638298	11.25	93.18181818	50	50.63291139	81.81818182	492.4569265	5.320148705	0.264840186	7.777777778	7.5	91.83673469	51.68539326	47.5	83.67346939	-67.47838151	-65.97131265
Epochs 120	0.229357794	7.291666667	10.71428571	89.47368421	50	50.60240964	81.57894737	206.8448471	5.320148705	0.269406378	8.791208791	7.5	93.75	52.22222222	48.75	87.5	-53.14779999	-65.97131265
Epochs 140	0.238532111	8.510638298	10.46511628	92.10526316	52.12765957	50.58823529	84.21052632	318.6452274	5.320148705	0.260273963	7.954545455	7.142857143	93.61702128	50.57471264	46.42857143	87.23404255	-65.50665419	-65.97131265
Epochs 160	0.201834857	9.278350515	9.677419355	92.85714286	52.57731959	50	82.14285714	286.3493613	5.320148705	0.228310496	7.368421053	7.142857143	92.5	51.06382979	46.42857143	85	-66.97854665	-65.97131265

Epochs 180	0.188073397	9	8.791208791	88.88888889	52	48.88888889	81.48148148	154.0380112	5.320148705	0.200913236	7.291666667	6.741573034	91.17647059	51.57894737	49.43820225	82.35294118	-74.68192742	-65.97131265
Epochs 200	0.188073397	9	8.791208791	88.88888889	54	48.88888889	77.77777778	303.3483138	5.320148705	0.205479458	7.368421053	6.741573034	91.42857143	53.19148936	50.56179775	80	-66.77196246	-65.97131265

Table 14-10 Results of 50 Percent More Buy Class LSTM Models , Non-Cyclic Stocks

Singapore Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.509174287	4.494382022	9.090909091	89.83050847	44.94382022	54.54545455	76.06837607	-70.08399606	-64.15459983	0.395348847	6.194690265	13.04347826	94.93670886	42.47787611	65.2173913	89.74358974	-30.73313415	-78.23835547
Epochs 40	0.403669715	9.85915493	12.32876712	97.2972973	54.92957746	53.42465753	91.78082192	-7.846398878	-64.15459983	0.362790704	8.045977011	10	95.58823529	49.42528736	61.66666667	89.55223881	-57.03824029	-78.23835547
Epochs 60	0.417431206	9.375	12	96.20253165	53.125	50.66666667	89.74358974	144.8265119	-64.15459983	0.344186038	7.954545455	9.677419355	93.84615385	48.86363636	61.29032258	85.9375	-76.47651381	-78.23835547
Epochs 80	0.399082571	9.230769231	9.459459459	93.67088608	53.84615385	45.94594595	87.17948718	52.61969089	-64.15459983	0.358139545	8.235294118	9.677419355	94.11764706	47.05882353	59.67741935	86.56716418	-81.67377898	-78.23835547
Epochs 100	0.43577981	10.16949153	10.81081081	95.29411765	50.84745763	44.59459459	88.0952381	-78.99499322	-64.15459983	0.367441863	8.536585366	9.523809524	94.28571429	47.56097561	58.73015873	85.50724638	-69.58068498	-78.23835547
Epochs 120	0.399082571	10.44776119	10.52631579	96	50.74626866	47.36842105	87.83783784	-61.15501845	-64.15459983	0.348837197	8.235294118	9.375	93.93939394	47.05882353	57.8125	86.15384615	-69.71315421	-78.23835547
Epochs 140	0.362385333	8.823529412	8.860759494	92.95774648	51.47058824	45.56962025	85.71428571	-61.51897744	-64.15459983	0.367441863	9.523809524	9.523809524	95.58823529	51.19047619	60.31746032	88.05970149	-21.83660759	-78.23835547
Epochs 160	0.380733937	7.575757576	8.219178082	91.13924051	50	46.57534247	84.61538462	-62.12155364	-64.15459983	0.38139534	9.523809524	11.29032258	97.10144928	51.19047619	59.67741935	86.76470588	-31.27948758	-78.23835547
Epochs 180	0.389908254	7.692307692	8.219178082	92.5	49.23076923	41.09589041	86.07594937	-72.19209191	-64.15459983	0.390697688	9.638554217	11.47540984	97.18309859	46.98795181	59.01639344	87.14285714	-4.719929319	-78.23835547
Epochs 200	0.408256888	7.575757576	8.823529412	92.85714286	48.48484848	44.11764706	83.13253012	-76.66608361	-64.15459983	0.409302324	9.638554217	10.71428571	97.36842105	46.98795181	58.92857143	89.33333333	-3.895647715	-78.23835547
OCBC Bank Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.357798159	7.01754386	0	92.10526316	46.90265487	50	88.15789474	-72.94716747	-55.90202866	0.47441861	7.407407407	6.896551724	89.52380952	40.74074074	55.17241379	84.61538462	215.8974334	-24.56291964
Epochs 40	0.201834857	8.641975309	5.882352941	88.57142857	58.02469136	53.46534653	85.71428571	-86.28041273	-55.90202866	0.293023258	8.43373494	11.25	90.38461538	53.01204819	60	86.2745098	-26.44895138	-24.56291964
Epochs 60	0.24311927	9.459459459	5.102040816	89.13043478	58.10810811	54.63917526	84.7826087	-65.84665534	-55.90202866	0.293023258	8.536585366	11.11111111	90.38461538	52.43902439	60.49382716	84.31372549	-27.97373556	-24.56291964
Epochs 80	0.25688073	9.210526316	5.376344086	89.79591837	59.21052632	54.34782609	85.71428571	-91.50358943	-55.90202866	0.302325577	8.75	11.11111111	90.74074074	52.5	59.25925926	86.79245283	-37.84322247	-24.56291964
Epochs 100	0.25688073	9.459459459	4.301075269	88.23529412	59.45945946	53.26086957	84.31372549	-84.21999389	-55.90202866	0.311627895	8.75	10.38961039	89.65517241	52.5	58.44155844	87.71929825	-38.547151	-24.56291964
Epochs 120	0.275229365	9.85915493	4.301075269	90.74074074	61.97183099	55.43478261	85.18518519	-89.12336792	-55.90202866	0.293023258	8.333333333	11.39240506	90.38461538	53.57142857	59.49367089	88.23529412	-54.76547675	-24.56291964
Epochs 140	0.275229365	9.85915493	3.296703297	89.28571429	60.56338028	54.44444444	83.92857143	-91.73172058	-55.90202866	0.279069781	8.333333333	8.974358974	86.79245283	54.76190476	58.97435897	82.69230769	-53.37782687	-24.56291964
Epochs 160	0.293577969	7.246376812	4.597701149	88.70967742	59.42028986	53.48837209	83.87096774	-93.27299273	-55.90202866	0.325581402	8.333333333	8.974358974	87.69230769	56.94444444	60.25641026	84.375	-40.86306647	-24.56291964
Epochs 180	0.284403682	4.6875	3.370786517	86.15384615	56.25	52.27272727	81.53846154	-99.34120877	-55.90202866	0.33488372	8.571428571	7.894736842	86.95652174	58.57142857	59.21052632	83.82352941	-55.42024229	-24.56291964
Epochs 200	0.293577969	4.6875	3.448275862	86.56716418	54.6875	52.3255814	82.08955224	-99.06796213	-55.90202866	0.33488372	8.450704225	6.849315068	85.91549296	56.33802817	56.16438356	82.85714286	-46.8933016	-24.56291964
CNOOC Limited Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit

Epochs 20	0.478672981	4.705882353	0	88.99082569	49.41176471	62.5	81.65137615	-45.90799124	-54.68960087	0.375586867	5.309734513	5.263157895	90.12345679	42.85714286	52.63157895	81.48148148	-78.11034935	-84.2898875
Epochs 40	0.260663509	5.813953488	8.75	95.55555556	55.81395349	58.2278481	88.88888889	312.1084946	-54.68960087	0.342723012	9.782608696	8.474576271	95.16129032	50	60.34482759	88.70967742	-51.70658755	-84.2898875
Epochs 60	0.260663509	6.25	6.172839506	90	57.5	60	82	432.376507	-54.68960087	0.361502349	9.87654321	9.230769231	94.02985075	50.61728395	57.8125	86.56716418	-80.27607722	-84.2898875
Epochs 80	0.265402853	6.329113924	6.097560976	92	59.49367089	60.49382716	84	476.6550201	-54.68960087	0.375586867	10.12658228	8.064516129	93.05555556	53.16455696	59.01639344	86.11111111	-79.78152574	-84.2898875
Epochs 100	0.303317547	6.493506494	6.493506494	94.73684211	58.44155844	63.15789474	84.21052632	530.4339797	-54.68960087	0.389671355	9.090909091	8.474576271	92.20779221	51.94805195	58.62068966	84.41558442	-90.34806531	-84.2898875
Epochs 120	0.303317547	6.756756757	6.25	94.73684211	60.81081081	62.02531646	85.96491228	598.9951146	-54.68960087	0.380281687	10.38961039	7.936507937	93.15068493	51.94805195	59.67741935	83.56164384	-89.12880428	-84.2898875
Epochs 140	0.308056861	6.666666667	6.41025641	94.82758621	61.33333333	62.33766234	89.65517241	713.9235644	-54.68960087	0.366197169	10.12658228	7.8125	92.85714286	51.89873418	58.73015873	81.42857143	-87.2985691	-84.2898875
Epochs 160	0.34123224	5.555555556	6.944444444	94.02985075	61.11111111	60.56338028	88.05970149	479.0314027	-54.68960087	0.389671355	9.210526316	8.333333333	92.20779221	51.31578947	57.62711864	81.81818182	-89.54684778	-84.2898875
Epochs 180	0.34123224	5.405405405	5.882352941	92.75362319	60.81081081	64.17910448	88.4057971	562.4605817	-54.68960087	0.384976536	8.860759494	8.620689655	92.10526316	49.36708861	56.14035088	81.57894737	-88.93729988	-84.2898875
Epochs 200	0.350710899	5.194805195	7.575757576	95.58823529	61.03896104	64.61538462	88.23529412	743.4918724	-54.68960087	0.394366205	8.536585366	9.433962264	92.30769231	47.56097561	55.76923077	80.76923077	-87.50887248	-84.2898875
JP Morgan Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.490825683	6.944444444	2.857142857	90.99099099	47.22222222	44.11764706	86.48648649	211.8850495	1576.179166	0.543379009	5.555555556	13.04347826	90.32258065	38.88888889	60.86956522	82.11382114	105.621406	-31.90034799
Epochs 40	0.174311921	10.52631579	3.076923077	90.32258065	49.12280702	43.41085271	83.87096774	946.5404859	1576.179166	0.378995448	8.823529412	11.84210526	90.66666667	50	56.57894737	81.08108108	-39.00122055	-31.90034799
Epochs 60	0.192660555	10	2.307692308	89.47368421	50	41.08527132	84.21052632	823.7904765	1576.179166	0.388127863	8.196721311	12.19512195	92.10526316	50.81967213	57.31707317	84	-64.13373003	-31.90034799
Epochs 80	0.201834857	8.620689655	2.5	90	46.55172414	42.01680672	82.5	1152.585248	1576.179166	0.401826471	9.677419355	10.38961039	92.5	54.83870968	57.14285714	84.81012658	-79.46861482	-31.90034799
Epochs 100	0.224770635	7.547169811	2.542372881	89.36170213	47.16981132	44.44444444	85.10638298	1735.734837	1576.179166	0.438356161	12.06896552	9.589041096	93.18181818	56.89655172	58.90410959	85.05747126	-65.42583455	-31.90034799
Epochs 120	0.220183492	9.803921569	3.225806452	90.69767442	45.09803922	43.90243902	86.04651163	2274.522895	1576.179166	0.374429226	10.95890411	9.459459459	93.05555556	53.42465753	56.75675676	84.50704225	-36.73952279	-31.90034799
Epochs 140	0.229357794	10	3.225806452	93.18181818	44	43.90243902	86.36363636	1969.94579	1576.179166	0.356164396	8.333333333	10.38961039	91.42857143	51.38888889	58.44155844	82.60869565	-52.80130975	-31.90034799
Epochs 160	0.252293587	10.63829787	2.521008403	90.38461538	44.68085106	44.91525424	84.61538462	65.00634546	1576.179166	0.378995448	7.246376812	10.95890411	90.90909091	50.72463768	60.2739726	82.89473684	-57.22538515	-31.90034799
Epochs 180	0.266055048	8.888888889	2.586206897	89.47368421	42.22222222	43.47826087	84.21052632	30.56801614	1576.179166	0.397260278	7.246376812	10.44776119	90.36144578	52.17391304	61.19402985	79.26829268	-52.89237929	-31.90034799
Epochs 200	0.266055048	8	2.702702703	89.47368421	42	42.72727273	84.21052632	11.63253359	1576.179166	0.392694056	7.142857143	10.44776119	90.24390244	51.42857143	62.68656716	80.24691358	-52.89237929	-31.90034799
American Axle (small cap) Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.389908254	5.660377358	3.846153846	90.69767442	39.62264151	57.69230769	83.52941176	-23.85063518	-40.19620025	0.570776284	6.41025641	11.11111111	90.15151515	50	44.44444444	82.44274809	-19.4706546	-32.50977019
Epochs 40	0.220183492	2.247191011	7.058823529	90.90909091	44.94382022	49.41176471	88.37209302	-97.98819011	-40.19620025	0.401826471	14.49275362	9.459459459	93.42105263	62.31884058	58.10810811	85.33333333	6.640078485	-32.50977019
Epochs 60	0.24311927	1.25	6.896551724	90.19607843	45	51.72413793	84	-82.85069398	-40.19620025	0.406392694	14.51612903	8.860759494	93.58974359	62.29508197	59.49367089	85.8974359	163.8664094	-32.50977019
Epochs 80	0.270642191	4.597701149	8.641975309	96	43.67816092	51.85185185	85.71428571	-71.51533667	-40.19620025	0.401826471	11.47540984	8	90.36144578	56.66666667	61.33333333	84.3373494	148.8345066	-32.50977019
Epochs 100	0.252293587	1.25	6.097560976	87.5	42.5	53.65853659	80	-81.65042463	-40.19620025	0.406392694	11.66666667	8.108108108	89.41176471	57.62711864	59.45945946	82.35294118	220.8918691	-32.50977019
Epochs 120	0.266055048	3.703703704	6.172839506	89.28571429	44.44444444	56.79012346	80	28.88424502	-40.19620025	0.383561641	11.86440678	8.43373494	90.90909091	58.62068966	60.24096386	84.41558442	390.6017795	-32.50977019

Epochs 140	0.25688073	3.614457831	6.172839506	88.88888889	44.57831325	55.55555556	79.24528302	-5.69361561	-40.19620025	0.374429226	9.836065574	8.641975309	89.61038961	58.33333333	60.49382716	83.11688312	397.9599096	-32.50977019
Epochs 160	0.298165143	5.128205128	6.41025641	90.32258065	47.43589744	57.69230769	83.60655738	113.3566625	-40.19620025	0.415525109	10.52631579	9.210526316	90.69767442	53.57142857	59.21052632	83.72093023	641.0004231	-32.50977019
Epochs 180	0.302752286	3.896103896	6.578947368	89.23076923	46.75324675	56.57894737	82.8125	139.0600261	-40.19620025	0.401826471	10.16949153	10.12658228	91.35802469	53.44827586	60.75949367	83.95061728	362.7990968	-32.50977019
Epochs 200	0.302752286	5	6.578947368	91.93548387	47.5	57.89473684	85.24590164	99.08551059	-40.19620025	0.388127863	9.677419355	9.090909091	90	54.09836066	59.74025974	85	580.776259	-32.50977019

Table 14-11 Results of 50 Percent More Hold Class LSTM Models , Cyclic Stocks

Kweichow Moutai Co., Ltd. Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.371980667	6.451612903	5.555555556	88.46153846	45.65217391	41.66666667	83.33333333	1425.520513	1666.892281	0.427884609	10	8.333333333	96.25	45	54.16666667	84.81012658	1232.573739	678.7940879
Epochs 40	0.318840593	12.6984127	8.139534884	87.93103448	56.4516129	46.51162791	84.48275862	3351.65284	1666.892281	0.326923072	12.76595745	6.796116505	94.82758621	57.44680851	51.45631068	87.71929825	287.1062834	678.7940879
Epochs 60	0.400966197	20	7.142857143	91.78082192	60	46.98795181	87.67123288	314.2898891	1666.892281	0.350961536	10.52631579	6.862745098	91.17647059	55.26315789	50.98039216	86.56716418	149.6415682	678.7940879
Epochs 80	0.449275374	19.23076923	7.142857143	91.76470588	57.69230769	46.37681159	88.23529412	277.9751745	1666.892281	0.370192319	10.81081081	7.142857143	90.4109589	54.05405405	50	86.11111111	178.6082553	678.7940879
Epochs 100	0.434782594	18.18181818	7.042253521	92.59259259	58.18181818	47.14285714	88.88888889	212.9131298	1666.892281	0.370192319	9.302325581	7.52688172	91.66666667	58.13953488	49.46236559	85.91549296	188.7396348	678.7940879
Epochs 120	0.434782594	17.64705882	8	92.59259259	54.90196078	48.64864865	90.12345679	170.5866799	1666.892281	0.379807681	9.756097561	7.52688172	91.89189189	63.41463415	48.38709677	86.30136986	362.9553012	678.7940879
Epochs 140	0.439613521	16.98113208	8.333333333	92.68292683	54.71698113	50.70422535	90.24390244	126.0118847	1666.892281	0.384615391	9.090909091	7.865168539	92	63.63636364	49.43820225	87.83783784	412.4289582	678.7940879
Epochs 160	0.463768125	16.32653061	8.695652174	92.13483146	55.10204082	51.47058824	87.64044944	129.657775	1666.892281	0.384615391	9.523809524	7.692307692	92	61.9047619	49.45054945	87.83783784	439.2434657	678.7940879
Epochs 180	0.483091801	16	9.375	92.47311828	54	52.38095238	89.24731183	120.5529592	1666.892281	0.394230783	13.33333333	7.865168539	93.24324324	60	48.31460674	89.04109589	456.435627	678.7940879
Epochs 200	0.478260875	15.38461538	9.523809524	92.39130435	53.84615385	53.22580645	90.2173913	531.5405412	1666.892281	0.403846145	13.04347826	8.139534884	93.42105263	60.86956522	48.8372093	89.33333333	396.5881973	678.7940879
Midea Group Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.265700489	5.833333333	12.19512195	93.47826087	49.16666667	53.65853659	77.77777778	1140.597971	1245.275482	0.307692319	4.545454545	0	92.1875	40.36697248	50	84.375	-5.177536807	468.5733088
Epochs 40	0.178743958	8.045977011	6.52173913	85.71428571	55.17241379	54.94505495	71.42857143	17911.53436	1245.275482	0.259615391	9.433962264	4.62962963	93.61702128	54.71698113	54.20560748	82.9787234	40.96449775	468.5733088
Epochs 60	0.33816424	11.29032258	8.43373494	90.32258065	61.29032258	59.75609756	80.64516129	29065.8381	1245.275482	0.317307681	9.756097561	6.481481481	93.22033898	56.09756098	53.7037037	84.48275862	113.9109475	468.5733088
Epochs 80	0.36714977	10.90909091	8.536585366	90	61.81818182	60.49382716	81.42857143	20789.44355	1245.275482	0.331730783	10.25641026	6.542056075	93.5483871	56.41025641	54.20560748	85.24590164	153.4554901	468.5733088
Epochs 100	0.357487917	11.47540984	7.594936709	91.04477612	63.93442623	60.25641026	82.08955224	38582.02141	1245.275482	0.317307681	11.11111111	7.407407407	96.36363636	60	56.48148148	87.03703704	152.4541884	468.5733088
Epochs 120	0.362318844	10	7.894736842	88.73239437	63.33333333	58.66666667	78.87323944	11669.9976	1245.275482	0.317307681	9.090909091	7.476635514	94.73684211	59.09090909	57.00934579	85.71428571	148.7487673	468.5733088
Epochs 140	0.376811594	8.333333333	9.589041096	89.18918919	63.33333333	58.33333333	79.72972973	11073.22625	1245.275482	0.346153855	9.523809524	7.766990291	95.23809524	57.14285714	54.36893204	87.09677419	120.4823746	468.5733088
Epochs 160	0.386473417	9.836065574	8.571428571	89.47368421	65.57377049	59.42028986	80.26315789	18196.09187	1245.275482	0.350961536	11.36363636	7.766990291	98.36065574	59.09090909	56.31067961	91.66666667	65.89362522	468.5733088
Epochs 180	0.38164252	8.620689655	7.142857143	87.34177215	65.51724138	56.52173913	78.48101266	18522.90625	1245.275482	0.355769217	9.090909091	8.080808081	95.38461538	56.81818182	55.55555556	89.0625	67.58470158	468.5733088
Epochs 200	0.376811594	8.771929825	6.944444444	87.17948718	64.9122807	56.33802817	78.20512821	19178.97973	1245.275482	0.379807681	11.36363636	8.24742268	98.50746269	56.81818182	55.67010309	90.90909091	104.164416	468.5733088

Walmart Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.284403682	4.132231405	5.263157895	93.22033898	43.80165289	45.94594595	88.13559322	8275.160395	9380.979094	0.246575341	4.964539007	6.896551724	91.83673469	48.57142857	51.72413793	89.79591837	721.6789959	255.7316817
Epochs 40	0.252293587	6.024096386	8.791208791	95.45454545	53.01204819	48.35164835	81.39534884	2143.949631	9380.979094	0.260273963	6.097560976	8.988764045	91.66666667	50.61728395	50.56179775	79.16666667	211.8433668	255.7316817
Epochs 60	0.270642191	4.545454545	7.142857143	90.74074074	53.03030303	47.95918367	81.13207547	186.9208232	9380.979094	0.342465758	5.797101449	10.71428571	93.93939394	47.05882353	45.23809524	84.84848485	236.5101883	255.7316817
Epochs 80	0.325688064	3.50877193	7.446808511	92.53731343	50.87719298	48.93617021	84.84848485	16.89074767	9380.979094	0.342465758	5.797101449	9.87654321	91.30434783	50	46.91358025	82.60869565	258.9827205	255.7316817
Epochs 100	0.298165143	1.754385965	7.070707071	91.93548387	49.12280702	49.49494949	83.60655738	-26.34231299	9380.979094	0.351598173	4.6875	10.71428571	91.54929577	47.61904762	47.61904762	81.69014085	152.1686548	255.7316817
Epochs 120	0.288990825	1.694915254	7.070707071	91.66666667	52.54237288	50.50505051	83.05084746	4.735128002	9380.979094	0.319634706	4.761904762	9.782608696	90.625	50	47.82608696	81.25	19.57389789	255.7316817
Epochs 140	0.293577969	1.694915254	7.142857143	91.80327869	52.54237288	50	83.33333333	-58.0935729	9380.979094	0.333333343	4.761904762	10.98901099	92.30769231	51.61290323	48.35164835	83.07692308	48.68333197	255.7316817
Epochs 160	0.293577969	3.389830508	7.070707071	91.66666667	52.54237288	47.47474747	83.05084746	-71.2358588	9380.979094	0.328767121	4.6875	10.98901099	92.1875	52.38095238	49.45054945	82.8125	58.96097468	255.7316817
Epochs 180	0.311926603	3.448275862	7.291666667	92.1875	55.17241379	48.95833333	82.53968254	-21.51153436	9380.979094	0.337899536	4.761904762	10.22727273	91.17647059	54.83870968	50	82.35294118	85.06834823	255.7316817
Epochs 200	0.325688064	3.571428571	7.368421053	92.53731343	50	49.47368421	83.33333333	-37.43259869	9380.979094	0.347031951	4.47761194	10.97560976	91.42857143	54.54545455	51.2195122	84.28571429	106.3203743	255.7316817
Fresh Del Monte Produce Inc (small cap)Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.233944952	5.982905983	10.16949153	90.47619048	35.8974359	45.76271186	80.48780488	20.04487908	5.320148705	0.178082198	6.25	6.52173913	93.10344828	49.65034965	56.52173913	89.65517241	135.3291503	-65.97131265
Epochs 40	0.252293587	8.988764045	11.11111111	94.87179487	55.05617978	49.43820225	79.48717949	1982.627698	5.320148705	0.242009133	7.865168539	7.058823529	88.88888889	53.40909091	49.41176471	84.44444444	1462.634649	-65.97131265
Epochs 60	0.362385333	11.42857143	10.84337349	95.38461538	58.57142857	54.21686747	85.9375	279.4708459	5.320148705	0.296803653	10.76923077	7.070707071	92.72727273	54.6875	50.50505051	85.45454545	-73.95020843	-65.97131265
Epochs 80	0.403669715	12.5	9.210526316	93.58974359	60.9375	50	85.71428571	299.8939738	5.320148705	0.333333343	11.47540984	7.368421053	93.65079365	53.33333333	53.68421053	84.12698413	-10.46212858	-65.97131265
Epochs 100	0.408256888	11.94029851	10.81081081	94.80519481	62.68656716	48.64864865	86.84210526	350.2681392	5.320148705	0.333333343	8.474576271	7.446808511	92.42424242	51.72413793	52.12765957	83.33333333	-67.52314382	-65.97131265
Epochs 120	0.380733937	12.6984127	9.411764706	95.71428571	63.49206349	48.23529412	86.95652174	1266.459827	5.320148705	0.324200898	8.771929825	7.142857143	92.1875	51.78571429	50	84.375	-33.40688051	-65.97131265
Epochs 140	0.394495428	12.5	9.87654321	95.89041096	60.9375	48.14814815	87.5	1350.923294	5.320148705	0.305936068	10.16949153	6.060606061	90.16393443	51.72413793	48.48484848	81.96721311	32.77551169	-65.97131265
Epochs 160	0.380733937	12.90322581	9.302325581	95.71428571	62.90322581	46.51162791	88.4057971	1131.011785	5.320148705	0.324200898	10.16949153	6.315789474	90.76923077	50	49.47368421	81.53846154	-82.59648263	-65.97131265
Epochs 180	0.376146793	12.6984127	9.302325581	95.65217391	63.49206349	46.51162791	88.23529412	987.1247827	5.320148705	0.351598173	10.34482759	7.608695652	92.75362319	52.63157895	51.08695652	84.05797101	-69.67447648	-65.97131265
Epochs 200	0.366972476	12.90322581	8.988764045	95.52238806	66.12903226	46.06741573	87.87878788	912.8782468	5.320148705	0.342465758	10.34482759	6.52173913	91.30434783	52.63157895	51.08695652	82.60869565	-50.7675335	-65.97131265

Table 14-12 Results of 50 Percent More Hold Class LSTM Models , Non-Cyclic Stocks

Singapore Airlines Test Set	Non-Recession								Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained
Epochs 20	0.573394477	9.090909091	4	92.91338583	43.93939394	50	80.31496063	-66.1581603	0.465116292	6.976744186	6.666666667	92.92929293	45.34883721	56.66666667	88.7755102	-82.93486552	-78.23835547
Epochs 40	0.311926603	7.954545455	10.66666667	96.36363636	47.72727273	44.59459459	83.63636364	53.07543442	0.279069781	6.666666667	11.11111111	97.87234043	48.57142857	62.90322581	97.87234043	-69.04695379	-78.23835547
Epochs 60	0.325688064	8.43373494	9.459459459	93.44262295	44.57831325	44.59459459	83.33333333	52.04464676	0.260465115	6.666666667	10.60606061	95.45454545	49.52380952	61.53846154	95.45454545	-70.39602191	-78.23835547
Epochs 80	0.325688064	9.210526316	8.641975309	93.44262295	43.42105263	44.44444444	85	54.97360255	0.269767433	7.446808511	9.333333333	95.65217391	52.12765957	58.10810811	95.65217391	-68.26377891	-78.23835547
Epochs 100	0.270642191	9.333333333	7.446808511	91.83673469	45.33333333	45.74468085	85.41666667	54.72909788	0.260465115	6.666666667	8.641975309	97.72727273	48.88888889	55	95.45454545	-83.40555215	-78.23835547
Epochs 120	0.247706428	8.536585366	7.608695652	90.90909091	46.34146341	47.82608696	83.72093023	46.75578986	0.218604654	6.060606061	7.692307692	92.10526316	49.49494949	54.54545455	89.47368421	-78.69880002	-78.23835547
Epochs 140	0.224770635	7.954545455	7.692307692	89.74358974	44.31818182	43.95604396	86.84210526	-13.02456926	0.209302321	5.825242718	7.894736842	91.66666667	48.54368932	52	91.66666667	-86.82540036	-78.23835547
Epochs 160	0.201834857	7.608695652	7.608695652	88.23529412	46.73913043	45.65217391	84.84848485	42.21868456	0.200000003	5.714285714	7.894736842	91.17647059	47.61904762	54.66666667	85.29411765	-86.58190341	-78.23835547
Epochs 180	0.211009175	8.421052632	7.865168539	91.17647059	48.42105263	44.94382022	87.87878788	32.07051963	0.186046511	5.555555556	7.894736842	90.32258065	47.22222222	56	83.87096774	-74.33692053	-78.23835547
Epochs 200	0.211009175	8.333333333	7.954545455	91.17647059	50	45.45454545	90.90909091	46.7320337	0.162790701	5.405405405	6.41025641	92.30769231	44.14414414	54.54545455	84.61538462	-86.01355192	-78.23835547
OCBC Bank Test Set	Non-Recession								Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained
Epochs 20	0.444954127	8.108108108	4.255319149	91.75257732	52.7027027	45.65217391	85.56701031	-60.35483912	0.446511626	5.555555556	9.523809524	87.12871287	48.61111111	50	82	-29.15398962	-24.56291964
Epochs 40	0.206422016	8.602150538	6.593406593	91.17647059	59.13978495	54.44444444	91.17647059	-85.33183685	0.227906972	9.090909091	8.860759494	89.18918919	53.53535354	60.25641026	81.08108108	-23.66952066	-24.56291964
Epochs 60	0.206422016	8.695652174	5.555555556	88.88888889	59.7826087	55.05617978	86.11111111	-88.28016235	0.246511623	9.183673469	10.25641026	92.30769231	54.08163265	62.33766234	87.17948718	-7.793087228	-24.56291964
Epochs 80	0.17889908	9.638554217	4.761904762	86.66666667	59.03614458	51.92307692	83.33333333	-88.34387077	0.260465115	9.090909091	9.523809524	93.02325581	54.54545455	60.24096386	90.69767442	-8.586722697	-24.56291964
Epochs 100	0.155963302	8.333333333	6.25	90.90909091	57.14285714	52.25225225	81.81818182	-89.0488549	0.227906972	8.333333333	7.608695652	89.74358974	50	58.24175824	84.61538462	2.297367018	-24.56291964
Epochs 120	0.146788985	8.045977011	7.079646018	94.44444444	57.47126437	51.78571429	94.44444444	-72.88456614	0.176744193	8.695652174	7.216494845	88.46153846	51.08695652	57.29166667	84.61538462	-3.473070741	-24.56291964
Epochs 140	0.16055046	7.777777778	7.476635514	95.23809524	58.88888889	53.77358491	95.23809524	-44.30541899	0.172093019	9.278350515	7.446808511	87.5	50.51546392	56.98924731	83.33333333	21.74952481	-24.56291964
Epochs 160	0.174311921	7.777777778	7.692307692	95.83333333	58.88888889	53.39805825	95.83333333	75.77910051	0.162790701	9.375	7.142857143	90.47619048	52.08333333	55.67010309	85.71428571	-13.42128271	-24.56291964
Epochs 180	0.174311921	7.692307692	7.766990291	95.83333333	58.24175824	52.94117647	95.83333333	75.77910051	0.158139542	9.278350515	7.142857143	90	51.54639175	56.70103093	85	-10.76524913	-24.56291964
Epochs 200	0.165137619	7.777777778	7.547169811	95.45454545	57.77777778	52.38095238	95.45454545	9.637687584	0.139534891	8.24742268	6.930693069	88.23529412	51.54639175	56	82.35294118	-33.33176919	-24.56291964
CNOOC Limited Test Set	Non-Recession								Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained
Epochs 20	0.440758288	5.063291139	3.125	88	53.16455696	61.29032258	77	-46.5848615	0.455399066	4.761904762	7.692307692	88.34951456	42.85714286	53.84615385	78.43137255	-71.7011977	-84.2898875
Epochs 40	0.175355449	5.882352941	8.235294118	100	55.88235294	64.28571429	87.5	164.9071453	0.347417831	7	10.86956522	92.53731343	45	60	86.56716418	-43.64671423	-84.2898875
Epochs 60	0.19905214	6.18556701	8.235294118	100	58.7628866	64.28571429	89.65517241	240.4912202	0.352112681	8.080808081	10.41666667	93.93939394	48.48484848	61.70212766	86.36363636	-33.72421447	-84.2898875
Epochs 80	0.19905214	6.52173913	7.777777778	100	60.86956522	62.92134831	93.10344828	692.9143131	0.333333343	7.865168539	8.064516129	95.16129032	46.06741573	57.37704918	85.48387097	-81.34322075	-84.2898875

Epochs 100	0.184834123	6.666666667	7.368421053	100	58.88888889	60.63829787	88.46153846	569.64157	0.291079819	7.954545455	8.108108108	96.07843137	47.72727273	60.2739726	88.23529412	-88.43613274	-84.2898875
Epochs 120	0.165876776	6.18556701	6.666666667	95.83333333	58.7628866	57.30337079	87.5	139.1123578	0.230046943	6.12244898	8	92.5	44.89795918	60	82.05128205	-85.56538493	-84.2898875
Epochs 140	0.156398103	5.940594059	6.818181818	95.45454545	59.40594059	58.62068966	90.90909091	194.4686494	0.253521115	6.060606061	8.695652174	93.33333333	44.44444444	57.97101449	84.09090909	-90.03360085	-84.2898875
Epochs 160	0.151658773	5.882352941	6.818181818	95.23809524	57.84313725	57.47126437	90.47619048	250.8011438	0.220657274	6.542056075	8.571428571	94.44444444	45.79439252	58.57142857	85.71428571	-89.30469947	-84.2898875
Epochs 180	0.146919429	5.714285714	6.976744186	95	56.19047619	57.64705882	95	213.0558827	0.206572771	6.481481481	8.333333333	93.93939394	47.22222222	59.72222222	84.375	-81.93215756	-84.2898875
Epochs 200	0.146919429	5.714285714	6.976744186	95	56.19047619	57.64705882	95	213.0558827	0.201877937	6.422018349	8.333333333	93.75	48.62385321	59.72222222	83.87096774	-75.75143948	-84.2898875
JP Morgan Test Set	Non-Recession								Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained
Epochs 20	0.302752286	8.333333333	2.777777778	91.93548387	51.19047619	46.47887324	88.70967742	165.2947056	0.566210032	5.263157895	10	89.39393939	47.36842105	56.66666667	82.44274809	39.95868811	-31.90034799
Epochs 40	0.174311921	9.090909091	4.424778761	92.85714286	48.05194805	46.42857143	85.71428571	4686.754666	0.287671238	8.888888889	12.34567901	93.75	43.82022472	58.02469136	87.5	-11.88709717	-31.90034799
Epochs 60	0.165137619	7.894736842	4.385964912	89.28571429	47.36842105	46.01769912	82.14285714	2085.405246	0.315068483	8.888888889	12.32876712	92.85714286	48.31460674	58.90410959	89.28571429	-16.98307986	-31.90034799
Epochs 80	0.201834857	6.779661017	4.201680672	87.5	45.76271186	46.61016949	85	1233.683443	0.328767121	7.594936709	11.68831169	90.47619048	51.28205128	62.33766234	87.3015873	-31.36431206	-31.90034799
Epochs 100	0.183486238	8.333333333	4.032258065	88.23529412	48.33333333	47.96747967	85.29411765	5510.534969	0.283105016	9.411764706	12.35955056	95.55555556	55.95238095	58.42696629	88.88888889	-28.18480168	-31.90034799
Epochs 120	0.151376143	7.462686567	4.032258065	85.18518519	46.26865672	46.34146341	81.48148148	5021.923864	0.210045666	9.900990099	11.11111111	92.85714286	55	58.88888889	85.71428571	-8.518335187	-31.90034799
Epochs 140	0.137614682	7.575757576	3.875968992	86.95652174	48.48484848	46.875	82.60869565	5988.858001	0.196347028	9.803921569	10.86956522	92	54.45544554	57.60869565	84	0.466937708	-31.90034799
Epochs 160	0.114678897	7.246376812	3.816793893	83.33333333	50.72463768	46.15384615	77.77777778	4541.316954	0.187214613	8.910891089	10.63829787	91.66666667	54	55.31914894	83.33333333	-38.36693415	-31.90034799
Epochs 180	0.119266056	7.894736842	4	88.23529412	50	45.96774194	82.35294118	4172.717889	0.168949768	8.256880734	11.11111111	90	52.77777778	57.77777778	85	-43.86724293	-31.90034799
Epochs 200	0.114678897	8.108108108	3.90625	87.5	50	46.45669291	81.25	3978.027493	0.159817353	8.333333333	10.75268817	88.88888889	52.3364486	54.83870968	83.33333333	-43.72590372	-31.90034799
American Axle (small cap) Test Set	Non-Recession								Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained
Epochs 20	0.403669715	4.444444444	7.692307692	91.01123596	46.66666667	51.28205128	86.36363636	-2.224554132	0.561643839	7.936507937	7.692307692	89.23076923	53.96825397	57.69230769	82.94573643	222.6162541	-32.50977019
Epochs 40	0.220183492	3.96039604	8.974358974	94.87179487	44.55445545	50	89.47368421	-70.48841939	0.269406378	12.94117647	6.818181818	91.30434783	61.9047619	57.95454545	84.7826087	9.506321197	-32.50977019
Epochs 60	0.247706428	4.12371134	10.25641026	97.6744186	44.32989691	52.56410256	90.47619048	-69.52586715	0.251141548	11.76470588	6.666666667	88.63636364	60.71428571	60	81.81818182	145.9811089	-32.50977019
Epochs 80	0.247706428	4.395604396	8.641975309	93.47826087	42.85714286	51.85185185	84.44444444	-65.86451869	0.251141548	12.16216216	7	86.66666667	58.90410959	56	82.22222222	-9.929908754	-32.50977019
Epochs 100	0.224770635	4.395604396	9.090909091	94.87179487	41.75824176	51.72413793	87.17948718	-60.94409309	0.214611873	12.82051282	7.407407407	87.87878788	61.03896104	55.55555556	84.84848485	11.09660549	-32.50977019
Epochs 120	0.197247714	4.301075269	7.692307692	94.11764706	43.01075269	54.44444444	85.29411765	-64.47888909	0.182648405	12.64367816	8.181818182	90.90909091	59.30232558	56.36363636	90.90909091	80.67410845	-32.50977019
Epochs 140	0.197247714	5.319148936	7.692307692	93.93939394	43.61702128	53.33333333	84.84848485	31.4159178	0.173515975	12.35955056	8.181818182	90	55.68181818	55.45454545	85	3.628738761	-32.50977019
Epochs 160	0.201834857	4.347826087	7.692307692	94.28571429	44.56521739	51.64835165	85.29411765	-64.60816006	0.178082198	12.22222222	8.333333333	90.47619048	56.17977528	56.48148148	85.71428571	91.71560832	-32.50977019
Epochs 180	0.197247714	5.263157895	7.692307692	96.875	45.26315789	51.64835165	90.32258065	-64.60816006	0.168949768	11.70212766	8.490566038	89.47368421	53.76344086	57.54716981	84.21052632	618.9829336	-32.50977019
Epochs 200	0.188073397	5.208333333	7.608695652	96.66666667	45.83333333	53.26086957	89.65517241	-56.4955644	0.173515975	10.86956522	8.490566038	90.47619048	54.94505495	56.60377358	85.71428571	440.2382206	-32.50977019

Table 14-13 Results of 50 Percent More Sell Class LSTM Models , Cyclic Stocks

Kweichow Moutai Co., Ltd. Test Set	Non-Recession								Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained
Epochs 20	0.057971016	5.789473684	5.882352941	0	40.74074074	41.17647059	0	1232.507437	0.048076924	4.736842105	0	100	40.21164021	41.17647059	100	494.191514	678.7940879
Epochs 40	0.207729474	9.523809524	9.565217391	89.65517241	59.67741935	48.69565217	89.65517241	2411.679121	0.211538464	8.771929825	5.217391304	91.66666667	50.87719298	48.24561404	83.33333333	630.0147848	678.7940879
Epochs 60	0.212560385	11.53846154	8.870967742	87.09677419	58.82352941	48.38709677	83.87096774	1823.48202	0.182692304	10.20408163	6.766917293	92.30769231	53.06122449	47.72727273	88.46153846	192.2318178	678.7940879
Epochs 80	0.231884062	12	9.016393443	88.57142857	54	46.28099174	85.71428571	1658.523688	0.173076928	9.433962264	6.870229008	91.66666667	52.83018868	48.46153846	87.5	201.1212086	678.7940879
Epochs 100	0.231884062	13.04347826	8.73015873	88.57142857	58.69565217	45.6	85.71428571	2918.584002	0.1875	11.62790698	6.52173913	92.59259259	51.1627907	46.71532847	85.18518519	160.902645	678.7940879
Epochs 120	0.212560385	10.41666667	8.73015873	84.84848485	56.25	45.6	81.81818182	3247.829105	0.15384616	11.62790698	6.164383562	94.73684211	51.1627907	46.89655172	89.47368421	89.9170307	678.7940879
Epochs 140	0.198067635	10	8.661417323	83.33333333	52	45.23809524	80	1641.368988	0.15384616	8.888888889	6.293706294	95	51.11111111	45.77464789	90	27.63740888	678.7940879
Epochs 160	0.198067635	12	8.527131783	85.71428571	56	45.3125	82.14285714	1343.901905	0.134615391	8.695652174	6.164383562	93.75	50	44.82758621	87.5	27.52716195	678.7940879
Epochs 180	0.198067635	12.5	8.396946565	85.71428571	58.33333333	46.15384615	82.14285714	1456.93129	0.139423072	8.695652174	6.206896552	94.11764706	50	43.75	88.23529412	26.26730506	678.7940879
Epochs 200	0.188405797	11.53846154	8.527131783	84.61538462	55.76923077	45.3125	84.61538462	1601.844663	0.125	8	6.25	92.85714286	52	45.45454545	85.71428571	17.39842237	678.7940879
Midea Group Test Set	Non-Recession								Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained
Epochs 20	0.057971016	5.729166667	6.666666667	0	45.83333333	57.14285714	0	2983.438232	0.043269232	3.448275862	0	100	42.57425743	33.33333333	100	521.9495794	468.5733088
Epochs 40	0.193236709	9.302325581	7.608695652	86.20689655	56.97674419	54.94505495	79.31034483	17840.21099	0.149038464	7.042253521	5.217391304	90.90909091	52.11267606	50	77.27272727	60.10509454	468.5733088
Epochs 60	0.251207739	11.66666667	7.619047619	88.0952381	60	55.76923077	80.95238095	95977.94229	0.177884609	9.803921569	5.384615385	92.59259259	60.78431373	49.6124031	77.77777778	17.35337695	468.5733088
Epochs 80	0.222222224	12.12121212	8.181818182	93.5483871	57.57575758	56.88073394	90.32258065	68132.53926	0.177884609	10.20408163	5.303030303	92.59259259	67.34693878	50.38167939	85.18518519	188.3739585	468.5733088
Epochs 100	0.222222224	13.79310345	6.896551724	90.90909091	60.34482759	55.65217391	84.84848485	173028.2404	0.173076928	9.302325581	5.072463768	92.59259259	62.79069767	48.90510949	85.18518519	117.5489934	468.5733088
Epochs 120	0.212560385	13.33333333	6.896551724	90.32258065	61.66666667	56.52173913	83.87096774	165149.9621	0.149038464	6.52173913	5.072463768	87.5	60.86956522	48.90510949	79.16666667	83.89084408	468.5733088
Epochs 140	0.222222224	12.6984127	7.207207207	90.90909091	60.31746032	57.27272727	84.84848485	128405.3237	0.15384616	6.666666667	5.714285714	91.30434783	62.22222222	48.92086331	82.60869565	80.67506216	468.5733088
Epochs 160	0.207729474	12.12121212	7.96460177	92.85714286	60.60606061	58.03571429	89.28571429	163772.6883	0.149038464	4.545454545	5.714285714	87.5	61.36363636	48.20143885	79.16666667	74.55493578	468.5733088
Epochs 180	0.202898547	12.30769231	7.826086957	92.59259259	64.61538462	58.77192982	88.88888889	215079.5389	0.144230768	4.444444444	5.714285714	86.95652174	60	48.92086331	78.26086957	55.56897315	468.5733088
Epochs 200	0.193236709	11.76470588	7.894736842	92	61.76470588	58.40707965	88	105886.7124	0.144230768	4.651162791	5.633802817	86.95652174	60.46511628	48.93617021	82.60869565	66.14229016	468.5733088
Walmart Test Set	Non-Recession								Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained
Epochs 20	0.041284405	4.102564103	4.347826087	0	43.29896907	65.2173913	0	10777.70958	0.045662101	3.448275862	7.142857143	100	44.55445545	42.85714286	100	279.028785	255.7316817
Epochs 40	0.17889908	6.25	6.363636364	96.42857143	53.75	50	96.2962963	1182.280005	0.205479458	5.494505495	8.695652174	88.88888889	47.77777778	47.82608696	83.33333333	275.5004912	255.7316817

Epochs 60	0.17889908	4.444444444	5.035971223	88.23529412	46.66666667	43.88489209	87.87878788	87.07204676	0.232876718	7.692307692	7.207207207	88.37209302	54.6875	45.04504505	81.39534884	393.0258313	255.7316817
Epochs 80	0.133027524	2.173913043	5.333333333	90.90909091	54.34782609	45.33333333	85.71428571	36.07441011	0.228310496	7.936507937	8.474576271	92.10526316	54.83870968	44.91525424	86.84210526	299.3141885	255.7316817
Epochs 100	0.128440365	2.564102564	5.063291139	90.47619048	52.63157895	43.03797468	85.71428571	-21.28564673	0.205479458	7.142857143	7.751937984	91.17647059	50.90909091	43.41085271	88.23529412	262.467418	255.7316817
Epochs 120	0.110091746	2.5	4.968944099	88.23529412	53.84615385	42.23602484	82.35294118	-21.28564673	0.168949768	7.272727273	7.246376812	88.46153846	50.90909091	44.52554745	84.61538462	79.32903753	255.7316817
Epochs 140	0.105504587	2.5	4.90797546	93.33333333	53.84615385	42.33128834	86.66666667	-52.54681801	0.159817353	6.666666667	7.407407407	87.5	49.15254237	42.22222222	83.33333333	18.54927601	255.7316817
Epochs 160	0.096330278	2.5	4.848484848	92.30769231	53.84615385	42.42424242	84.61538462	-47.37647984	0.155251145	7.142857143	7.142857143	86.95652174	51.78571429	41.72661871	82.60869565	39.9293317	255.7316817
Epochs 180	0.096330278	2.43902439	4.87804878	92.30769231	52.5	42.07317073	84.61538462	-11.5144087	0.155251145	6.896551724	7.246376812	86.95652174	50.87719298	42.02898551	82.60869565	40.05040322	255.7316817
Epochs 200	0.087155961	2.222222222	4.968944099	83.33333333	52.27272727	42.85714286	75	-30.0322436	0.150684938	6.557377049	7.352941176	86.36363636	51.66666667	42.64705882	86.36363636	39.71885797	255.7316817
Fresh Del Monte Produce Inc (small cap)Test Set	Non-Recession								Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained
Epochs 20	0.064220183	4.812834225	7.142857143	100	35.48387097	53.57142857	100	5.581858964	0.050228309	4.807692308	9.090909091	0	45.41062802	63.63636364	0	-43.35373488	-65.97131265
Epochs 40	0.25688073	10.34482759	8.888888889	95.12195122	47.12643678	49.43820225	85.36585366	89.67840781	0.205479458	7.692307692	8.333333333	93.75	53.33333333	50	87.5	182.6841825	-65.97131265
Epochs 60	0.24311927	7.692307692	9.009009009	90.47619048	50.76923077	46.36363636	85.71428571	155.1483735	0.255707771	10.34482759	7.627118644	95.34883721	56.14035088	48.30508475	86.04651163	-6.359954353	-65.97131265
Epochs 80	0.188073397	10	8.064516129	100	52.85714286	47.15447154	95.83333333	396.1025377	0.232876718	10	6.722689076	92.5	54.23728814	48.7394958	82.5	-69.34048312	-65.97131265
Epochs 100	0.155963302	8.955223881	7.518796992	100	52.23880597	46.21212121	94.44444444	371.0563554	0.196347028	5.882352941	6.015037594	91.42857143	56	46.61654135	80	-62.99942613	-65.97131265
Epochs 120	0.16055046	10.29411765	7.633587786	94.73684211	52.94117647	45.38461538	89.47368421	617.9109315	0.187214613	9.090909091	5.970149254	93.33333333	51.85185185	46.26865672	83.33333333	-92.53088302	-65.97131265
Epochs 140	0.146788985	10.29411765	7.462686567	93.75	52.94117647	44.36090226	87.5	528.8676951	0.19178082	7.01754386	6.201550388	90.90909091	51.78571429	46.51162791	81.81818182	-93.35244615	-65.97131265
Epochs 160	0.146788985	10.44776119	7.407407407	93.75	53.73134328	44.02985075	87.5	528.8676951	0.182648405	7.142857143	6.060606061	90.32258065	52.72727273	46.96969697	83.87096774	-92.88975222	-65.97131265
Epochs 180	0.146788985	9.523809524	7.246376812	94.11764706	52.38095238	44.52554745	88.23529412	163.7307817	0.178082198	7.142857143	6.015037594	90	52.72727273	47.36842105	83.33333333	-82.36401296	-65.97131265
Epochs 200	0.137614682	9.375	7.194244604	93.33333333	51.5625	44.92753623	86.66666667	213.6565932	0.155251145	6.557377049	5.303030303	88.46153846	46.66666667	46.21212121	80.76923077	-85.78837767	-65.97131265

Table 14-14 Results of 50 Percent More Sell Class LSTM Models , Non-Cyclic Stocks

Singapore Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Test accuracy
Epochs 20	0.417431206	7.692307692	6.12244898	90.10989011	50	40.81632653	83.33333333	-86.08890538	-64.15459983	0.372093022	7.070707071	12.76595745	97.10144928	47.47474747	57.44680851	88.23529412	-88.95126668	-78.23835547
Epochs 40	0.288990825	7.317073171	9.638554217	92.45283019	50	45.78313253	88.46153846	64.53292427	-64.15459983	0.362790704	9.090909091	9.677419355	98.46153846	52.27272727	59.01639344	89.23076923	-79.29174445	-78.23835547
Epochs 60	0.270642191	6.976744186	8.641975309	90.19607843	46.51162791	44.44444444	86	106.0056344	-64.15459983	0.367441863	9.302325581	9.523809524	98.48484848	51.1627907	59.67741935	92.42424242	-60.33041902	-78.23835547
Epochs 80	0.233944952	5.813953488	8.045977011	86.66666667	50	42.52873563	84.09090909	-27.91438508	-64.15459983	0.325581402	7.865168539	8.823529412	98.27586207	50.56179775	58.20895522	93.10344828	-55.44651869	-78.23835547
Epochs 100	0.247706428	6.172839506	7.865168539	87.5	46.91358025	42.69662921	80.85106383	-88.28322182	-64.15459983	0.344186038	8.860759494	8.219178082	96.82539683	51.89873418	54.16666667	92.06349206	-22.56122916	-78.23835547
Epochs 120	0.233944952	6.493506494	7.291666667	86.66666667	44.15584416	41.66666667	79.54545455	-86.25300163	-64.15459983	0.344186038	9.090909091	8	96.82539683	49.35064935	54.05405405	90.47619048	-4.992689077	-78.23835547

Epochs 140	0.25688073	6.849315068	9.090909091	91.30434783	46.57534247	42.42424242	82.22222222	-82.06889417	-64.15459983	0.353488386	9.210526316	8.108108108	96.92307692	50	52.05479452	90.76923077	-62.71479182	-78.23835547
Epochs 160	0.229357794	6.329113924	9.090909091	90	49.36708861	41.41414141	82.05128205	-83.60796064	-64.15459983	0.344186038	8.860759494	8.219178082	96.82539683	48.10126582	52.77777778	90.47619048	-80.59561342	-78.23835547
Epochs 180	0.229357794	6.41025641	9	90	50	44	82.05128205	-77.93086978	-64.15459983	0.353488386	9.210526316	9.333333333	96.875	47.36842105	51.35135135	89.0625	-75.05222722	-78.23835547
Epochs 200	0.270642191	6.849315068	7.608695652	88.67924528	45.20547945	43.47826087	80.76923077	-85.60673947	-64.15459983	0.372093022	9.459459459	9.589041096	97.05882353	47.2972973	51.38888889	89.70588235	-79.9890035	-78.23835547
OCBC Bank Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Test accuracy
Epochs 20	0.266055048	7.446808511	6.849315068	90.19607843	57.44680851	51.38888889	86.2745098	-84.52873137	-55.90202866	0.330232561	6.896551724	8.620689655	85.71428571	52.87356322	62.06896552	78.26086957	-22.27451236	-24.56291964
Epochs 40	0.128440365	8.080808081	5.882352941	82.35294118	56.56565657	52.47524752	82.35294118	-85.76215124	-55.90202866	0.251162797	8.163265306	9.589041096	88.63636364	54.08163265	62.5	84.09090909	-38.803645	-24.56291964
Epochs 60	0.142201841	8	5.208333333	81.81818182	56	51.57894737	72.72727273	-83.27062766	-55.90202866	0.223255813	7.070707071	9.090909091	87.17948718	52.52525253	59.21052632	82.05128205	-33.52188193	-24.56291964
Epochs 80	0.146788985	8.695652174	5.714285714	85.71428571	58.69565217	53.84615385	76.19047619	-56.91062134	-55.90202866	0.241860464	8.163265306	9.333333333	88.0952381	54.08163265	59.45945946	85.71428571	-18.19019601	-24.56291964
Epochs 100	0.188073397	9.523809524	6.603773585	92.85714286	58.33333333	54.28571429	78.57142857	-48.99111709	-55.90202866	0.274418592	8.235294118	8.974358974	86.53846154	52.94117647	57.14285714	80.76923077	-16.55494921	-24.56291964
Epochs 120	0.183486238	7.5	6.481481481	90	58.75	53.27102804	76.66666667	-53.84090693	-55.90202866	0.255813956	9.302325581	8.43373494	86.95652174	54.65116279	56.09756098	80.43478261	-19.74598691	-24.56291964
Epochs 140	0.17889908	7.5	6.422018349	89.65517241	58.75	51.85185185	75.86206897	-85.50203369	-55.90202866	0.232558146	9.090909091	8.139534884	85.36585366	55.68181818	55.29411765	80.48780488	-32.30939771	-24.56291964
Epochs 160	0.17889908	7.407407407	6.542056075	86.66666667	59.25925926	51.88679245	73.33333333	-78.01096856	-55.90202866	0.255813956	9.411764706	8.333333333	86.95652174	55.29411765	54.21686747	80.43478261	-38.38938448	-24.56291964
Epochs 180	0.197247714	7.792207792	6.481481481	90.90909091	57.14285714	51.40186916	78.78787879	-81.03455822	-55.90202866	0.246511623	7.407407407	7.954545455	86.95652174	55.55555556	54.02298851	82.60869565	-32.7321261	-24.56291964
Epochs 200	0.215596333	7.894736842	6.730769231	89.47368421	57.89473684	51.45631068	78.94736842	-76.66692187	-55.90202866	0.279069781	7.407407407	8.641975309	88.67924528	54.32098765	52.5	83.01886792	-29.3944645	-24.56291964
CNOOC Limited Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Test accuracy
Epochs 20	0.336492896	6.741573034	10.9375	100	57.30337079	63.49206349	87.93103448	456.3630963	-54.68960087	0.42723006	8.791208791	12.82051282	93.97590361	47.25274725	63.15789474	87.95180723	-51.62629958	-84.2898875
Epochs 40	0.218009472	6.25	8.536585366	100	53.125	59.25925926	87.87878788	467.0548294	-54.68960087	0.338028163	9.090909091	9.523809524	93.5483871	53.40909091	66.12903226	90.32258065	-78.35476984	-84.2898875
Epochs 60	0.227488145	6.25	8.75	100	54.16666667	62.02531646	88.57142857	810.0874378	-54.68960087	0.323943675	8.163265306	10.71428571	93.22033898	51.02040816	65.45454545	86.44067797	-71.93562139	-84.2898875
Epochs 80	0.218009472	6.451612903	7.142857143	100	52.68817204	60.24096386	85.29411765	637.9537762	-54.68960087	0.342723012	9.195402299	9.523809524	93.65079365	48.27586207	61.29032258	85.71428571	-86.53136279	-84.2898875
Epochs 100	0.265402853	5.952380952	8.641975309	95.65217391	50	61.25	84.7826087	-43.82552417	-54.68960087	0.3568075	10.12658228	8.695652174	95.38461538	49.36708861	56.52173913	85.9375	-85.39066172	-84.2898875
Epochs 120	0.274881512	6.097560976	8.536585366	97.87234043	50	58.02469136	87.23404255	-42.858017	-54.68960087	0.347417831	10.12658228	9.722222222	95.16129032	49.36708861	58.33333333	85.24590164	-74.80514791	-84.2898875
Epochs 140	0.270142168	6.493506494	8.045977011	95.74468085	49.35064935	59.30232558	85.10638298	631.1796876	-54.68960087	0.300469488	9.638554217	8.974358974	94.23076923	49.39759036	57.14285714	82.69230769	-66.58715645	-84.2898875
Epochs 160	0.279620856	6.578947368	8.139534884	95.91836735	50	57.64705882	83.67346939	-46.14199117	-54.68960087	0.319248825	8.536585366	9.589041096	93.10344828	48.7804878	58.33333333	82.75862069	-73.6892871	-84.2898875
Epochs 180	0.274881512	6.578947368	8.045977011	95.83333333	51.31578947	59.30232558	85.41666667	-32.56419193	-54.68960087	0.305164307	8.641975309	10.12658228	94.33962264	49.38271605	60.25641026	84.90566038	-69.13954985	-84.2898875
Epochs 200	0.303317547	6.666666667	8.536585366	96.2962963	50.66666667	58.02469136	87.03703704	-44.3926616	-54.68960087	0.305164307	8.641975309	9.090909091	92.72727273	50.61728395	56.57894737	85.45454545	-82.15442933	-84.2898875
JP Morgan Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Test accuracy

Epochs 20	0.270642191	8.974358974	4.597701149	90.56603774	50	50	83.01886792	8069.97849	1576.179166	0.465753436	9.459459459	12.24489796	92.70833333	43.83561644	59.18367347	86.45833333	-17.28459232	-31.90034799
Epochs 40	0.220183492	11.26760563	4.587155963	92.10526316	52.11267606	48.14814815	89.47368421	2169.285846	1576.179166	0.333333343	8.333333333	13.33333333	93.33333333	48.19277108	64	85	-21.22934801	-31.90034799
Epochs 60	0.201834857	10.29411765	3.539823009	89.18918919	48.52941176	47.32142857	83.78378378	1909.41524	1576.179166	0.328767121	9.638554217	13.75	94.64285714	50	62.5	87.5	0.944923498	-31.90034799
Epochs 80	0.183486238	10.60606061	3.389830508	85.29411765	51.51515152	50.42735043	79.41176471	1844.708051	1576.179166	0.305936068	9.756097561	12.64367816	96	53.08641975	62.06896552	88	4.115510613	-31.90034799
Epochs 100	0.201834857	10.34482759	3.305785124	87.17948718	51.72413793	48.33333333	84.61538462	1854.104024	1576.179166	0.319634706	10.52631579	12.35955056	94.44444444	53.94736842	59.09090909	85.18518519	10.56639377	-31.90034799
Epochs 120	0.197247714	11.53846154	3.125	86.84210526	53.84615385	47.24409449	84.21052632	2480.567578	1576.179166	0.310502291	11.39240506	12.08791209	97.95918367	54.43037975	57.77777778	89.79591837	19.4089823	-31.90034799
Epochs 140	0.174311921	8.928571429	3.100775194	87.87878788	51.78571429	46.09375	84.84848485	2054.925761	1576.179166	0.301369876	10.66666667	11.57894737	95.91836735	54.66666667	57.44680851	89.79591837	0.321242931	-31.90034799
Epochs 160	0.201834857	9.433962264	3.2	87.5	49.05660377	47.58064516	85	654.578965	1576.179166	0.292237431	10.12658228	11.82795699	95.74468085	51.89873418	56.52173913	89.36170213	5.969892848	-31.90034799
Epochs 180	0.206422016	11.32075472	3.937007874	89.47368421	52.83018868	48.41269841	86.84210526	2743.055354	1576.179166	0.296803653	10.81081081	11.34020619	95.83333333	54.05405405	56.25	89.58333333	22.07308921	-31.90034799
Epochs 200	0.215596333	12.5	3.305785124	87.80487805	50	49.16666667	85.36585366	731.399751	1576.179166	0.310502291	10.52631579	11.11111111	94.33962264	53.94736842	55.05617978	88.67924528	-29.9335569	-31.90034799
American Axle (small cap) Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Test accuracy
Epochs 20	0.330275238	5.263157895	9.090909091	91.17647059	47.36842105	58.18181818	86.56716418	234.5945284	-40.19620025	0.433789968	10.12658228	12.96296296	93.02325581	56.41025641	59.25925926	87.20930233	26.66151701	-32.50977019
Epochs 40	0.206422016	4.12371134	8.333333333	91.89189189	46.39175258	52.38095238	88.88888889	28.48312951	-40.19620025	0.292237431	10.71428571	8.536585366	90.56603774	55.42168675	59.75609756	86.79245283	139.6530543	-32.50977019
Epochs 60	0.224770635	3.157894737	8.641975309	92.85714286	48.42105263	51.85185185	87.80487805	-21.32330054	-40.19620025	0.292237431	10.46511628	9.756097561	92.15686275	54.11764706	59.75609756	90.19607843	141.7501556	-32.50977019
Epochs 80	0.229357794	4.347826087	8.235294118	95.12195122	50	50.58823529	90	20.0150603	-40.19620025	0.246575341	10.46511628	8.695652174	90.24390244	56.47058824	57.60869565	87.80487805	0.794829789	-32.50977019
Epochs 100	0.233944952	4.761904762	7.692307692	93.02325581	52.38095238	52.74725275	85.71428571	-64.00826212	-40.19620025	0.237442926	12	7.692307692	87.5	56.75675676	53.84615385	85	-37.24726566	-32.50977019
Epochs 120	0.238532111	4.651162791	7.954545455	93.18181818	51.1627907	52.27272727	86.04651163	-63.4409071	-40.19620025	0.255707771	13.04347826	7.547169811	88.63636364	57.35294118	54.71698113	86.36363636	-8.236492186	-32.50977019
Epochs 140	0.220183492	4.651162791	7.608695652	92.5	48.8372093	51.08695652	82.05128205	-75.09993845	-40.19620025	0.251141548	11.94029851	7.476635514	86.66666667	56.06060606	54.20560748	84.44444444	-13.92539963	-32.50977019
Epochs 160	0.233944952	5.882352941	7.608695652	95.12195122	50.58823529	53.26086957	90	-95.19925455	-40.19620025	0.237442926	11.26760563	7.476635514	87.80487805	57.14285714	55.14018692	85.36585366	-8.841076693	-32.50977019
Epochs 180	0.247706428	6.25	7.446808511	95.45454545	50	52.12765957	88.37209302	-80.21009835	-40.19620025	0.237442926	11.42857143	7.407407407	87.80487805	57.97101449	56.48148148	85.36585366	57.00356619	-32.50977019
Epochs 200	0.284403682	7.792207792	7.865168539	94.23076923	53.24675325	53.93258427	88.23529412	264.0852014	-40.19620025	0.273972601	13.04347826	7.766990291	91.4893617	58.82352941	55.33980583	89.36170213	237.815483	-32.50977019

Table 14-15 Results of Balanced Class Ratio LSTM Models , Cyclic Stocks

Kweichow Moutai Co., Ltd. Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Test accuracy
Epochs 20	0.420289844	8.536585366	2.777777778	88.76404494	46.91358025	41.66666667	85.39325843	2765.377267	1666.892281	0.5	7.692307692	7.692307692	92.30769231	44.61538462	51.28205128	85.4368932	880.8059914	678.7940879
Epochs 40	0.236714974	13.51351351	8.163265306	88.57142857	56.75675676	49.48453608	85.71428571	1083.983036	1666.892281	0.1875	9.523809524	6.837606838	89.28571429	53.96825397	48.27586207	85.71428571	225.0232846	678.7940879
Epochs 60	0.236714974	13.51351351	8.163265306	88.57142857	58.10810811	49.48453608	82.85714286	1104.105381	1666.892281	0.197115391	9.375	6.956521739	93.10344828	53.125	46.08695652	89.28571429	201.1793021	678.7940879
Epochs 80	0.251207739	13.15789474	8.510638298	91.89189189	55.26315789	50.53763441	86.48648649	1227.211556	1666.892281	0.1875	9.090909091	6.956521739	92.59259259	54.54545455	48.69565217	88.46153846	254.0983027	678.7940879

Epochs 100	0.265700489	13.15789474	8.791208791	92.5	55.26315789	48.88888889	87.5	1227.211556	1666.892281	0.225961536	8.823529412	7.619047619	94.28571429	54.41176471	48.57142857	85.29411765	205.7258367	678.7940879
Epochs 120	0.280193239	12.98701299	9.195402299	93.02325581	55.84415584	48.8372093	88.37209302	1261.599336	1666.892281	0.278846145	9.230769231	7.368421053	93.75	55.38461538	50.52631579	82.9787234	390.7011426	678.7940879
Epochs 140	0.289855063	12.98701299	9.411764706	93.33333333	54.54545455	50	91.11111111	1172.667427	1666.892281	0.293269217	9.375	7.692307692	90.56603774	54.6875	50.54945055	80.76923077	432.394779	678.7940879
Epochs 160	0.280193239	12.98701299	9.195402299	93.02325581	54.54545455	50	90.69767442	1208.565482	1666.892281	0.269230783	9.523809524	7.142857143	91.4893617	53.96825397	51.02040816	80.43478261	409.4341786	678.7940879
Epochs 180	0.275362313	12.98701299	9.090909091	92.85714286	53.24675325	49.42528736	90.47619048	743.9013688	1666.892281	0.274038464	10.34482759	6.930693069	89.79591837	55.17241379	51.48514851	77.08333333	274.3537546	678.7940879
Epochs 200	0.280193239	12.98701299	9.195402299	93.02325581	54.54545455	50	90.69767442	928.5201448	1666.892281	0.278846145	10	7.142857143	90	55	52.04081633	79.59183673	101.4343662	678.7940879
Midea Group Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Test accuracy
Epochs 20	0.342995167	6.382978723	10.41666667	92.30769231	52.12765957	61.70212766	84.61538462	12074.74957	1245.275482	0.475961536	7.228915663	3.448275862	95.83333333	39.75903614	42.85714286	89.58333333	189.5925559	468.5733088
Epochs 40	0.256038636	8	7.142857143	85.41666667	58.66666667	59.03614458	75	59184.98991	1245.275482	0.25	10.71428571	5.454545455	95.23809524	60.71428571	50.4587156	88.0952381	122.2748497	468.5733088
Epochs 60	0.251207739	9.722222222	6.666666667	86.66666667	58.33333333	58.42696629	75.55555556	125733.5344	1245.275482	0.230769232	10.90909091	6.779661017	97.14285714	63.63636364	54.23728814	91.17647059	135.9583286	468.5733088
Epochs 80	0.246376812	8.450704225	6.666666667	84.7826087	57.74647887	58.42696629	76.08695652	40370.22687	1245.275482	0.201923072	8.474576271	6.722689076	96.66666667	62.71186441	52.54237288	93.33333333	116.7627944	468.5733088
Epochs 100	0.285024166	8.450704225	8.333333333	88.46153846	57.74647887	57.8313253	76.92307692	11377.10697	1245.275482	0.21634616	9.090909091	5.93220339	94.28571429	63.63636364	53.84615385	88.57142857	142.6076208	468.5733088
Epochs 120	0.314009666	8.219178082	9.210526316	89.65517241	56.16438356	62.66666667	75.86206897	10764.39335	1245.275482	0.22115384	8.333333333	5.454545455	92.10526316	63.33333333	53.21100917	86.84210526	93.08867964	468.5733088
Epochs 140	0.333333343	9.589041096	9.459459459	91.66666667	54.79452055	61.64383562	78.33333333	14956.51107	1245.275482	0.230769232	8.620689655	4.587155963	92.68292683	62.06896552	51.85185185	85.36585366	41.00550644	468.5733088
Epochs 160	0.333333343	10.14492754	8.974358974	91.66666667	57.97101449	62.33766234	78.33333333	18545.21457	1245.275482	0.211538464	8.474576271	4.464285714	91.89189189	62.71186441	52.25225225	83.78378378	61.93887662	468.5733088
Epochs 180	0.342995167	8.955223881	9.210526316	90.625	56.71641791	61.33333333	78.125	15193.61272	1245.275482	0.230769232	8.771929825	4.545454545	92.68292683	61.40350877	53.21100917	85.36585366	60.06237504	468.5733088
Epochs 200	0.347826093	10.29411765	8.108108108	90.76923077	57.35294118	60.2739726	78.46153846	10272.72449	1245.275482	0.235576928	8.196721311	4.761904762	92.85714286	62.29508197	51.92307692	85.71428571	45.99384362	468.5733088
Walmart Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Test accuracy
Epochs 20	0.339449555	6.25	7.272727273	95.52238806	51.04166667	50	86.56716418	3071.981805	9380.979094	0.305936068	5.982905983	11.62790698	93.22033898	49.13793103	53.48837209	88.13559322	19079.55951	255.7316817
Epochs 40	0.16055046	5.063291139	7.079646018	88.46153846	50.63291139	48.67256637	80	183.9255958	9380.979094	0.260273963	6.896551724	12.08791209	97.56097561	51.1627907	50.54945055	85.36585366	94.44275367	255.7316817
Epochs 60	0.174311921	7.792207792	6.896551724	96	51.94805195	49.13793103	91.66666667	347.1446383	9380.979094	0.255707771	7.228915663	10.63829787	95.23809524	52.43902439	48.93617021	83.33333333	109.8719287	255.7316817
Epochs 80	0.142201841	7.792207792	6.451612903	100	50.64935065	46.77419355	100	150.6775938	9380.979094	0.200913236	6.097560976	9.523809524	90.625	54.32098765	46.66666667	81.25	60.97637947	255.7316817
Epochs 100	0.146788985	7.692307692	6.557377049	100	51.28205128	46.72131148	100	172.995988	9380.979094	0.19178082	6.024096386	8.653846154	87.5	53.65853659	44.23076923	81.25	73.5183324	255.7316817
Epochs 120	0.16055046	6.41025641	6.837606838	95.65217391	51.28205128	46.15384615	95.45454545	-15.19313725	9380.979094	0.200913236	6.097560976	8.737864078	88.23529412	55.55555556	45.63106796	82.35294118	165.0220483	255.7316817
Epochs 140	0.174311921	5.333333333	6.956521739	92.85714286	52	47.82608696	92.59259259	-11.10067992	9380.979094	0.205479458	5	8.823529412	86.48648649	54.43037975	46.07843137	78.37837838	144.0675564	255.7316817
Epochs 160	0.174311921	5.333333333	6.956521739	92.85714286	49.33333333	46.95652174	92.59259259	-35.25855265	9380.979094	0.214611873	5.194805195	9.433962264	91.66666667	55.26315789	47.16981132	80.55555556	146.4973164	255.7316817
Epochs 180	0.17889908	6.666666667	6.896551724	96.2962963	50.66666667	47.4137931	96.15384615	76.59043433	9380.979094	0.246575341	5.333333333	9.900990099	93.02325581	54.05405405	48.51485149	83.72093023	153.0825508	255.7316817
Epochs 200	0.192660555	6.666666667	7.079646018	96.66666667	49.33333333	48.67256637	96.55172414	71.57244126	9380.979094	0.246575341	5.479452055	9.708737864	93.02325581	52.77777778	45.63106796	81.39534884	43.25534244	255.7316817

Fresh Del Monte Produce Inc (small cap)Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Test accuracy
Epochs 20	0.270642191	7.627118644	11.32075472	93.61702128	41.52542373	50.94339623	86.95652174	83.45923928	5.320148705	0.260273963	6.086956522	7.407407407	92	54.38596491	55.55555556	86	2828.715533	-65.97131265
Epochs 40	0.229357794	9.782608696	9.782608696	94.11764706	52.17391304	48.35164835	79.41176471	616.6823982	5.320148705	0.232876718	7.865168539	7.777777778	92.5	53.40909091	53.33333333	80	-27.23783736	-65.97131265
Epochs 60	0.211009175	9.89010989	8.333333333	93.5483871	53.84615385	48.42105263	80.64516129	789.0191005	5.320148705	0.196347028	9.411764706	8.411214953	96.2962963	52.38095238	48.59813084	88.88888889	-24.01744817	-65.97131265
Epochs 80	0.197247714	9.782608696	7.291666667	90	55.43478261	45.26315789	80	797.0706535	5.320148705	0.196347028	9.411764706	8.411214953	96.2962963	55.95238095	49.53271028	88.88888889	-71.64713702	-65.97131265
Epochs 100	0.211009175	10.11235955	7.291666667	90.90909091	55.05617978	44.21052632	81.81818182	561.1070791	5.320148705	0.200913236	10	7.339449541	93.33333333	59.49367089	48.62385321	90	138.201969	-65.97131265
Epochs 120	0.25688073	10.46511628	7.865168539	93.02325581	53.48837209	44.31818182	81.39534884	443.5496861	5.320148705	0.205479458	8.860759494	7.476635514	90.90909091	58.97435897	49.53271028	87.87878788	-46.65754685	-65.97131265
Epochs 140	0.275229365	10.97560976	7.865168539	93.61702128	54.87804878	44.31818182	82.9787234	423.8014977	5.320148705	0.214611873	8.860759494	7.619047619	91.42857143	61.53846154	50.47619048	88.57142857	54.48068081	-65.97131265
Epochs 160	0.252293587	10	8.24742268	95.12195122	55	43.75	80.48780488	137.9420901	5.320148705	0.210045666	10	7.476635514	93.75	59.49367089	49.53271028	90.625	-63.16329413	-65.97131265
Epochs 180	0.270642191	10.66666667	7.291666667	93.61702128	54.66666667	41.05263158	82.9787234	28.23190188	5.320148705	0.210045666	10	6.603773585	93.93939394	59.49367089	50.94339623	90.90909091	-9.626848226	-65.97131265
Epochs 200	0.261467904	9.210526316	7.291666667	93.47826087	52.63157895	40	84.7826087	23.93130024	5.320148705	0.223744288	9.756097561	6.930693069	94.44444444	56.79012346	49.5049505	91.66666667	-27.78800224	-65.97131265

Table 14-16 Results of Balanced Class Ratio LSTM Models , Non-Cyclic Stocks

15 Appendix 10

CNN Accumulation Phase Model									
Accumulation Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.266129047	6.25	0	91.93548387	40.97222222	46.34146341	80.64516129	-14.91285089	82.55793694
Epochs 40	0.056451611	6.41025641	3.296703297	100	42.30769231	48.88888889	0	-6.081377084	82.55793694
Epochs 60	0.116935484	8.653846154	3.90625	93.75	50	48.81889764	87.5	79.14546161	82.55793694
Epochs 80	0.169354841	8.490566038	2.752293578	90.90909091	47.16981132	48.14814815	81.81818182	-1.050145103	82.55793694
Epochs 100	0.366935492	10.66666667	2.352941176	92.04545455	50.66666667	47.05882353	81.6091954	-23.64857159	82.55793694
Epochs 120	0.52822578	11.11111111	3.571428571	94.57364341	53.96825397	50	84.375	42.51357207	82.55793694
Epochs 140	0.665322602	10.25641026	2.777777778	92.48554913	48.71794872	52.77777778	83.72093023	62.37036966	82.55793694
Epochs 160	0.794354856	14.28571429	0	92.38095238	47.61904762	64.70588235	83.73205742	64.84424701	82.55793694
Epochs 180	0.806451619	17.64705882	5	92.89099526	52.94117647	63.15789474	83.88625592	125.6178864	82.55793694
Epochs 200	0.810483873	15.38461538	0	92.12962963	53.84615385	55.55555556	83.33333333	135.9248528	82.55793694
Mark-up Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.337899536	5.309734513	8.571428571	91.54929577	46.42857143	48.57142857	87.32394366	583.5533282	255.7316817
Epochs 40	0.073059358	4.761904762	7.777777778	100	50.4	47.77777778	100	217.8730164	255.7316817
Epochs 60	0.155251145	6.024096386	7.079646018	91.30434783	51.80722892	44.24778761	90.90909091	107.6792577	255.7316817
Epochs 80	0.214611873	7.446808511	6.741573034	94.44444444	54.83870968	47.19101124	88.88888889	5233.759568	255.7316817
Epochs 100	0.442922384	9.523809524	7.575757576	95.55555556	52.38095238	43.93939394	86.51685393	6167.487181	255.7316817
Epochs 120	0.529680371	7.407407407	8	93.91304348	51.85185185	46	86.84210526	578.2689019	255.7316817
Epochs 140	0.652968049	6.060606061	10.52631579	92.56756757	54.54545455	47.36842105	86.39455782	868.1470986	255.7316817
Epochs 160	0.808219194	6.25	13.33333333	92.55319149	50	46.66666667	86.63101604	200.741135	255.7316817
Epochs 180	0.794520557	0	11.11111111	91.97860963	50	44.44444444	85.48387097	226.2909381	255.7316817
Epochs 200	0.808219194	0	10.52631579	92.10526316	50	42.10526316	85.71428571	216.0413868	255.7316817
Distribution Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.297872335	6.923076923	10.11235955	93.38842975	43.07692308	44.94382022	86.66666667	752.9990859	-35.06524102
Epochs 40	0.078723401	7.01754386	7.182320442	100	45.96491228	50.55555556	100	29085.44186	-35.06524102
Epochs 60	0.131914899	7.881773399	6.86695279	88.23529412	53.20197044	51.72413793	79.41176471	21105.43106	-35.06524102
Epochs 80	0.193617016	8.095238095	7.142857143	93.75	52.38095238	53.33333333	87.5	24016.52412	-35.06524102
Epochs 100	0.353191495	8.333333333	5.921052632	88.88888889	52.56410256	52.31788079	82.09876543	15392.13149	-35.06524102

Epochs 120	0.453191489	7.692307692	7.407407407	88.58447489	54.54545455	54.20560748	82.19178082	124031.988	-35.06524102
Epochs 140	0.612765968	9.278350515	8.450704225	90.39735099	55.67010309	51.42857143	84.43708609	2713.521832	-35.06524102
Epochs 160	0.785106361	14.58333333	12.90322581	91.5601023	62.5	63.33333333	86.18925831	3547.43958	-35.06524102
Epochs 180	0.804255307	15.15151515	12.12121212	91.33663366	54.54545455	59.375	85.64356436	2143.780009	-35.06524102
Epochs 200	0.814893603	18.51851852	13.88888889	91.64619165	59.25925926	65.71428571	86.24078624	1897.69042	-35.06524102
Mark-down Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.248201445	7.428571429	6.52173913	92.98245614	41.37931034	50	91.22807018	-95.99431839	-97.60414084
Epochs 40	0.079136692	7.936507937	6.818181818	100	40.42553191	45.45454545	100	-96.92665571	-97.60414084
Epochs 60	0.143884897	9.285714286	8.403361345	89.47368421	45.32374101	47.05882353	84.21052632	-93.17361115	-97.60414084
Epochs 80	0.208633095	9.655172414	9.375	94.59459459	47.22222222	53.125	91.89189189	-93.51052319	-97.60414084
Epochs 100	0.453237414	10.63829787	11.76470588	93.10344828	47.87234043	60.29411765	89.56521739	-94.34572782	-97.60414084
Epochs 120	0.507194221	8.045977011	10.41666667	90.20979021	47.12643678	54.16666667	86.61971831	-96.07730429	-97.60414084
Epochs 140	0.651079118	7.692307692	12.12121212	89.6373057	42.30769231	63.63636364	85.41666667	-93.87367278	-97.60414084
Epochs 160	0.766187072	7.142857143	6.666666667	89.36170213	35.71428571	80	83.76068376	-93.30260052	-97.60414084
Epochs 180	0.794964015	10	6.666666667	89.71193416	35	86.66666667	83.47107438	-91.98635527	-97.60414084
Epochs 200	0.809352517	13.33333333	15	90.53497942	26.66666667	80	83.88429752	-91.59204105	-97.60414084
Bull Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.451923072	8.333333333	8.510638298	94.38202247	48.61111111	53.19148936	88.63636364	2105.688796	678.7940879
Epochs 40	0.072115384	8.695652174	5.217391304	100	43.47826087	47.36842105	100	663.4045587	678.7940879
Epochs 60	0.105769232	12	6	87.5	60	46.30872483	87.5	137.7292856	678.7940879
Epochs 80	0.201923072	11.66666667	6.779661017	90	55	52.13675214	83.33333333	202.8182481	678.7940879
Epochs 100	0.360576928	12.5	7.920792079	92.53731343	62.5	53	86.56716418	70.505534	678.7940879
Epochs 120	0.528846145	12.82051282	9.677419355	92.52336449	61.53846154	55.73770492	87.85046729	155.4735352	678.7940879
Epochs 140	0.625	10.34482759	9.090909091	91.11111111	62.06896552	58.13953488	85.18518519	120.0646657	678.7940879
Epochs 160	0.793269217	14.28571429	11.11111111	91.47727273	57.14285714	58.82352941	85.22727273	163.7489551	678.7940879
Epochs 180	0.788461566	15.38461538	5.555555556	90.96045198	61.53846154	47.05882353	84.74576271	253.7622044	678.7940879
Epochs 200	0.8125	28.57142857	5.263157895	91.20879121	71.42857143	44.44444444	85.16483516	96.3818605	678.7940879
Bear Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.285714298	6.962025316	6.4	90.90909091	46.03174603	41.6	85.71428571	-92.37877485	-91.88465799
Epochs 40	0.082352944	7.692307692	7.883817427	100	47.14285714	49.79253112	66.66666667	-24.32583079	-91.88465799
Epochs 60	0.144537821	8.438818565	6.818181818	90	51.89873418	48.85993485	78	49.28138795	-91.88465799

Epochs 80	0.17478992	7.450980392	6.201550388	84.14634146	50.19607843	49.41634241	76.82926829	-51.5695468	-91.88465799
Epochs 100	0.363025218	7.73480663	5.583756345	88.01843318	51.93370166	52.55102041	79.7235023	21.08483749	-91.88465799
Epochs 120	0.492436975	7.926829268	7.03125	89.43894389	49.3902439	57.48031496	81.84818482	64.3023066	-91.88465799
Epochs 140	0.635294139	8.256880734	9.302325581	90.25	53.21100917	60	83	-65.03962686	-91.88465799
Epochs 160	0.763025224	8.928571429	6.666666667	90.28340081	48.21428571	60	83.77281947	-91.69321174	-91.88465799
Epochs 180	0.784873962	10	6.818181818	90.01956947	50	56.81818182	83.33333333	-93.87071605	-91.88465799
Epochs 200	0.793277323	12.5	9.803921569	90.4296875	46.875	58.82352941	83.75733855	-77.98970974	-91.88465799
Full Cycle test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.291166842	6.470588235	6.369426752	89.6	45.38310413	35.66878981	85.6	-59.48769791	-96.00669322
Epochs 40	0.089422025	7.220216606	8.045977011	93.33333333	45.56962025	47.98850575	86.66666667	-97.4304351	-96.00669322
Epochs 60	0.148309708	7.751937984	7.929515419	92.10526316	48.70466321	47.13656388	78.94736842	-52.77182639	-96.00669322
Epochs 80	0.166848421	6.872037915	7.25388601	88.0733945	47.26840855	48.1865285	78.89908257	-78.88843918	-96.00669322
Epochs 100	0.341330439	6.312292359	7.348242812	89.43894389	46.66666667	49.52076677	80.85808581	-86.68127236	-96.00669322
Epochs 120	0.484187573	6.614785992	8.962264151	91.07142857	46.875	54.24528302	83.70535714	-64.68255539	-96.00669322
Epochs 140	0.627044737	6.547619048	9.523809524	91.36212625	47.90419162	58.50340136	84.2192691	-85.73453451	-96.00669322
Epochs 160	0.777535439	8.235294118	11.76470588	91.36125654	52.94117647	66.17647059	85.05897772	-60.12099755	-96.00669322
Epochs 180	0.786259532	7.792207792	12.12121212	91.34366925	49.35064935	65.15151515	84.86416559	-66.61062447	-96.00669322
Epochs 200	0.799345672	9.090909091	12.98701299	91.46496815	58.18181818	67.53246753	84.82142857	-76.29653509	-96.00669322

Table 15-1 Accumulation Phase Data Trained CNN Model Results

CNN Mark Up Phase Model									
Accumulation Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.072580643	4.564315353	0	100	39.58333333	0	100	82.55793694	82.55793694
Epochs 40	0.052419353	6.504065041	3.225806452	100	43.08943089	46.34146341	100	-24.50610871	82.55793694
Epochs 60	0.080645159	8.333333333	3.603603604	100	46.96969697	50	80	9.105065133	82.55793694
Epochs 80	0.262096763	7.777777778	3.03030303	93.22033898	47.77777778	52.52525253	84.48275862	-45.74552869	82.55793694
Epochs 100	0.32661289	10.81081081	3.921568627	95.83333333	51.35135135	49.01960784	88.73239437	-34.63629689	82.55793694
Epochs 120	0.495967746	7.042253521	1.960784314	92.85714286	50.70422535	45.09803922	84.8	-55.9232377	82.55793694
Epochs 140	0.572580636	6	2.040816327	92.61744966	52	46.93877551	85.13513514	-52.71271697	82.55793694
Epochs 160	0.741935492	6.666666667	0	92.85714286	56.66666667	50	83.58974359	0.374518924	82.55793694
Epochs 180	0.745967746	5.555555556	0	92.89340102	52.77777778	33.33333333	84.69387755	-26.35632086	82.55793694
Epochs 200	0.790322602	7.142857143	0	93.26923077	57.14285714	33.33333333	84.05797101	-12.65404357	82.55793694
Mark-up Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.031963471	3.196347032	0	0	44.95412844	0	0	255.7316817	255.7316817

Epochs 40	0.073059358	5.217391304	8.737864078	100	52.63157895	49.51456311	100	468.9461985	255.7316817
Epochs 60	0.091324203	5.511811024	9.302325581	83.33333333	53.17460317	50	66.66666667	274.8442852	255.7316817
Epochs 80	0.319634706	8.045977011	9.589041096	94.91525424	54.02298851	53.42465753	93.10344828	17289.73321	255.7316817
Epochs 100	0.365296811	8.333333333	10.38961039	94.28571429	51.38888889	51.94805195	91.30434783	13785.00586	255.7316817
Epochs 120	0.506849289	7.352941176	13.63636364	93.45794393	48.52941176	54.54545455	89.62264151	437.596336	255.7316817
Epochs 140	0.589041114	9.433962264	10.81081081	93.02325581	47.16981132	59.45945946	88.28125	517.2727411	255.7316817
Epochs 160	0.785388112	11.11111111	25	93.75	55.55555556	50	87.42857143	466.1663233	255.7316817
Epochs 180	0.812785387	12	30	93.47826087	56	50	86.8852459	340.4935409	255.7316817
Epochs 200	0.840182662	14.28571429	33.33333333	93.22916667	52.38095238	66.66666667	86.91099476	205.9863892	255.7316817
Distribution Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.061702128	5.161290323	0	100	38.36206897	0	100	-35.06524102	-35.06524102
Epochs 40	0.074468084	6.85483871	7.272727273	100	43.9516129	46.11872146	100	1925.453468	-35.06524102
Epochs 60	0.110638298	8.270676692	6.593406593	81.81818182	46.61654135	51.38121547	81.81818182	105152.8014	-35.06524102
Epochs 80	0.280851066	10.3626943	7.142857143	91.74311927	49.74093264	54.49101796	87.1559633	4194.727662	-35.06524102
Epochs 100	0.302127659	9.036144578	7.344632768	89.76377953	50	55.68181818	82.67716535	619.0843101	-35.06524102
Epochs 120	0.489361703	8.843537415	4.705882353	89.49579832	50.34013605	56.47058824	82.70042194	532.8366205	-35.06524102
Epochs 140	0.553191483	6.194690265	5.194805195	88.92857143	46.90265487	53.24675325	82.07885305	328.1813225	-35.06524102
Epochs 160	0.697872341	8.219178082	4.651162791	90.39548023	45.20547945	60.46511628	84.41926346	-3.974674962	-35.06524102
Epochs 180	0.73829788	7.462686567	4	90.21164021	46.26865672	64	84.61538462	80.21842227	-35.06524102
Epochs 200	0.79361701	8.510638298	10.52631579	90.84158416	48.93617021	68.42105263	85.11166253	201.9815604	-35.06524102
Mark-down Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.064748198	5.797101449	0	100	37.81818182	0	100	-97.60414084	-97.60414084
Epochs 40	0.08273381	7.692307692	7.476635514	100	41.07142857	43.92523364	100	-96.02531593	-97.60414084
Epochs 60	0.118705034	8.196721311	10.58823529	90	42.30769231	48.23529412	90	-96.29828483	-97.60414084
Epochs 80	0.266187042	9.285714286	10	91.37931034	42.14285714	55	82.45614035	-93.88187176	-97.60414084
Epochs 100	0.377697855	9.821428571	10.95890411	92.47311828	44.64285714	54.16666667	84.94623656	-95.43365496	-97.60414084
Epochs 120	0.50359714	9.900990099	3.125	88.96551724	43.56435644	53.125	81.94444444	-96.91403204	-97.60414084
Epochs 140	0.643884897	14.0625	3.703703704	90.37433155	46.875	53.84615385	83.42245989	-96.11994065	-97.60414084
Epochs 160	0.802158296	16.66666667	12.5	90.41666667	50	62.5	84.10041841	-94.65664653	-97.60414084
Epochs 180	0.812949657	19.35483871	16.66666667	90.87136929	48.38709677	66.66666667	85	-96.66491442	-97.60414084
Epochs 200	0.83453238	6.25	0	89.18918919	43.75	33.33333333	82.94573643	-96.60561469	-97.60414084
Bull Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.081730768	4.5	0	100	41.20603015	0	87.5	678.7940879	678.7940879
Epochs 40	0.07692308	8.823529412	5.109489051	100	48.52941176	48.52941176	100	1825.890929	678.7940879
Epochs 60	0.11057692	8.860759494	5.882352941	90	45.56962025	47.45762712	80	360.4938707	678.7940879
Epochs 80	0.3125	10.63829787	5.882352941	91.52542373	59.57446809	49.5049505	84.74576271	589.3768556	678.7940879
Epochs 100	0.341346145	13.88888889	4.761904762	91.04477612	58.33333333	46.15384615	82.08955224	1429.761251	678.7940879
Epochs 120	0.5625	16.21621622	3.773584906	92.37288136	56.75675676	58.49056604	85.47008547	2081.09141	678.7940879

Epochs 140	0.600961566	4.761904762	4	89.05109489	61.9047619	56	82.35294118	1619.82125	678.7940879
Epochs 160	0.75	0	0	89.14285714	81.81818182	54.54545455	83.90804598	187.6611216	678.7940879
Epochs 180	0.783653855	0	0	89.56043956	70	50	83.97790055	160.8450955	678.7940879
Epochs 200	0.817307711	0	0	89.94708995	85.71428571	33.33333333	84.57446809	26.26808059	678.7940879
Bear Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.072268911	5.488850772	0	91.66666667	41.0652921	0	91.66666667	-91.88465799	-91.88465799
Epochs 40	0.073949583	7.236842105	6.920415225	100	47.52475248	46.36678201	100	-70.80299355	-91.88465799
Epochs 60	0.095798321	7.207207207	7.786885246	77.77777778	47.59036145	50.81967213	66.66666667	-24.50348225	-91.88465799
Epochs 80	0.26386556	8.298755187	6.944444444	88.4057971	51.66666667	53.24074074	80.43478261	85.56849988	-91.88465799
Epochs 100	0.304201692	7.729468599	6.912442396	87.71929825	52.91262136	51.61290323	80.70175439	70.60133325	-91.88465799
Epochs 120	0.48067227	8.379888268	7.317073171	89.41979522	53.93258427	52.84552846	82.93515358	176.6136135	-91.88465799
Epochs 140	0.549579859	7.299270073	7.894736842	89.53488372	54.01459854	57.01754386	82.79883382	110.6466902	-91.88465799
Epochs 160	0.724369764	8.219178082	8.928571429	90.12875536	57.53424658	62.5	82.79569892	159.3181509	-91.88465799
Epochs 180	0.757983208	6.944444444	6.896551724	89.87854251	52.77777778	65.51724138	82.75862069	-10.20728601	-91.88465799
Epochs 200	0.79831934	6.25	8.333333333	89.86615679	52.08333333	66.66666667	82.95019157	181.3101393	-91.88465799
Full Cycle test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.062159214	5.077262693	0	100	40.33149171	0	90.90909091	-96.00669322	-96.00669322
Epochs 40	0.077426389	7.584830339	6.829268293	83.33333333	46.6	43.65853659	83.33333333	-63.14478965	-96.00669322
Epochs 60	0.115594327	7.663551402	8.454810496	92.30769231	47.19101124	48.68804665	89.74358974	-80.01716549	-96.00669322
Epochs 80	0.262813509	8.905852417	9.009009009	92.14659686	50.76530612	52.55255255	85.86387435	-60.24184373	-96.00669322
Epochs 100	0.322791725	8.588957055	8.562691131	90.90909091	51.38461538	52.29357798	81.81818182	-62.65073686	-96.00669322
Epochs 120	0.48200655	10.16393443	5.882352941	90.7239819	53.61842105	54.11764706	83.03167421	-81.17161269	-96.00669322
Epochs 140	0.596510351	10.1010101	6.040268456	90.87719298	56.34517766	55.03355705	84.03508772	-79.87572052	-96.00669322
Epochs 160	0.757906199	13.7254902	5.555555556	91.11709287	59.40594059	61.11111111	84.65679677	-77.82241307	-96.00669322
Epochs 180	0.779716492	13.46153846	4.444444444	91.015625	60.19417476	64.44444444	84.89583333	-88.50704459	-96.00669322
Epochs 200	0.805888772	13.33333333	6.976744186	90.86357947	58.10810811	72.09302326	84.73091364	-75.27640189	-96.00669322

Table 15-2 Mark-Up Phase Data Trained CNN Model Results

CNN Distribution Phase Model									
Accumulation Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.483870953	6.25	0	93.33333333	43.75	0	84.03361345	169.9322282	82.55793694
Epochs 40	0.274193555	7.446808511	4.395604396	90.47619048	47.87234043	47.77777778	79.36507937	72.6560005	82.55793694
Epochs 60	0.149193555	8.474576271	3.773584906	95.83333333	44.91525424	47.61904762	87.5	-1.906872013	82.55793694
Epochs 80	0.173387095	8.988764045	3.937007874	93.75	44.94382022	49.20634921	81.25	-60.02529771	82.55793694
Epochs 100	0.358870953	8.641975309	5.813953488	95.0617284	48.14814815	48.8372093	82.5	-43.24413013	82.55793694
Epochs 120	0.5	8.333333333	4.761904762	92.8	53.33333333	50.79365079	80.64516129	-43.2791246	82.55793694

Epochs 140	0.620967746	7.407407407	8.108108108	93.63057325	51.85185185	56.75675676	83.33333333	-13.86050027	82.55793694
Epochs 160	0.693548381	10	3.571428571	92.77777778	60	46.42857143	83.24022346	14.18805104	82.55793694
Epochs 180	0.786290348	12.5	0	92.75362319	66.66666667	52.94117647	83.98058252	91.55042561	82.55793694
Epochs 200	0.79838711	15.78947368	0	92.41706161	68.42105263	50	83.33333333	132.1316665	82.55793694
Mark-up Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.474885851	6.140350877	0	92.38095238	49.55752212	0	85.71428571	312.1058098	255.7316817
Epochs 40	0.292237431	6.666666667	8.219178082	92.85714286	50.56179775	49.31506849	80.35714286	344.9947693	255.7316817
Epochs 60	0.141552508	5.882352941	9.523809524	100	51.69491525	51.19047619	87.5	9980.721896	255.7316817
Epochs 80	0.219178081	6.896551724	8.24742268	97.14285714	51.1627907	49.48453608	80	682.1082457	255.7316817
Epochs 100	0.424657524	5.405405405	13.1147541	96.42857143	50	57.37704918	87.95180723	820.272116	255.7316817
Epochs 120	0.552511394	7.407407407	8.888888889	94.16666667	48.14814815	60	87.39495798	2256.407275	255.7316817
Epochs 140	0.648401797	6.12244898	12	93.79310345	53.06122449	60	87.5	290.5666812	255.7316817
Epochs 160	0.721461177	8.333333333	14.28571429	93.82716049	58.33333333	66.66666667	86.95652174	1282.730201	255.7316817
Epochs 180	0.794520557	10.71428571	20	93.37016575	57.14285714	100	87.22222222	1462.632439	255.7316817
Epochs 200	0.826484025	10.52631579	25	93.61702128	73.68421053	91.66666667	87.1657754	837.5216736	255.7316817
Distribution Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.425531924	6.015037594	0	90.19607843	39.47368421	0	83.74384236	-36.13179868	-35.06524102
Epochs 40	0.285106391	7.692307692	7.142857143	89.25619835	50.76923077	48.36601307	80.16528926	1338.192667	-35.06524102
Epochs 60	0.129787236	7.335907336	6.857142857	83.33333333	47.87644788	50.57471264	77.77777778	19669.08129	-35.06524102
Epochs 80	0.246808514	9.550561798	7.389162562	94.38202247	53.37078652	50.4950495	84.26966292	31159.98498	-35.06524102
Epochs 100	0.391489357	9.554140127	6.617647059	90.39548023	57.32484076	53.33333333	82.48587571	21978.76901	-35.06524102
Epochs 120	0.548936188	9.482758621	7.954545455	90.22556391	56.89655172	59.77011494	83.45864662	36327.9347	-35.06524102
Epochs 140	0.646808505	9	6.382978723	90.40247678	58	59.57446809	83.85093168	9354.927672	-35.06524102
Epochs 160	0.702127635	8.43373494	8.823529412	90.65155807	56.62650602	55.88235294	84.09090909	1436.127614	-35.06524102
Epochs 180	0.785106361	8.771929825	8.333333333	90.52369077	59.64912281	50	84.25	4.898501041	-35.06524102
Epochs 200	0.814893603	11.9047619	7.692307692	90.84337349	54.76190476	53.84615385	84.5410628	136.8440862	-35.06524102
Mark-down Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.352517992	6.629834254	0	88.65979381	40	0	83.50515464	-97.60414084	-97.60414084
Epochs 40	0.284172654	8.02919708	10.66666667	90.90909091	41.17647059	50.66666667	87.87878788	-95.83098511	-97.60414084
Epochs 60	0.161870509	8.588957055	8.988764045	88.46153846	41.35802469	48.31460674	88.46153846	-96.50398223	-97.60414084
Epochs 80	0.241007194	9.016393443	7.843137255	88.88888889	43.44262295	49.01960784	84.90566038	-95.77715444	-97.60414084

Epochs 100	0.399280578	9.174311927	9.523809524	89.62264151	46.78899083	53.96825397	83.80952381	-95.09076124	-97.60414084
Epochs 120	0.525179863	10.12658228	8.163265306	89.33333333	45.56962025	53.06122449	82.55033557	-93.33799833	-97.60414084
Epochs 140	0.600719452	10	3.448275862	88.82681564	44.28571429	48.27586207	82.02247191	-95.1772125	-97.60414084
Epochs 160	0.66546762	10.71428571	4.347826087	89.44723618	41.07142857	47.82608696	82.82828283	-95.73178099	-97.60414084
Epochs 180	0.74820143	8.571428571	0	89.13043478	40	46.15384615	82.53275109	-96.81653813	-97.60414084
Epochs 200	0.776978433	12.5	0	89.12133891	54.16666667	46.66666667	82.77310924	-97.03702494	-97.60414084
Bull Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.591346145	7.407407407	0	92.12598425	41.97530864	0	84.92063492	883.8418182	678.7940879
Epochs 40	0.288461536	9.615384615	6.060606061	85.96491228	53.84615385	47.95918367	80.70175439	1284.929238	678.7940879
Epochs 60	0.129807696	8	6.779661017	86.66666667	49.33333333	47.86324786	73.33333333	233.2086662	678.7940879
Epochs 80	0.206730768	10.63829787	6.349206349	85.71428571	57.44680851	49.6	77.14285714	378.8710425	678.7940879
Epochs 100	0.418269217	14.70588235	6.593406593	91.56626506	67.64705882	52.22222222	83.13253012	303.7693371	678.7940879
Epochs 120	0.572115362	16	9.230769231	92.37288136	72	58.46153846	84.61538462	761.2409474	678.7940879
Epochs 140	0.711538434	13.63636364	9.677419355	91.61290323	68.18181818	54.83870968	85.06493506	5608.613397	678.7940879
Epochs 160	0.778846145	18.75	13.04347826	92.30769231	68.75	52.17391304	86.30952381	4630.660257	678.7940879
Epochs 180	0.8125	25	6.25	91.66666667	66.66666667	50	85.47486034	2152.518391	678.7940879
Epochs 200	0.826923072	28.57142857	6.25	91.35135135	71.42857143	50	85.32608696	2264.466535	678.7940879
Bear Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.463865548	6.752411576	0	89.78873239	47.74193548	0	82.04225352	-91.88465799	-91.88465799
Epochs 40	0.326050431	9.322033898	10.44776119	95.56962025	51.27118644	52.23880597	91.08280255	348.4044994	-91.88465799
Epochs 60	0.152941182	7.951070336	9.049773756	95.74468085	48.92966361	51.13122172	84.7826087	3.103277444	-91.88465799
Epochs 80	0.258823544	10.64814815	7.984790875	94.82758621	53.7037037	49.61832061	87.93103448	151.0540238	-91.88465799
Epochs 100	0.408403367	10.41666667	9.89010989	92.760181	53.64583333	54.3956044	85.90909091	39.84824637	-91.88465799
Epochs 120	0.529411793	8.843537415	8.8	90.09287926	52.38095238	55.2	83.54037267	-6.558848395	-91.88465799
Epochs 140	0.613445401	9.420289855	9.459459459	90.07832898	53.62318841	67.56756757	82.98429319	-7.933260518	-91.88465799
Epochs 160	0.689075649	8.163265306	10.52631579	90	54.08163265	70.1754386	82.68792711	103.6764744	-91.88465799
Epochs 180	0.763025224	9.589041096	12.5	90.40816327	54.79452055	71.875	83.43558282	85.32008151	-91.88465799
Epochs 200	0.788235307	11.53846154	11.11111111	90.53254438	57.69230769	72.22222222	83.59683794	115.947261	-91.88465799
Full Cycle test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.448200643	5.930470348	0	89.25233645	45.28688525	0	84.57943925	-93.84963168	-96.00669322
Epochs 40	0.282442749	8.465608466	7.594936709	91.03139013	49.86737401	47.15189873	85.20179372	-92.98901149	-96.00669322

Epochs 60	0.153762266	7.459677419	7.76119403	90.69767442	47.67676768	48.35820896	82.55813953	-97.08518206	-96.00669322
Epochs 80	0.229007632	8.645533141	7.389162562	91.46341463	51.73410405	48.76847291	80.48780488	-91.54475141	-96.00669322
Epochs 100	0.420937836	10.2739726	8.61423221	93.01675978	53.60824742	49.81273408	85.19553073	-90.18132756	-96.00669322
Epochs 120	0.565976024	11.11111111	7.471264368	91.46110057	55.81395349	54.02298851	84.62998102	-89.71736419	-96.00669322
Epochs 140	0.651035964	10.47120419	8.653846154	91.31832797	54.21052632	59.61538462	84.40514469	-71.7382557	-96.00669322
Epochs 160	0.696837485	9.459459459	5.952380952	90.51094891	55.10204082	57.14285714	84.08759124	-82.78061224	-96.00669322
Epochs 180	0.763358772	10.18518519	0	90.30144168	56.07476636	47.82608696	83.87942333	-93.16967757	-96.00669322
Epochs 200	0.796074152	11.26760563	0	90.36295369	52.85714286	51.06382979	83.97997497	-94.48236275	-96.00669322

Table 15-3 Distribution Phase Data Trained CNN Model Results

CNN Mark Down Phase Model									
Accumulation Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.052419353	7.092198582	2.803738318	0	41.84397163	47.16981132	0	62.43173965	82.55793694
Epochs 40	0.052419353	5.164319249	5.714285714	0	40.09433962	45.71428571	0	-20.9156333	82.55793694
Epochs 60	0.076612905	8.064516129	4.958677686	100	46.77419355	49.16666667	100	-28.18265574	82.55793694
Epochs 80	0.108870968	8	3.669724771	92.85714286	48	49.07407407	78.57142857	-28.01591576	82.55793694
Epochs 100	0.169354841	7.874015748	2.272727273	90.90909091	47.24409449	46.59090909	84.375	-39.7862662	82.55793694
Epochs 120	0.310483873	9.090909091	2.898550725	94.20289855	51.81818182	47.82608696	88.23529412	3.473152175	82.55793694
Epochs 140	0.395161301	9.677419355	3.278688525	92.55319149	51.61290323	47.54098361	82.79569892	25.79143375	82.55793694
Epochs 160	0.467741936	10.12658228	3.636363636	92.98245614	51.89873418	47.27272727	84.95575221	-11.34632487	82.55793694
Epochs 180	0.536290348	9.523809524	2.083333333	91.97080292	53.96825397	45.83333333	82.35294118	245.687496	82.55793694
Epochs 200	0.616935492	7.547169811	2.941176471	91.92546584	52.83018868	52.94117647	83.125	227.4785362	82.55793694
Mark-up Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.063926943	4.347826087	9.87654321	0	49.6350365	46.91358025	0	44.02914263	255.7316817
Epochs 40	0.04109589	3.571428571	8.695652174	0	46.66666667	52.17391304	0	190.7705621	255.7316817
Epochs 60	0.073059358	4.918032787	9.473684211	50	51.23966942	47.36842105	50	48.44676831	255.7316817
Epochs 80	0.118721463	5.084745763	10.11235955	91.66666667	50.42735043	48.31460674	91.66666667	43.53617581	255.7316817
Epochs 100	0.19178082	5.042016807	10.60606061	85.29411765	49.15254237	51.51515152	73.52941176	12.23914923	255.7316817
Epochs 120	0.337899536	6.25	7.843137255	88.88888889	50	49.01960784	78.87323944	32.71058141	255.7316817
Epochs 140	0.433789968	7.317073171	9.090909091	91.39784946	52.43902439	50	81.52173913	114.8193959	255.7316817
Epochs 160	0.488584489	5.555555556	5.882352941	89.38053097	50	52.94117647	81.25	67.02621098	255.7316817
Epochs 180	0.593607306	7.547169811	6.666666667	91.17647059	52.83018868	56.66666667	82.96296296	60.61411269	255.7316817
Epochs 200	0.666666687	8.888888889	5	91.55844156	51.11111111	55	83.66013072	103.8564233	255.7316817

Distribution Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.068085104	6.785714286	6.842105263	0	41.78571429	48.14814815	0	641.3490959	-35.06524102
Epochs 40	0.057446808	5.623471883	6.557377049	0	39.60880196	45	0	14693.94766	-35.06524102
Epochs 60	0.078723401	7.364341085	7.655502392	66.66666667	46.51162791	51.44230769	66.66666667	1047.572719	-35.06524102
Epochs 80	0.110638298	7.96812749	7.035175879	90	47.41035857	54.04040404	75	1026.382088	-35.06524102
Epochs 100	0.187234044	8.097165992	8.024691358	90.16393443	48.98785425	54.03726708	78.68852459	1547.810235	-35.06524102
Epochs 120	0.295744687	8.597285068	7.751937984	91.66666667	50.67873303	58.59375	82.5	1097.136265	-35.06524102
Epochs 140	0.363829792	6.52173913	7.01754386	87.79069767	52.17391304	58.40707965	78.48837209	1151.481463	-35.06524102
Epochs 160	0.457446814	7.643312102	7.52688172	89.09090909	54.77707006	60.86956522	80.90909091	1884.224655	-35.06524102
Epochs 180	0.540425539	8.130081301	8.43373494	89.77272727	55.28455285	63.41463415	81.43939394	1884.495163	-35.06524102
Epochs 200	0.627659559	8.490566038	9.433962264	90.35369775	57.54716981	63.46153846	83.27974277	490.6026049	-35.06524102
Mark-down Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.06115108	6.593406593	5.208333333	0	39.22651934	41.66666667	0	-96.43376842	-97.60414084
Epochs 40	0.068345323	6.374501992	11.11111111	0	38.4	51.85185185	0	-97.77795634	-97.60414084
Epochs 60	0.086330935	8.383233533	9.009009009	0	43.97590361	51.35135135	0	-87.00443295	-97.60414084
Epochs 80	0.115107916	8.125	9.345794393	81.81818182	44.02515723	51.40186916	81.81818182	-87.59537396	-97.60414084
Epochs 100	0.194244608	7.741935484	11.36363636	91.42857143	45.16129032	53.40909091	85.29411765	-87.23515904	-97.60414084
Epochs 120	0.287769794	8.510638298	11.26760563	90.90909091	44.68085106	57.14285714	87.87878788	-59.9034383	-97.60414084
Epochs 140	0.363309354	8.73015873	8.928571429	88.54166667	44.44444444	54.54545455	85.41666667	-94.43925503	-97.60414084
Epochs 160	0.438848913	9.90990991	8.510638298	89.16666667	45.94594595	54.34782609	84.16666667	-95.20635428	-97.60414084
Epochs 180	0.543165445	12.22222222	10.52631579	90.66666667	47.77777778	51.35135135	85.33333333	-94.68717702	-97.60414084
Epochs 200	0.640287757	14.66666667	14.81481481	92.61363636	52	53.84615385	86.36363636	-93.90170435	-97.60414084
Bull Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.0625	6.730769231	5.769230769	0	43.68932039	45.19230769	0	384.7914967	678.7940879
Epochs 40	0.052884616	5	7.142857143	0	40.22346369	50	0	666.9167856	678.7940879
Epochs 60	0.086538464	10	6.349206349	100	46.25	48	100	325.000451	678.7940879
Epochs 80	0.139423072	9.85915493	5.785123967	93.75	52.11267606	46.66666667	93.75	302.9403684	678.7940879
Epochs 100	0.25	9.090909091	6.666666667	95.12195122	49.35064935	51.68539326	90.24390244	291.2086234	678.7940879
Epochs 120	0.413461536	9.090909091	9.375	94.87179487	50	50	90.90909091	554.8670289	678.7940879
Epochs 140	0.504807711	9.259259259	9.615384615	93.1372549	53.7037037	48.07692308	89.10891089	644.8771954	678.7940879
Epochs 160	0.557692289	8.695652174	6.976744186	91.59663866	54.34782609	48.8372093	86.44067797	586.7146051	678.7940879
Epochs 180	0.639423072	8.823529412	8.333333333	92.02898551	55.88235294	50	86.13138686	864.145236	678.7940879
Epochs 200	0.701923072	9.677419355	8.333333333	92.15686275	61.29032258	58.33333333	86.18421053	503.8914917	678.7940879

Bear Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.077310927	7.602339181	7.90513834	0	46.92082111	49.01185771	0	39.20261451	-91.88465799
Epochs 40	0.068907566	6.25	10.84337349	0	42.66144814	50.60240964	0	-88.50511397	-91.88465799
Epochs 60	0.094117649	9.493670886	8	100	49.84126984	52.36363636	100	128.2027993	-91.88465799
Epochs 80	0.15126051	9.764309764	9.266409266	94.87179487	51.68918919	53.66795367	89.74358974	146.1616646	-91.88465799
Epochs 100	0.233613446	9.602649007	12.13592233	97.70114943	52.49169435	57.2815534	89.65517241	133.85244	-91.88465799
Epochs 120	0.389915973	11.15537849	15	97.82608696	55.6	56.25	91.30434783	451.1415633	-91.88465799
Epochs 140	0.485714287	12.44239631	17.77777778	97.94238683	56.48148148	54.81481481	91.35802469	593.9410349	-91.88465799
Epochs 160	0.568067253	13.18681319	20	96.36963696	59.66850829	56.36363636	88.77887789	408.3916591	-91.88465799
Epochs 180	0.652100861	15.97222222	23.15789474	96.34831461	61.53846154	61.05263158	88.76404494	588.1582204	-91.88465799
Epochs 200	0.724369764	18.11023622	31.34328358	96.50872818	63.49206349	65.67164179	88.77805486	2937.766427	-91.88465799
Full Cycle test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.075245366	7.339449541	7.795698925	0	45.95588235	45.69892473	0	-83.44876906	-96.00669322
Epochs 40	0.066521265	5.806451613	11.26760563	0	42.50645995	51.4084507	0	-94.46127974	-96.00669322
Epochs 60	0.092693567	8.232931727	8.980582524	100	49.49698189	48.30097087	57.14285714	-80.22808385	-96.00669322
Epochs 80	0.11886587	8.333333333	9.183673469	96.96969697	49.28716904	49.74489796	90.90909091	-57.24691295	-96.00669322
Epochs 100	0.223555073	8.47107438	11.33333333	97.7443609	50.31055901	51	91.72932331	-63.12796905	-96.00669322
Epochs 120	0.370774269	9.653465347	13.55932203	97.11191336	52.10918114	54.23728814	90.97472924	4.831739818	-96.00669322
Epochs 140	0.463467836	10.08902077	14.57286432	95.01312336	52.97619048	54.27135678	87.13910761	-48.85254397	-96.00669322
Epochs 160	0.549618304	11.9133574	15.11627907	95.08547009	57.60869565	52.90697674	88.24786325	-36.28013619	-96.00669322
Epochs 180	0.622682691	14.41441441	15.23178808	94.85294118	58.82352941	51.65562914	87.68382353	55.13100048	-96.00669322
Epochs 200	0.695747018	15.73604061	20.38834951	94.97568882	60.20408163	55.33980583	87.68233387	79.37506908	-96.00669322

Table 15-4 Mark-Down Phase Data Trained CNN Model Results

CNN Bull Phase Model									
Accumulation Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.048387095	7.01754386	4.188481675	0	50.87719298	46.84210526	0	-22.04313827	82.55793694
Epochs 40	0.181451619	8.571428571	4.545454545	93.93939394	48.57142857	50.4587156	78.78787879	29.02452907	82.55793694
Epochs 60	0.104838707	8.943089431	4.347826087	100	47.15447154	50	90	56.76440405	82.55793694
Epochs 80	0.266129047	10.41666667	5.102040816	94.44444444	51.04166667	55.10204082	81.13207547	97.64962095	82.55793694
Epochs 100	0.375	11.49425287	6.25	96.2962963	52.87356322	48.75	83.75	82.38389438	82.55793694
Epochs 120	0.52822578	9.090909091	4.081632653	92.48120301	48.48484848	46.93877551	81.81818182	111.9835468	82.55793694
Epochs 140	0.584677398	10.60606061	5.405405405	93.79310345	51.51515152	54.05405405	83.33333333	99.87567565	82.55793694
Epochs 160	0.697580636	11.9047619	6.896551724	93.78531073	50	51.72413793	84.65909091	124.0333001	82.55793694
Epochs 180	0.790322602	13.79310345	0	92.75362319	51.72413793	41.66666667	83.98058252	31.87944961	82.55793694

Epochs 200	0.802419364	14.28571429	5.882352941	92.85714286	42.85714286	52.94117647	83.25358852	105.1469941	82.55793694
Mark-up Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.06849315	9.615384615	5.988023952	0	48.07692308	40.96385542	0	148.8684076	255.7316817
Epochs 40	0.155251145	5.050505051	8.24742268	91.30434783	51.51515152	47.42268041	72.72727273	-91.04160271	255.7316817
Epochs 60	0.100456618	5.217391304	9.278350515	100	50.87719298	47.42268041	85.71428571	-92.15433942	255.7316817
Epochs 80	0.255707771	5.681818182	9.638554217	89.58333333	49.42528736	50.60240964	77.08333333	381.1066919	255.7316817
Epochs 100	0.383561641	5.405405405	11.76470588	93.50649351	49.31506849	48.52941176	85.71428571	348.6210433	255.7316817
Epochs 120	0.552511394	6.666666667	15	93.27731092	51.66666667	60	84.74576271	315.4419491	255.7316817
Epochs 140	0.598173499	6.896551724	14.28571429	92.48120301	50	60.71428571	84.09090909	287.6001703	255.7316817
Epochs 160	0.675799072	7.894736842	11.11111111	92.20779221	57.89473684	59.25925926	84.96732026	261.3296869	255.7316817
Epochs 180	0.757990897	7.692307692	6.666666667	91.57303371	61.53846154	66.66666667	85.31073446	907.9683586	255.7316817
Epochs 200	0.780821919	9.523809524	11.76470588	92.26519337	66.66666667	64.70588235	86.11111111	314.8890337	255.7316817
Distribution Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.065957449	9.677419355	5.49132948	0	52.41935484	44.05797101	0	273.1112704	-35.06524102
Epochs 40	0.161702126	7.943925234	7.211538462	91.66666667	49.53271028	50.24154589	87.5	4126.851239	-35.06524102
Epochs 60	0.080851063	7.8125	7.109004739	100	49.609375	54.28571429	100	5946.658139	-35.06524102
Epochs 80	0.23829788	6.632653061	7.344632768	88.65979381	49.48979592	55.68181818	83.50515464	6211.256119	-35.06524102
Epochs 100	0.34893617	6.043956044	7.142857143	88.88888889	48.9010989	56	83.33333333	1140.324342	-35.06524102
Epochs 120	0.487234056	5.369127517	9.523809524	89.87341772	45.63758389	63.0952381	84.3220339	745.2330707	-35.06524102
Epochs 140	0.527659595	5.405405405	8.196721311	90.03831418	45.27027027	59.01639344	83.84615385	611.0815959	-35.06524102
Epochs 160	0.631914914	7.142857143	3.921568627	89.71962617	53.06122449	62.74509804	84.0625	1016.201768	-35.06524102
Epochs 180	0.765957475	10.90909091	3.846153846	90.74550129	61.81818182	46.15384615	84.27835052	1305.324623	-35.06524102
Epochs 200	0.763829768	8.510638298	3.225806452	90.30612245	61.70212766	51.61290323	83.88746803	2706.991739	-35.06524102
Mark-down Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.071942449	10.29411765	5.741626794	100	45.58823529	39.90384615	0	-34.71018932	-97.60414084
Epochs 40	0.176258996	8.724832215	10.78431373	92.59259259	43.24324324	48.03921569	88.88888889	-93.00933819	-97.60414084
Epochs 60	0.140287772	8.982035928	10.30927835	100	42.1686747	49.48453608	100	-94.51056541	-97.60414084
Epochs 80	0.305755407	8.943089431	9.87654321	89.18918919	44.26229508	50.61728395	82.43243243	-93.81419557	-97.60414084
Epochs 100	0.384892076	9.649122807	9.375	90	43.36283186	56.25	82	-92.27477833	-97.60414084
Epochs 120	0.514388502	10.98901099	6.976744186	90.27777778	45.05494505	53.48837209	83.91608392	-94.8348128	-97.60414084
Epochs 140	0.543165445	9.782608696	6.666666667	89.74358974	44.56521739	53.33333333	82.58064516	-96.07641609	-97.60414084
Epochs 160	0.66906476	13.55932203	7.692307692	91.19170984	44.06779661	46.15384615	85.41666667	-96.75645426	-97.60414084
Epochs 180	0.758992791	15.78947368	0	90.7079646	42.10526316	42.85714286	84.88888889	-97.10097461	-97.60414084
Epochs 200	0.773381293	10.71428571	6.25	90.17094017	35.71428571	43.75	83.26180258	-94.89482796	-97.60414084

Bull Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.0625	10.25641026	5.325443787	0	51.28205128	43.45238095	0	585.1680623	678.7940879
Epochs 40	0.168269232	12.30769231	6.451612903	100	52.30769231	51.2195122	94.73684211	367.9454433	678.7940879
Epochs 60	0.100961536	10	6.504065041	100	51.25	51.63934426	100	242.7377204	678.7940879
Epochs 80	0.317307681	10.71428571	8.24742268	94.54545455	58.92857143	53.60824742	85.18518519	368.3607503	678.7940879
Epochs 100	0.360576928	10.52631579	8.235294118	93.93939394	54.38596491	49.41176471	86.15384615	297.1367262	678.7940879
Epochs 120	0.528846145	13.63636364	9.836065574	95.14563107	56.81818182	52.45901639	88.23529412	415.0755464	678.7940879
Epochs 140	0.557692289	8.163265306	9.523809524	92.30769231	55.10204082	59.52380952	85.34482759	827.3050405	678.7940879
Epochs 160	0.663461566	13.33333333	3.03030303	91.72413793	63.33333333	54.54545455	84.72222222	841.1436988	678.7940879
Epochs 180	0.725961566	8.695652174	4.761904762	90.24390244	65.2173913	66.66666667	83.43558282	1214.639429	678.7940879
Epochs 200	0.740384638	10.52631579	4.545454545	90.41916168	68.42105263	68.18181818	83.73493976	1397.08182	678.7940879
Bear Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.060504202	7.339449541	5.567010309	100	55.04587156	43.59504132	0	-3.590779044	-91.88465799
Epochs 40	0.164705887	8.239700375	7.865168539	90.16393443	48.87218045	51.31086142	86.8852459	-35.58091759	-91.88465799
Epochs 60	0.095798321	8.256880734	8.108108108	100	47.85276074	51.35135135	100	-44.28754661	-91.88465799
Epochs 80	0.257142872	8.097165992	6.976744186	88.72180451	51.01214575	53.02325581	81.06060606	-51.18229123	-91.88465799
Epochs 100	0.321008414	7.522123894	5.586592179	86.31578947	50.88495575	52.51396648	78.83597884	-45.60907216	-91.88465799
Epochs 120	0.49579832	9.090909091	7.627118644	89.70099668	50.56818182	56.77966102	83.66666667	-59.64192478	-91.88465799
Epochs 140	0.531092465	8.670520231	6.52173913	89.39393939	50.28901734	56.52173913	83.58662614	-66.02715531	-91.88465799
Epochs 160	0.650420189	7.843137255	5.633802817	88.86255924	54.90196078	59.15492958	82.42280285	169.1232435	-91.88465799
Epochs 180	0.734453797	10.95890411	6.12244898	90.06342495	50.68493151	59.18367347	83.26271186	110.9633174	-91.88465799
Epochs 200	0.756302536	10.90909091	4.166666667	89.83739837	49.09090909	60.41666667	82.89205703	116.2449405	-91.88465799
Full Cycle test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.058887675	7.936507937	5.22696011	100	52.12765957	41.12792297	100	-12.60600113	-96.00669322
Epochs 40	0.171210468	8.780487805	7.804878049	91.75257732	49.38875306	47.31707317	84.53608247	-90.30580455	-96.00669322
Epochs 60	0.097055614	8.130081301	7.881773399	89.47368421	49.08350305	49.01477833	84.21052632	-90.0798682	-96.00669322
Epochs 80	0.284623772	9.115281501	8.814589666	92.09302326	51.61290323	50.15197568	84.65116279	-93.12945779	-96.00669322
Epochs 100	0.338058889	9.090909091	8.041958042	91.39784946	51.28205128	51.04895105	84.94623656	-71.26176536	-96.00669322
Epochs 120	0.48200655	8.602150538	7.329842932	90.3803132	53.5971223	52.87958115	82.77404922	-67.39772025	-96.00669322
Epochs 140	0.500545263	7.692307692	5.263157895	89.56158664	51.57894737	50	82.25469729	-66.13709854	-96.00669322
Epochs 160	0.616139591	7.407407407	4.958677686	89.78583196	53.19148936	48.76033058	82.53706755	-48.73852487	-96.00669322
Epochs 180	0.724100351	6.837606838	1.408450704	89.84910837	56.03448276	50.70422535	82.85322359	-92.76496881	-96.00669322
Epochs 200	0.742639065	3.658536585	1.25	89.66887417	54.32098765	46.25	82.64900662	-95.39953631	-96.00669322

Table 15-5 Bull Phase Data Trained CNN Model Results

CNN Bear Phase Model

Accumulation Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.056451611	7.006369427	3.296703297	0	42.67515924	47.77777778	0	35.9593753	82.55793694
Epochs 40	0.064516127	7.971014493	4.545454545	0	46.37681159	48.62385321	0	66.40499742	82.55793694
Epochs 60	0.149193555	7.746478873	2.5	92.30769231	45.07042254	44.30379747	84.61538462	13.7398826	82.55793694
Epochs 80	0.241935477	8.333333333	2.352941176	89.09090909	44.44444444	45.88235294	81.48148148	-11.43950752	82.55793694
Epochs 100	0.370967746	8.695652174	1.538461538	91.20879121	45.65217391	41.53846154	81.11111111	2.846148167	82.55793694
Epochs 120	0.495967746	10.66666667	1.960784314	93.44262295	52	43.1372549	84.29752066	137.4313016	82.55793694
Epochs 140	0.556451619	12.28070175	3.773584906	93.47826087	50.87719298	45.28301887	86.13138686	97.56937354	82.55793694
Epochs 160	0.637096763	15.90909091	4.347826087	94.30379747	47.72727273	47.82608696	85.35031847	60.73548496	82.55793694
Epochs 180	0.669354856	18.75	4.255319149	93.49112426	50	46.80851064	84.52380952	56.02920942	82.55793694
Epochs 200	0.729838729	19.23076923	5.555555556	93.5483871	46.15384615	55.55555556	83.78378378	107.3579204	82.55793694

Mark-up Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.06849315	4.827586207	10.81081081	0	50.69444444	51.35135135	0	166.5928752	255.7316817
Epochs 40	0.063926943	4.964539007	8.974358974	0	51.42857143	51.28205128	0	41.32232979	255.7316817
Epochs 60	0.105022833	5	7.575757576	84.61538462	51.07913669	51.51515152	84.61538462	147.2361227	255.7316817
Epochs 80	0.223744288	6.194690265	7.8125	88.0952381	55.35714286	50	80.95238095	4050.344009	255.7316817
Epochs 100	0.374429226	6.18556701	9.302325581	91.13924051	57.29166667	51.1627907	83.5443038	289.5698111	255.7316817
Epochs 120	0.525114179	6.756756757	7.407407407	91.52542373	57.53424658	48.14814815	83.89830508	379.182529	255.7316817
Epochs 140	0.616438329	7.843137255	10	92.75362319	60	43.33333333	85.50724638	399.6750984	255.7316817
Epochs 160	0.671232879	8.108108108	7.407407407	91.61290323	56.75675676	48.14814815	85.06493506	353.4909681	255.7316817
Epochs 180	0.698630154	9.677419355	12.90322581	92.99363057	54.83870968	51.61290323	87.17948718	372.2735292	255.7316817
Epochs 200	0.753424644	12	9.523809524	92.48554913	56	38.0952381	87.20930233	41.62115252	255.7316817

Distribution Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.070212767	6.51465798	7.975460123	0	41.69381107	47.5308642	0	713.4390519	-35.06524102
Epochs 40	0.074468084	7.352941176	7.575757576	0	45.58823529	48.73096447	0	773.5535023	-35.06524102
Epochs 60	0.159574464	7.954545455	7.975460123	95.34883721	47.72727273	54.9382716	93.02325581	1224.310614	-35.06524102
Epochs 80	0.219148934	7.929515419	8.43373494	92.20779221	50.66079295	53.93939394	88.31168831	987.1729064	-35.06524102
Epochs 100	0.365957439	7.486631016	8.547008547	89.15662651	50.80213904	56.89655172	84.93975904	4225.067118	-35.06524102
Epochs 120	0.489361703	6.040268456	6.493506494	88.52459016	48.99328859	62.33766234	81.48148148	2166.804071	-35.06524102
Epochs 140	0.582978725	5.319148936	7.5	88.85135135	48.93617021	62.5	82.03389831	4182.990159	-35.06524102
Epochs 160	0.634042561	6.41025641	8.219178082	89.96865204	52.56410256	63.01369863	83.33333333	7422.945435	-35.06524102
Epochs 180	0.670212746	5.084745763	7.246376812	89.76608187	49.15254237	60.86956522	83.28445748	1961.899656	-35.06524102
Epochs 200	0.727659583	5.882352941	6.52173913	90.08042895	50.98039216	60.86956522	83.60215054	2061.380675	-35.06524102

Mark-down Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.075539567	7.317073171	8.219178082	0	39.21568627	42.46575342	0	-96.5794474	-97.60414084
Epochs 40	0.093525179	8.938547486	10.1010101	0	42.69662921	49.49494949	0	-96.09802411	-97.60414084
Epochs 60	0.143884897	8.556149733	12.16216216	88.23529412	42.47311828	51.35135135	88.23529412	-96.52820374	-97.60414084
Epochs 80	0.262589931	10.13513514	11.68831169	92.45283019	47.61904762	49.35064935	83.01886792	-95.12159949	-97.60414084
Epochs 100	0.366906464	9.022556391	14.54545455	91.11111111	46.96969697	52.72727273	81.11111111	-95.23144041	-97.60414084

Epochs 120	0.496402889	9.708737864	10.81081081	89.85507246	44.66019417	48.64864865	81.75182482	-95.41709583	-97.60414084
Epochs 140	0.514388502	8.045977011	5.128205128	88.15789474	42.52873563	41.02564103	80.13245033	-95.31190039	-97.60414084
Epochs 160	0.597122312	10.14492754	5.882352941	89.71428571	39.13043478	44.11764706	82.75862069	-89.25859549	-97.60414084
Epochs 180	0.625899255	8.620689655	3.225806452	88.88888889	36.20689655	45.16129032	81.91489362	-91.56866977	-97.60414084
Epochs 200	0.658273399	7.142857143	4.545454545	89	35.71428571	45.45454545	82.4120603	-92.38919618	-97.60414084
Bull Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.0625	7.272727273	5.102040816	0	43.11926606	47.95918367	0	575.0153386	678.7940879
Epochs 40	0.072115384	8.045977011	6.611570248	0	49.42528736	50	0	418.8483484	678.7940879
Epochs 60	0.177884609	7.058823529	5.494505495	81.25	49.41176471	49.45054945	74.19354839	192.8904957	678.7940879
Epochs 80	0.3125	8.333333333	5.882352941	87.3015873	60	49.41176471	77.41935484	400.1817139	678.7940879
Epochs 100	0.442307681	7.843137255	7.692307692	90.2173913	60	52.30769231	82.60869565	453.3414533	678.7940879
Epochs 120	0.528846145	6.666666667	10	90.26548673	56.81818182	54	83.18584071	420.5781097	678.7940879
Epochs 140	0.620192289	9.677419355	10.86956522	92.36641221	60	50	86.25954198	435.9743138	678.7940879
Epochs 160	0.649038434	12	10.86956522	92.70072993	66.66666667	50	86.86131387	2265.933145	678.7940879
Epochs 180	0.677884638	16.66666667	8.888888889	92.4137931	61.11111111	48.88888889	86.11111111	2758.624287	678.7940879
Epochs 200	0.740384638	11.76470588	10.34482759	91.97530864	52.94117647	44.82758621	85.0931677	3106.331976	678.7940879
Bear Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.075630255	7.2	8.181818182	0	45.18716578	45.90909091	0	-12.32516668	-91.88465799
Epochs 40	0.075630255	7.492795389	7.661290323	0	47.97687861	50.80645161	0	-0.484789048	-91.88465799
Epochs 60	0.144537821	7.323943662	7.8125	93.75	46.89265537	52.08333333	89.58333333	-95.20351169	-91.88465799
Epochs 80	0.248739496	8.391608392	7.446808511	90.90909091	50.52631579	53.72340426	82.6446281	-94.64318319	-91.88465799
Epochs 100	0.389915973	8.032128514	8.196721311	90.17857143	51.80722892	54.91803279	81.61434978	-88.48976654	-91.88465799
Epochs 120	0.510924399	6.806282723	6.097560976	88.81987578	51.30890052	53.65853659	81.30841121	-91.94114934	-91.88465799
Epochs 140	0.610084057	7.086614173	8.43373494	90.12987013	55.11811024	50.60240964	82.8125	-41.00088735	-91.88465799
Epochs 160	0.636974812	7.692307692	5	89.29440389	56.73076923	51.25	82.68292683	-51.30956459	-91.88465799
Epochs 180	0.665546238	7.142857143	5	89.55916473	57.14285714	51.89873418	83.06264501	-46.10860069	-91.88465799
Epochs 200	0.739495814	8.695652174	9.803921569	90.31578947	53.62318841	54.90196078	83.5443038	-25.33869585	-91.88465799
Full Cycle test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.0697928	6.610169492	7.645259939	0	45.16129032	47.70642202	0	-48.83805175	-96.00669322
Epochs 40	0.074154854	7.076350093	7.894736842	0	47.3880597	48.15789474	0	-88.4952735	-96.00669322
Epochs 60	0.137404576	6.776556777	9.060402685	84.93150685	47.1559633	51.67785235	79.45205479	-82.83657999	-96.00669322
Epochs 80	0.226826608	7.809110629	9.333333333	92.30769231	50	53	85.25641026	-77.20705537	-96.00669322
Epochs 100	0.392584503	7.8125	10.65989848	91.96428571	50.65274151	55.83756345	85.71428571	-84.94006357	-96.00669322
Epochs 120	0.53435117	9.246575342	11.42857143	92.16494845	51.89003436	57.85714286	86.18556701	-89.88688318	-96.00669322
Epochs 140	0.592148304	7.881773399	8.219178082	90.66901408	52.97029703	56.16438356	84.50704225	-94.14783813	-96.00669322
Epochs 160	0.642311871	8.695652174	8.088235294	90.96774194	53.75	56.61764706	84.83870968	-90.80520813	-96.00669322
Epochs 180	0.670665205	10.6870229	6.71641791	90.79754601	54.19847328	54.47761194	84.1781874	-83.41676488	-96.00669322
Epochs 200	0.719738305	10.81081081	7.766990291	91.03840683	52.25225225	54.36893204	84.75783476	-53.26940203	-96.00669322

Table 15-6 Bear Phase Data Trained CNN Model Results

CNN Full Cycle Model									
Accumulation Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.060483869	7.092198582	4.672897196	0	39.71631206	45.28301887	0	-25.5384829	82.55793694
Epochs 40	0.302419364	8.333333333	5.405405405	93.93939394	47.22222222	50	81.53846154	-45.70129766	82.55793694
Epochs 60	0.185483873	8.547008547	4.081632653	96.96969697	47.00854701	55.10204082	81.25	-2.60074979	82.55793694
Epochs 80	0.258064508	9.523809524	4.444444444	94.33962264	50.47619048	50	84.61538462	-15.94215641	82.55793694
Epochs 100	0.42338711	10.71428571	5.970149254	94.84536082	51.19047619	46.26865672	85.41666667	-36.52794689	82.55793694
Epochs 120	0.552419364	12.5	6.666666667	95.41984733	52.77777778	35.55555556	85.38461538	-51.05510291	82.55793694
Epochs 140	0.693548381	16.32653061	10	95.26627219	57.14285714	46.66666667	86.30952381	154.0458061	82.55793694
Epochs 160	0.733870983	17.5	4.347826087	94.05405405	60	47.82608696	85.86956522	73.18676392	82.55793694
Epochs 180	0.802419364	20.68965517	11.76470588	94.55445545	55.17241379	58.82352941	86.56716418	593.2777814	82.55793694
Epochs 200	0.814516127	14.81481481	10	93.36492891	59.25925926	50	84.76190476	-43.75698778	82.55793694
Mark-up Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.059360731	4.651162791	7.777777778	0	50	45.55555556	0	39.79026936	255.7316817
Epochs 40	0.214611873	5.660377358	8	92.10526316	53.33333333	49.33333333	84.21052632	376.9932321	255.7316817
Epochs 60	0.150684938	5.309734513	8.235294118	95.23809524	50.89285714	48.23529412	85.71428571	304.554782	255.7316817
Epochs 80	0.223744288	5.825242718	8.860759494	97.2972973	50	45.56962025	89.18918919	295.6180502	255.7316817
Epochs 100	0.378995448	6.896551724	10.16949153	97.26027397	48.8372093	45.76271186	91.78082192	-81.97426622	255.7316817
Epochs 120	0.593607306	8.955223881	14.28571429	96.77419355	46.96969697	50	87.90322581	-62.41494498	255.7316817
Epochs 140	0.694063902	8.695652174	17.64705882	92.94871795	48.88888889	47.05882353	85.25641026	305.8123626	255.7316817
Epochs 160	0.748858452	8.823529412	20	92.94117647	39.39393939	53.33333333	85.29411765	263.6975675	255.7316817
Epochs 180	0.812785387	12	30	93.47826087	45.83333333	50	86.41304348	166.3837011	255.7316817
Epochs 200	0.849315047	15	40	93.29896907	42.10526316	80	86.59793814	338.9113434	255.7316817
Distribution Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.068085104	6.766917293	6.862745098	0	42.10526316	44.82758621	0	1986.142785	-35.06524102
Epochs 40	0.251063824	7.476635514	6.666666667	86.79245283	49.53271028	47.65100671	81.13207547	1954.370765	-35.06524102
Epochs 60	0.165957451	6.779661017	7.82122905	87.27272727	48.72881356	50.56179775	83.63636364	2078.523541	-35.06524102
Epochs 80	0.225531921	7.373271889	7.272727273	88.63636364	51.15207373	50.6097561	81.81818182	1354.02169	-35.06524102
Epochs 100	0.355319142	7.82122905	6.870229008	90	54.18994413	49.61832061	85.53459119	5630.218678	-35.06524102
Epochs 120	0.508510649	7.586206897	8.641975309	90.57377049	56.55172414	54.32098765	83.53909465	1026.158925	-35.06524102
Epochs 140	0.614893615	8.256880734	3.921568627	89.67741935	55.96330275	60.78431373	83.17152104	721.7695599	-35.06524102
Epochs 160	0.708510637	8.641975309	6.451612903	90.5027933	55.55555556	51.61290323	84.31372549	-73.32854245	-35.06524102
Epochs 180	0.748936176	8.196721311	7.407407407	90.31413613	54.09836066	51.85185185	84.2519685	194.913327	-35.06524102
Epochs 200	0.776595771	6	5.263157895	90.02493766	48	52.63157895	84	-39.22320151	-35.06524102
Mark-down Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.075539567	7.386363636	7.843137255	0	41.14285714	43.1372549	0	-95.83998694	-97.60414084
Epochs 40	0.215827331	8	6.666666667	81.13207547	42.95302013	44	73.58490566	-94.65001843	-97.60414084
Epochs 60	0.16546762	8.227848101	8.988764045	80.64516129	42.67515924	47.19101124	70.96774194	-96.54854621	-97.60414084
Epochs 80	0.25179857	9.85915493	9.756097561	88.88888889	46.09929078	47.56097561	81.48148148	-94.23787145	-97.60414084
Epochs 100	0.348920852	8.620689655	6.153846154	85.56701031	48.69565217	47.69230769	77.31958763	-95.02794887	-97.60414084
Epochs 120	0.482014388	6.12244898	8.333333333	86.80555556	50	44.44444444	80.41958042	-96.2573618	-97.60414084

Epochs 140	0.600719452	7.042253521	10.71428571	88.82681564	46.47887324	42.85714286	82.02247191	-93.70059674	-97.60414084
Epochs 160	0.683453262	7.272727273	15.78947368	89.70588235	45.45454545	47.36842105	83.25123153	-93.85759488	-97.60414084
Epochs 180	0.733812928	5.128205128	0	88.59649123	41.02564103	45.45454545	82.37885463	-96.04522958	-97.60414084
Epochs 200	0.762589931	0	0	87.96680498	37.5	60	82.08333333	-95.90247019	-97.60414084
Bull Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.067307696	8.045977011	5.785123967	0	45.34883721	48.76033058	0	661.0986695	678.7940879
Epochs 40	0.259615391	9.523809524	5.263157895	86	53.96825397	46.80851064	80	979.1628098	678.7940879
Epochs 60	0.182692304	9.090909091	4.587155963	81.81818182	50	47.22222222	75.75757576	360.9124105	678.7940879
Epochs 80	0.235576928	8.771929825	5.607476636	86.36363636	56.14035088	49.05660377	84.09090909	418.1930597	678.7940879
Epochs 100	0.408653855	9.615384615	4.347826087	88.50574713	55.76923077	47.82608696	83.72093023	514.266864	678.7940879
Epochs 120	0.552884638	9.090909091	4.651162791	90.08264463	54.54545455	55.81395349	85	775.1937766	678.7940879
Epochs 140	0.716346145	13.63636364	6.896551724	91.71974522	54.54545455	55.17241379	84.61538462	478.8383536	678.7940879
Epochs 160	0.764423072	15.78947368	5	91.71597633	52.63157895	70	85.11904762	4122.982823	678.7940879
Epochs 180	0.807692289	18.75	7.142857143	92.13483146	50	64.28571429	85.31073446	4995.95207	678.7940879
Epochs 200	0.855769217	20	20	92.55319149	46.66666667	40	86.09625668	14783.37973	678.7940879
Bear Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.073949583	7.763975155	6.95970696	0	46.41744548	45.42124542	0	10.07373952	-91.88465799
Epochs 40	0.253781527	8.61423221	8.292682927	90.24390244	50.7518797	49.75609756	84.55284553	58.62735303	-91.88465799
Epochs 60	0.16638656	7.920792079	7.522123894	87.87878788	47.68211921	50.88495575	81.81818182	-11.15814877	-91.88465799
Epochs 80	0.240336135	8.239700375	7.142857143	89.83050847	49.2481203	52.38095238	85.59322034	-82.39885563	-91.88465799
Epochs 100	0.389915973	9.375	6.164383562	89.77777778	50.22421525	54.10958904	82.22222222	-39.49178554	-91.88465799
Epochs 120	0.531092465	9.090909091	2.666666667	89.18918919	49.73262032	58.66666667	81.92771084	-53.73041148	-91.88465799
Epochs 140	0.648739517	7.2	4	89.28571429	51.2	54	81.62291169	-30.63137801	-91.88465799
Epochs 160	0.72100842	6.382978723	3.448275862	89.40677966	51.06382979	51.72413793	82.37791932	-12.26586532	-91.88465799
Epochs 180	0.757983208	5.555555556	0	89.22155689	51.38888889	40.90909091	82.6	-87.8770903	-91.88465799
Epochs 200	0.793277323	6.557377049	0	89.65517241	50.81967213	41.66666667	82.72552783	-92.23599844	-91.88465799
Full Cycle test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.068702288	6.779661017	6.994818653	0	46.22641509	43.78238342	0	-78.73501079	-96.00669322
Epochs 40	0.254089415	7.009345794	8.275862069	89.94974874	48.47775176	49.31034483	84.42211055	-89.39790804	-96.00669322
Epochs 60	0.191930205	7.708779443	9.063444109	92.43697479	49.35622318	50.75528701	87.39495798	-78.04565036	-96.00669322
Epochs 80	0.250817895	7.582938389	8.794788274	90.95744681	49.88123515	50.81433225	84.04255319	-76.53643846	-96.00669322
Epochs 100	0.415485293	7.894736842	10.59907834	92.45810056	50.73313783	53.4562212	85.47486034	-25.79033758	-96.00669322
Epochs 120	0.526717544	7.560137457	8.59375	90.36144578	49.65517241	52.34375	84.53815261	78.48798121	-96.00669322
Epochs 140	0.640130877	8.333333333	5.617977528	90.54487179	51.72413793	49.43820225	83.97435897	27.4521904	-96.00669322
Epochs 160	0.696837485	5.769230769	4.838709677	89.69957082	52.90322581	41.93548387	83.54792561	-79.65934722	-96.00669322
Epochs 180	0.764449298	6.796116505	2.272727273	90	57.2815534	38.63636364	83.61508453	-86.40150914	-96.00669322
Epochs 200	0.799345672	5.747126437	0	89.98763906	55.17241379	28.57142857	83.41584158	-96.14503722	-96.00669322

Table 15-7 Full Cycle Data Trained CNN Model Results

LSTM Accumulation Phase Model

Accumulation Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.338709682	7.291666667	4.225352113	91.35802469	42.70833333	46.47887324	82.5	-0.543194046	82.55793694
Epochs 40	0.471774191	9.836065574	6.666666667	94.64285714	47.54098361	53.33333333	82.88288288	21.41179579	82.55793694
Epochs 60	0.544354856	10.52631579	6.666666667	95.41984733	45.61403509	55	81.53846154	28.37302127	82.55793694
Epochs 80	0.612903237	11.32075472	6.666666667	95.33333333	43.39622642	46.66666667	83.22147651	-8.335750837	82.55793694
Epochs 100	0.625	10.20408163	4.761904762	94.26751592	42.85714286	52.38095238	82.69230769	42.73296502	82.55793694
Epochs 120	0.649193525	10.25641026	2.380952381	93.41317365	46.15384615	54.76190476	81.92771084	854.5913678	82.55793694
Epochs 140	0.697580636	10.52631579	3.225806452	93.8547486	47.36842105	54.83870968	83.14606742	950.2729022	82.55793694
Epochs 160	0.70161289	11.42857143	3.03030303	93.88888889	45.71428571	54.54545455	83.24022346	721.6204849	82.55793694
Epochs 180	0.70161289	12.12121212	0	93.40659341	48.48484848	51.51515152	82.87292818	115.086315	82.55793694
Epochs 200	0.745967746	13.33333333	0	93.29896907	46.66666667	54.16666667	83.41968912	4311.081815	82.55793694

Mark-up Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.424657524	4.651162791	11.9047619	92.30769231	47.05882353	57.14285714	85.71428571	208.2139105	255.7316817
Epochs 40	0.479452044	6.557377049	9.433962264	91.42857143	55	56.60377358	83.80952381	390.5408522	255.7316817
Epochs 60	0.529680371	7.547169811	10	92.24137931	51.92307692	54	86.20689655	235.067261	255.7316817
Epochs 80	0.607305944	8.695652174	8.333333333	91.97080292	51.11111111	63.88888889	86.13138686	89.19725834	255.7316817
Epochs 100	0.684931517	10.52631579	11.11111111	92.85714286	59.45945946	70.37037037	87.01298701	348.8769336	255.7316817
Epochs 120	0.698630154	11.76470588	7.692307692	92.45283019	60.60606061	65.38461538	86.16352201	709.9681238	255.7316817
Epochs 140	0.767123282	14.28571429	11.76470588	93.10344828	60.71428571	76.47058824	86.70520231	1704.608634	255.7316817
Epochs 160	0.776255727	8.695652174	12.5	92.22222222	52.17391304	68.75	86.03351955	164.4459596	255.7316817
Epochs 180	0.794520557	11.11111111	6.666666667	91.93548387	44.44444444	60	85.94594595	127.3740734	255.7316817
Epochs 200	0.803652942	5.882352941	8.333333333	91.57894737	41.17647059	58.33333333	85.71428571	96.20117064	255.7316817

Distribution Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.387234032	8.421052632	8.411214953	90.75144509	47.89473684	52.83018868	84.97109827	987.9279645	-35.06524102
Epochs 40	0.461702138	8.823529412	8.403361345	90.69767442	53.67647059	60.16949153	84.65116279	429.728372	-35.06524102
Epochs 60	0.506383002	8.333333333	5.940594059	89.15662651	58.33333333	58	81.92771084	1035.622393	-35.06524102
Epochs 80	0.55531913	8.771929825	7.142857143	90.07352941	63.15789474	63.85542169	82.72058824	813.2116802	-35.06524102
Epochs 100	0.61914891	7.52688172	7.462686567	90	61.29032258	58.20895522	83.17152104	103.7954169	-35.06524102
Epochs 120	0.655319154	8	8.823529412	90.51987768	60	61.76470588	84.04907975	416.5535459	-35.06524102
Epochs 140	0.678723395	8.955223881	6.557377049	90.35087719	61.19402985	62.29508197	83.87096774	1673.04317	-35.06524102
Epochs 160	0.710638285	8.928571429	8.771929825	90.75630252	62.5	63.15789474	84.26966292	523.1503478	-35.06524102
Epochs 180	0.725531936	11.36363636	8.064516129	90.93406593	63.63636364	66.12903226	84.84848485	94.56669676	-35.06524102
Epochs 200	0.751063824	11.36363636	10	91.22340426	59.09090909	66	85.06666667	73.18611238	-35.06524102

Mark-down Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.323741019	9.032258065	10.86956522	92.20779221	46.75324675	50	81.81818182	-95.98550576	-97.60414084
Epochs 40	0.485611498	10.1010101	15.09433962	92.85714286	45.91836735	49.05660377	86.50793651	-95.15746455	-97.60414084
Epochs 60	0.517985582	10.86956522	9.302325581	90.90909091	49.45054945	46.51162791	85.31468531	-95.50061596	-97.60414084
Epochs 80	0.600719452	9.722222222	10	89.20454545	53.52112676	46.66666667	82.95454545	-92.70197068	-97.60414084

Epochs 100	0.654676259	6.896551724	13.04347826	88.83248731	51.72413793	47.82608696	83.16326531	-93.50459621	-97.60414084
Epochs 120	0.697841704	8.163265306	14.28571429	89.90384615	51.02040816	47.61904762	84.05797101	-92.62845881	-97.60414084
Epochs 140	0.74460429	8.571428571	15	90.13452915	51.42857143	50	83.78378378	-92.93158936	-97.60414084
Epochs 160	0.758992791	10.71428571	13.04347826	90.30837004	60.71428571	52.17391304	83.62831858	-85.23485752	-97.60414084
Epochs 180	0.773381293	8.333333333	10.52631579	89.78723404	66.66666667	42.10526316	83.33333333	-83.10312263	-97.60414084
Epochs 200	0.784172654	9.523809524	0	89.25619835	66.66666667	33.33333333	82.57261411	-77.81558895	-97.60414084
Bull Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.485576928	12.12121212	6.756756757	91.08910891	48.48484848	48.64864865	86	739.5088196	678.7940879
Epochs 40	0.4375	12.5	8.333333333	94.04761905	60	50.60240964	88.0952381	217.1908941	678.7940879
Epochs 60	0.543269217	13.33333333	7.575757576	92.85714286	63.33333333	47.69230769	87.5	921.3135397	678.7940879
Epochs 80	0.567307711	17.85714286	7.8125	93.10344828	64.28571429	50.79365079	87.93103448	972.9001778	678.7940879
Epochs 100	0.649038434	17.85714286	10.41666667	94.6969697	57.14285714	53.19148936	89.39393939	2087.429564	678.7940879
Epochs 120	0.682692289	11.11111111	11.11111111	93.10344828	44.44444444	54.54545455	88.27586207	231.1284755	678.7940879
Epochs 140	0.6875	11.76470588	11.11111111	93.15068493	47.05882353	50	88.35616438	210.3129026	678.7940879
Epochs 160	0.711538434	13.33333333	11.9047619	93.37748344	40	56.09756098	88.0794702	275.0043693	678.7940879
Epochs 180	0.721153855	13.33333333	10.52631579	92.90322581	46.66666667	56.75675676	87.09677419	106.4436747	678.7940879
Epochs 200	0.721153855	13.33333333	8.571428571	91.7721519	46.66666667	55.88235294	86.07594937	72.37217119	678.7940879
Bear Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.36470589	8.118081181	9.375	93.36734694	47.9704797	49.21875	84.1025641	191.4504531	-91.88465799
Epochs 40	0.485714287	11.37724551	7.586206897	91.51943463	52.09580838	52.4137931	84.04255319	-50.90305374	-91.88465799
Epochs 60	0.494117647	9.411764706	9.090909091	90.78498294	50	53.78787879	83.90410959	-46.34975568	-91.88465799
Epochs 80	0.556302547	11.18421053	10.52631579	91.79331307	51.97368421	57.01754386	85.36585366	-13.89125009	-91.88465799
Epochs 100	0.628571451	11.60714286	8.510638298	90.74550129	50	55.31914894	84.02061856	-77.87266598	-91.88465799
Epochs 120	0.65882355	12.22222222	5.681818182	90.16786571	50	53.40909091	82.69230769	-94.4366092	-91.88465799
Epochs 140	0.695798337	14.1025641	7.5	90.84668192	48.71794872	52.5	83.94495413	-87.96694093	-91.88465799
Epochs 160	0.690756321	13.69863014	7.058823529	90.38901602	49.31506849	52.94117647	83.48623853	-90.07688292	-91.88465799
Epochs 180	0.70588237	15.51724138	6.741573034	90.40178571	46.55172414	50.56179775	83.6689038	-89.639571	-91.88465799
Epochs 200	0.72100842	15.25423729	4.109589041	90.06479482	45.76271186	47.94520548	83.76623377	-93.26478301	-91.88465799
Full Cycle test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.344601959	6.531531532	7.058823529	90.75907591	45.59819413	46.47058824	83.49834983	-60.53703314	-96.00669322
Epochs 40	0.458015263	8.391608392	7.407407407	91.56626506	51.3986014	51.38888889	85.74879227	-67.69410142	-96.00669322
Epochs 60	0.52453655	8.661417323	6.896551724	91.41104294	52.36220472	50	84.83606557	-89.95739576	-96.00669322
Epochs 80	0.588876784	9.661835749	5.479452055	90.78014184	54.58937198	50	84.36944938	-94.15137134	-96.00669322
Epochs 100	0.647764444	9.826589595	4.385964912	90.79365079	54.33526012	45.61403509	84.26073132	-85.30479101	-96.00669322
Epochs 120	0.706652105	10	6.18556701	91.15942029	55.38461538	48.45360825	84.7605225	-76.08228047	-96.00669322
Epochs 140	0.726281345	8.695652174	5.813953488	90.92178771	50.43478261	47.6744186	84.75524476	-73.11189683	-96.00669322
Epochs 160	0.737186491	9.345794393	5.882352941	91.17241379	50.46728972	50.58823529	84.53038674	-87.25197014	-96.00669322
Epochs 180	0.742639065	11.49425287	5.050505051	91.10807114	49.42528736	47.47474747	84.38356164	-52.87086474	-96.00669322
Epochs 200	0.768811345	11.36363636	4.347826087	91.05263158	50	47.82608696	84.32147563	-87.81114931	-96.00669322

Table 15-8 Accumulation Phase Data Trained LSTM Model Results

LSTM Mark Up Phase Model									
Accumulation Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.270161301	6.71641791	5.357142857	94.82758621	43.28358209	42.85714286	89.47368421	-34.56462241	82.55793694
Epochs 40	0.427419364	10.71428571	4.615384615	94.94949495	52.38095238	44.61538462	84.69387755	-67.13844364	82.55793694
Epochs 60	0.540322602	12.6984127	5.357142857	95.34883721	53.96825397	41.07142857	83.59375	-62.20538835	82.55793694
Epochs 80	0.540322602	8.620689655	5.357142857	94.02985075	50	41.07142857	83.45864662	-72.51022745	82.55793694
Epochs 100	0.669354856	15.15151515	6.25	94.61077844	48.48484848	45.83333333	86.14457831	-67.71437835	82.55793694
Epochs 120	0.693548381	17.24137931	6.52173913	94.79768786	51.72413793	41.30434783	85.46511628	-62.39796254	82.55793694
Epochs 140	0.717741907	22.72727273	4.444444444	94.47513812	54.54545455	40	84.44444444	-62.29175475	82.55793694
Epochs 160	0.766129017	25	2.941176471	93.43434343	50	44.11764706	84.26395939	-69.55177875	82.55793694
Epochs 180	0.79838711	21.42857143	4	92.82296651	42.85714286	44	83.17307692	-63.3307306	82.55793694
Epochs 200	0.79838711	14.28571429	4	93.30143541	35.71428571	44	84.13461538	-68.18287852	82.55793694
Mark-up Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.273972601	5.6	5.128205128	92.72727273	48.38709677	48.71794872	87.27272727	183.4059026	255.7316817
Epochs 40	0.479452044	8.620689655	10.9375	95.87628866	50	50	86.45833333	1226.023686	255.7316817
Epochs 60	0.616438329	9.090909091	11.9047619	94.73684211	47.72727273	54.76190476	87.87878788	903.8665037	255.7316817
Epochs 80	0.652968049	7.5	8.823529412	94.48275862	40	52.94117647	88.88888889	368.022376	255.7316817
Epochs 100	0.767123282	10.71428571	15	94.73684211	39.28571429	55	88.23529412	1068.643889	255.7316817
Epochs 120	0.771689475	8	11.76470588	93.22033898	40	52.94117647	86.93181818	573.8004575	255.7316817
Epochs 140	0.789954364	5.555555556	11.11111111	92.89617486	33.33333333	55.55555556	86.26373626	305.3106119	255.7316817
Epochs 160	0.808219194	7.692307692	10.52631579	93.04812834	30.76923077	52.63157895	86.55913978	45.96124354	255.7316817
Epochs 180	0.831050217	0	15.38461538	92.78350515	25	61.53846154	86.52849741	28.80135836	255.7316817
Epochs 200	0.826484025	0	12.5	92.74611399	20	56.25	86.45833333	27.95509829	255.7316817
Distribution Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.242553189	6.713780919	8.888888889	89.69072165	43.26241135	45.55555556	82.4742268	7536.495677	-35.06524102
Epochs 40	0.419148922	9.271523179	5.833333333	88.44221106	52.98013245	51.2605042	81.90954774	698.4436628	-35.06524102
Epochs 60	0.546808481	7.56302521	7.407407407	89.62962963	51.2605042	56.79012346	82.89962825	622.8718036	-35.06524102
Epochs 80	0.582978725	9.174311927	6.756756757	90.24390244	53.21100917	55.40540541	82.86713287	1248.125885	-35.06524102
Epochs 100	0.680851042	9.302325581	10.63829787	91.09792285	54.65116279	53.19148936	84.22619048	-65.13859327	-35.06524102
Epochs 120	0.723404229	10.95890411	12.5	91.59663866	57.53424658	52.5	85.11235955	-20.4785618	-35.06524102
Epochs 140	0.753191471	12.5	10.25641026	91.46666667	62.5	56.41025641	85.29411765	289.1726969	-35.06524102
Epochs 160	0.797872365	13.95348837	13.79310345	91.70854271	62.79069767	62.06896552	85.64231738	776.1895346	-35.06524102
Epochs 180	0.806382954	12.19512195	13.04347826	91.37931034	63.41463415	60.86956522	85.67901235	157.3381387	-35.06524102
Epochs 200	0.810638309	11.42857143	15.38461538	91.19804401	68.57142857	57.69230769	85.53921569	-58.01021042	-35.06524102
Mark-down Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.219424456	7.8125	14.28571429	90.90909091	42.40837696	50	81.81818182	-96.86165342	-97.60414084
Epochs 40	0.525179863	13.18681319	12	93.43065693	56.04395604	48	86.76470588	-94.68679453	-97.60414084
Epochs 60	0.618705034	15.49295775	10.52631579	92.89940828	54.92957746	52.63157895	86.9047619	-95.02160522	-97.60414084
Epochs 80	0.640287757	14.0625	9.090909091	91.71270718	53.125	54.54545455	85.55555556	-93.79858431	-97.60414084
Epochs 100	0.658273399	9.615384615	9.375	90.20618557	48.07692308	53.125	83.41968912	-94.47931159	-97.60414084

Epochs 120	0.683453262	10.63829787	10	90.54726368	51.06382979	46.66666667	85	-94.62322792	-97.60414084
Epochs 140	0.723021567	12.82051282	8	90.65420561	53.84615385	40	84.50704225	-94.47572536	-97.60414084
Epochs 160	0.730215847	8.823529412	11.53846154	90.36697248	47.05882353	42.30769231	83.87096774	-95.64036865	-97.60414084
Epochs 180	0.766187072	7.142857143	11.11111111	90.0862069	46.42857143	44.44444444	83.98268398	-58.49795868	-97.60414084
Epochs 200	0.762589931	7.407407407	5.263157895	90.0862069	40.74074074	36.84210526	83.54978355	-53.46293344	-97.60414084
Bull Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.456730783	8.333333333	4.651162791	93.5483871	45.83333333	44.18604651	89.13043478	359.7215275	678.7940879
Epochs 40	0.399038464	12.5	5.063291139	90.12345679	50	49.36708861	86.25	474.8908475	678.7940879
Epochs 60	0.538461566	10.52631579	3.846153846	89.83050847	47.36842105	50	84.61538462	414.1554794	678.7940879
Epochs 80	0.591346145	10.52631579	2.564102564	90.07633588	44.73684211	53.84615385	84.61538462	410.6315436	678.7940879
Epochs 100	0.716346145	12	4.166666667	91.19496855	36	58.33333333	85.44303797	196.8314332	678.7940879
Epochs 120	0.725961566	9.523809524	0	89.75903614	42.85714286	57.14285714	84.24242424	176.1428632	678.7940879
Epochs 140	0.754807711	8.333333333	0	90.1734104	41.66666667	47.82608696	84.30232558	174.3854715	678.7940879
Epochs 160	0.778846145	9.090909091	5	90.39548023	36.36363636	55	84.09090909	365.7566159	678.7940879
Epochs 180	0.793269217	10	0	90.10989011	40	50	83.97790055	589.2962428	678.7940879
Epochs 200	0.774038434	9.090909091	0	89.88764045	36.36363636	47.36842105	83.61581921	169.0040528	678.7940879
Bear Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.233613446	7.5	6.779661017	88.88888889	47.63231198	55.93220339	82.05128205	-86.920161	-91.88465799
Epochs 40	0.477310926	9.473684211	10.60606061	92.30769231	51.85185185	56.06060606	84.61538462	-67.55738291	-91.88465799
Epochs 60	0.578151286	10.25641026	10.75268817	91.90751445	52.90322581	54.83870968	85.26011561	-61.34279727	-91.88465799
Epochs 80	0.608403385	10.52631579	8.139534884	90.69148936	51.51515152	54.65116279	83.77659574	-49.02696728	-91.88465799
Epochs 100	0.680672288	9.195402299	7.894736842	90.50925926	54.65116279	52.63157895	83.7962963	-57.20861445	-91.88465799
Epochs 120	0.712605059	9.333333333	10.14492754	90.90909091	48.64864865	52.17391304	84.03547672	-76.71192405	-91.88465799
Epochs 140	0.757983208	9.090909091	11.11111111	90.53497942	53.7037037	55.55555556	83.74485597	-17.13490819	-91.88465799
Epochs 160	0.773109257	8.695652174	10.20408163	90.2	55.55555556	59.18367347	83.4	-12.35125605	-91.88465799
Epochs 180	0.78319329	6.818181818	7.692307692	89.84375	54.54545455	58.97435897	83.1702544	-35.59062625	-91.88465799
Epochs 200	0.806722701	8.333333333	9.090909091	90.11406844	47.22222222	57.57575758	83.04761905	-82.41019596	-91.88465799
Full Cycle test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.22791712	6.397306397	10.45751634	91.17647059	44.68802698	52.94117647	85.88235294	-45.59677412	-96.00669322
Epochs 40	0.415485293	7.647058824	7.614213198	89.47368421	50.14749263	51.77664975	83.94736842	-52.55954531	-96.00669322
Epochs 60	0.56706655	9.163346614	9.090909091	90.82397004	52	54.54545455	85.39325843	24.06603375	-96.00669322
Epochs 80	0.599781871	9.734513274	9.016393443	90.86115993	51.11111111	55.73770492	84.8857645	3.577004143	-96.00669322
Epochs 100	0.684841871	10.52631579	11.23595506	91.32420091	51.17647059	65.16853933	84.77929985	16.56546106	-96.00669322
Epochs 120	0.719738305	7.407407407	12	90.66478076	48.14814815	66.66666667	83.99433428	146.3597532	-96.00669322
Epochs 140	0.756815732	7.619047619	11.11111111	90.65420561	47.61904762	66.66666667	84.09090909	146.8108938	-96.00669322
Epochs 160	0.786259532	7.954545455	13.7254902	90.87403599	46.59090909	66.66666667	84.2985843	-28.50685525	-96.00669322
Epochs 180	0.799345672	7.407407407	14.28571429	90.80604534	46.91358025	66.66666667	84.36317781	-56.95645893	-96.00669322
Epochs 200	0.803707719	5.555555556	15.2173913	90.86357947	45.83333333	67.39130435	84.3358396	8.276709541	-96.00669322

Table 15-9 Mark Up Phase Data Trained LSTM Model Results

LSTM Distribution Phase Model									
Accumulation Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.286290318	5.769230769	5.263157895	89.70588235	42.30769231	44.73684211	83.58208955	-58.95107499	82.55793694
Epochs 40	0.415322572	9.375	4.819277108	92.07920792	43.75	51.80722892	79	-48.41900785	82.55793694
Epochs 60	0.516129017	8.771929825	4.918032787	92.30769231	45.61403509	50.81967213	79.84496124	-35.32540404	82.55793694
Epochs 80	0.616935492	9.259259259	5.405405405	92.99363057	42.59259259	48.64864865	82.05128205	40.04693572	82.55793694
Epochs 100	0.616935492	7.936507937	3.846153846	92.45283019	41.26984127	42.30769231	81.64556962	28.60192034	82.55793694
Epochs 120	0.689516127	10.20408163	4.545454545	93.22033898	44.89795918	27.27272727	82.95454545	-66.73469221	82.55793694
Epochs 140	0.713709652	7.5	4.761904762	92.51336898	47.5	28.57142857	81.72043011	-18.66345773	82.55793694
Epochs 160	0.766129017	9.375	0	92.57425743	53.125	14.28571429	82.58706468	-73.74058393	82.55793694
Epochs 180	0.766129017	6.060606061	0	92.15686275	51.51515152	18.18181818	82.26600985	-47.52675104	82.55793694
Epochs 200	0.77822578	3.571428571	0	91.86602871	50	27.27272727	81.73076923	-17.08611303	82.55793694
Mark-up Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.296803653	5.504587156	9.615384615	93.10344828	53.21100917	50	89.47368421	325.3292549	255.7316817
Epochs 40	0.493150681	9.090909091	13.63636364	95.91836735	53.7037037	50	87.75510204	266.0190995	255.7316817
Epochs 60	0.547945201	8	11.76470588	93.22033898	48.97959184	50.98039216	85.59322034	539.9384401	255.7316817
Epochs 80	0.616438329	9.090909091	14.28571429	93.98496241	47.72727273	54.76190476	86.36363636	634.1159562	255.7316817
Epochs 100	0.630136967	9.803921569	12.90322581	94.16058394	49.01960784	58.06451613	87.5	398.5347062	255.7316817
Epochs 120	0.680365324	9.756097561	11.53846154	93.42105263	43.90243902	57.69230769	86.09271523	67.13824137	255.7316817
Epochs 140	0.662100434	6.976744186	11.53846154	92.66666667	41.86046512	57.69230769	85.23489933	98.42965828	255.7316817
Epochs 160	0.707762539	9.375	11.11111111	93.125	43.75	55.55555556	86.16352201	75.47747849	255.7316817
Epochs 180	0.703196347	8.108108108	9.523809524	92.54658385	44.44444444	57.14285714	85.71428571	74.37756634	255.7316817
Epochs 200	0.735159814	7.407407407	9.090909091	92.35294118	37.03703704	59.09090909	85.79881657	56.16648787	255.7316817
Distribution Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.23829788	7.608695652	6.603773585	95.45454545	40.72727273	48.11320755	86.36363636	8982.50792	-35.06524102
Epochs 40	0.404255331	10.73825503	7.638888889	92.09039548	55.70469799	50.34965035	83.05084746	7.072786331	-35.06524102
Epochs 60	0.534042537	11.96581197	6	91.30434783	59.82905983	47.47474747	84.58498024	309.0076403	-35.06524102
Epochs 80	0.608510613	11.76470588	7.792207792	92.09621993	58.82352941	42.85714286	84.82758621	78.4067374	-35.06524102
Epochs 100	0.644680858	13.27433628	6.12244898	92.53246753	59.2920354	46.93877551	85.99348534	-3.615926905	-35.06524102
Epochs 120	0.717021286	14.45783133	5.555555556	92.02279202	56.62650602	55.55555556	85.14285714	83.79783012	-35.06524102
Epochs 140	0.734042525	14.1025641	6.451612903	91.966759	52.56410256	58.06451613	85.55555556	-16.02929945	-35.06524102
Epochs 160	0.785106361	16.94915254	8.333333333	92.24806202	57.62711864	58.33333333	86.01036269	-22.8446334	-35.06524102
Epochs 180	0.787234068	14.51612903	6.25	91.83673469	53.22580645	56.25	85.42199488	-34.23572415	-35.06524102
Epochs 200	0.79361701	16.07142857	0	91.91919192	55.35714286	38.88888889	85.82278481	-62.10515334	-35.06524102
Mark-down Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.187050357	7.368421053	13.79310345	100	41.26984127	51.72413793	90	-96.56574983	-97.60414084
Epochs 40	0.482014388	11.95652174	12.6984127	93.49593496	53.26086957	49.20634921	88.52459016	-81.27992568	-97.60414084
Epochs 60	0.557553947	9.589041096	15.68627451	90.90909091	53.42465753	47.05882353	84.96732026	-91.82644465	-97.60414084
Epochs 80	0.597122312	12.16216216	15.38461538	91.51515152	55.40540541	51.28205128	85.97560976	-87.82089577	-97.60414084
Epochs 100	0.57913667	8.974358974	12.5	89.28571429	52.56410256	46.875	85.02994012	-94.3375415	-97.60414084

Epochs 120	0.66187048	11.11111111	13.63636364	90.15544041	52.38095238	40.90909091	85.41666667	-93.92413019	-97.60414084
Epochs 140	0.687050343	10.34482759	15.78947368	90.54726368	51.72413793	42.10526316	86	-92.71391113	-97.60414084
Epochs 160	0.723021567	8.695652174	14.28571429	89.44954128	56.52173913	28.57142857	83.87096774	-97.03795128	-97.60414084
Epochs 180	0.733812928	8.888888889	16.66666667	89.59276018	57.77777778	33.33333333	84.09090909	-96.75555958	-97.60414084
Epochs 200	0.74460429	9.756097561	15.38461538	89.73214286	53.65853659	30.76923077	83.85650224	-96.99290228	-97.60414084
Bull Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.4375	8.064516129	5.357142857	92.22222222	45.16129032	46.42857143	86.51685393	1841.681725	678.7940879
Epochs 40	0.355769217	10	5.319148936	87.83783784	52.5	49.46236559	81.08108108	298.3635401	678.7940879
Epochs 60	0.4375	11.42857143	6.097560976	90.10989011	54.28571429	49.38271605	83.51648352	282.3368849	678.7940879
Epochs 80	0.514423072	8.823529412	7.8125	90	44.11764706	54.6875	81.65137615	664.1676284	678.7940879
Epochs 100	0.567307711	10.71428571	7.01754386	90.24390244	42.85714286	50.87719298	82.78688525	1740.176111	678.7940879
Epochs 120	0.663461566	15	8.888888889	91.60839161	50	55.55555556	84.50704225	411.1349205	678.7940879
Epochs 140	0.673076928	15	8.888888889	93.00699301	50	53.33333333	85.91549296	395.4045412	678.7940879
Epochs 160	0.721153855	15.78947368	9.090909091	92.30769231	52.63157895	51.51515152	85.80645161	156.7253887	678.7940879
Epochs 180	0.759615362	16.66666667	8.695652174	91.61676647	55.55555556	60.86956522	85.54216867	309.3437801	678.7940879
Epochs 200	0.769230783	12.5	9.523809524	91.22807018	50	52.38095238	85.29411765	192.4923125	678.7940879
Bear Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.242016807	8.445945946	8.152173913	90.43478261	48.98648649	53.26086957	81.57894737	283.1488121	-91.88465799
Epochs 40	0.455462188	11.11111111	8.670520231	91.53846154	51.85185185	53.75722543	84.55598456	-45.18337905	-91.88465799
Epochs 60	0.551260531	10.25641026	9.523809524	91.23867069	52.99145299	52.38095238	85.15151515	-53.24982576	-91.88465799
Epochs 80	0.611764729	12.5	8.547008547	91.17647059	55.76923077	55.55555556	84.71849866	-26.28254558	-91.88465799
Epochs 100	0.636974812	11.81818182	6.818181818	90.68010076	55.04587156	53.40909091	83.62720403	-53.79053138	-91.88465799
Epochs 120	0.72100842	17.72151899	7.246376812	91.72259508	59.49367089	53.62318841	84.97757848	-13.64927183	-91.88465799
Epochs 140	0.756302536	17.46031746	10.16949153	91.54334038	53.96825397	57.62711864	84.11016949	-30.95951136	-91.88465799
Epochs 160	0.78319329	19.29824561	12.24489796	91.8200409	57.89473684	57.14285714	84.42622951	-37.90029951	-91.88465799
Epochs 180	0.796638668	18.96551724	10.81081081	91.8	55.17241379	54.05405405	84.56913828	-21.64864175	-91.88465799
Epochs 200	0.806722701	20	11.11111111	91.55206287	50	52.77777778	84.05511811	-43.64934323	-91.88465799
Full Cycle test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.266085058	6.401766004	8.43373494	90.23255814	45.57522124	48.59437751	80.93023256	-19.36613073	-96.00669322
Epochs 40	0.42966193	8.974358974	9.745762712	92.95392954	52.41157556	50.42372881	85.90785908	-63.04861078	-96.00669322
Epochs 60	0.55070883	8.547008547	10.6741573	92.27722772	52.99145299	51.12359551	86.30952381	-24.5957226	-96.00669322
Epochs 80	0.627044737	8.910891089	11.38211382	91.72297297	54.72636816	51.2195122	86.14864865	-80.68405012	-96.00669322
Epochs 100	0.651035964	8.415841584	7.407407407	90.5362776	53.73134328	49.38271605	85.01577287	-73.01936547	-96.00669322
Epochs 120	0.725190818	9.420289855	4.918032787	90.38997214	50.3649635	49.18032787	84.12256267	-92.46463229	-96.00669322
Epochs 140	0.744820058	10.83333333	4.918032787	90.625	47.89915966	47.54098361	84.10326087	-91.87070563	-96.00669322
Epochs 160	0.784078538	12.22222222	5.882352941	90.85051546	49.43820225	49.01960784	84.53608247	-91.27025419	-96.00669322
Epochs 180	0.780806959	10.37735849	2.941176471	90.6048906	49.52380952	41.17647059	84.2985843	-92.3004539	-96.00669322
Epochs 200	0.784078538	8.510638298	2.702702703	90.3307888	46.23655914	40.54054054	83.96946565	-94.55124725	-96.00669322

Table 15-10 Distribution Phase Data Trained LSTM Model Results

LSTM Mark Down Phase Model									
Accumulation Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.608870983	6	5	92.40506329	42	45	85.98726115	-9.89928279	82.55793694
Epochs 40	0.467741936	10.41666667	3.571428571	93.10344828	46.80851064	48.80952381	82.75862069	208.3197631	82.55793694
Epochs 60	0.584677398	11.11111111	1.639344262	92.71523179	51.42857143	44.26229508	82.1192053	162.5370613	82.55793694
Epochs 80	0.645161271	12.90322581	2	92.81437126	54.83870968	46	83.13253012	767.4744526	82.55793694
Epochs 100	0.729838729	21.73913043	2.564102564	94.08602151	60.86956522	46.15384615	83.78378378	727.6594797	82.55793694
Epochs 120	0.782258093	14.28571429	3.571428571	92.7184466	57.14285714	53.57142857	82.92682927	122.2093233	82.55793694
Epochs 140	0.790322602	17.64705882	0	92.78846154	58.82352941	47.82608696	83.09178744	-0.69122645	82.55793694
Epochs 160	0.82661289	9.090909091	0	92.30769231	63.63636364	50	82.72727273	-4.764837604	82.55793694
Epochs 180	0.850806475	14.28571429	0	92.51101322	57.14285714	57.14285714	82.74336283	20.99769509	82.55793694
Epochs 200	0.834677398	0	0	92	50	58.82352941	82.58928571	20.99769509	82.55793694
Mark-up Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.648401797	2.173913043	9.523809524	91.44736842	42.22222222	57.14285714	86.84210526	205.5104342	255.7316817
Epochs 40	0.493150681	7.317073171	9.722222222	92.45283019	58.53658537	50.70422535	83.96226415	588.0526932	255.7316817
Epochs 60	0.616438329	9.677419355	12.72727273	93.98496241	58.06451613	59.25925926	84.96240602	328.8585157	255.7316817
Epochs 80	0.680365324	12	14.89361702	94.55782313	56	56.52173913	86.39455782	134.5387488	255.7316817
Epochs 100	0.726027369	11.76470588	14.63414634	93.78881988	58.82352941	55	85.71428571	147.1220292	255.7316817
Epochs 120	0.780821919	14.28571429	18.75	94.21965318	71.42857143	54.83870968	86.70520231	255.9578487	255.7316817
Epochs 140	0.853881299	25	25	94.2408377	62.5	65	87.36842105	577.7835663	255.7316817
Epochs 160	0.867579937	0	23.07692308	92.57425743	50	61.53846154	86.06965174	53.15721392	255.7316817
Epochs 180	0.876712322	33.33333333	10	92.23300971	66.66666667	50	85.36585366	62.32520454	255.7316817
Epochs 200	0.876712322	33.33333333	10	92.23300971	66.66666667	50	85.36585366	62.32520454	255.7316817
Distribution Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.61063832	7.339449541	8.620689655	90.4290429	47.70642202	38.59649123	83.49834983	16.62816658	-35.06524102
Epochs 40	0.438297868	10.44776119	5.384615385	89.80582524	53.73134328	59.68992248	83.49514563	14774.26788	-35.06524102
Epochs 60	0.572340429	12.5	6.18556701	90.61371841	55.20833333	64.94845361	85.50724638	1010.39704	-35.06524102
Epochs 80	0.648936152	13.51351351	6.493506494	90.90909091	50	64.93506494	85.22012579	815.4206444	-35.06524102
Epochs 100	0.682978749	11.29032258	7.462686567	90.61583578	50	59.70149254	84.41176471	91.09036435	-35.06524102
Epochs 120	0.740425527	10.41666667	8.333333333	90.64171123	54.16666667	66.66666667	84.18230563	643.9978216	-35.06524102
Epochs 140	0.768085122	11.11111111	6.976744186	90.5370844	58.33333333	65.11627907	84.1025641	674.5064602	-35.06524102
Epochs 160	0.802127659	11.11111111	6.060606061	90.73170732	59.25925926	66.66666667	84.59657702	601.2352444	-35.06524102
Epochs 180	0.819148958	5.263157895	7.142857143	90.30732861	57.89473684	71.42857143	84.5971564	1511.292932	-35.06524102
Epochs 200	0.836170197	16.66666667	8	90.86651054	66.66666667	76	85.21126761	16741.94967	-35.06524102
Mark-down Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.521582723	7.142857143	12.12121212	91.15646259	44.32989691	57.57575758	83.67346939	-93.59933723	-97.60414084
Epochs 40	0.456834525	9.782608696	10.9375	90.98360656	48.91304348	56.25	84.29752066	-93.7999357	-97.60414084
Epochs 60	0.568345308	9.523809524	11.32075472	90.12345679	52.38095238	62.26415094	84.47204969	-90.74085759	-97.60414084
Epochs 80	0.636690676	12.24489796	7.142857143	89.83957219	53.06122449	61.9047619	84.94623656	-93.83246173	-97.60414084

Epochs 100	0.676258981	9.523809524	9.090909091	89.16256158	50	66.66666667	83.16831683	-96.98890228	-97.60414084
Epochs 120	0.730215847	9.090909091	4.761904762	88.83928571	48.48484848	71.42857143	83.40807175	-96.81222289	-97.60414084
Epochs 140	0.769784153	5	5.263157895	88.70292887	55	68.42105263	82.77310924	-85.945881	-97.60414084
Epochs 160	0.805755377	6.666666667	7.142857143	89.15662651	60	71.42857143	82.66129032	-96.22632462	-97.60414084
Epochs 180	0.823741019	11.11111111	6.666666667	89.37007874	55.55555556	73.33333333	83.00395257	-9.137246353	-97.60414084
Epochs 200	0.805755377	8.333333333	5.882352941	89.15662651	58.33333333	70.58823529	83.06451613	-23.51558409	-97.60414084
Bull Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.730769217	12.5	2.941176471	90.36144578	37.5	50	84.24242424	104.9234168	678.7940879
Epochs 40	0.413461536	14.28571429	6.18556701	91.56626506	53.57142857	48.95833333	85.54216867	388.2934365	678.7940879
Epochs 60	0.557692289	9.523809524	7.352941176	91.59663866	42.85714286	57.35294118	84.74576271	418.6376357	678.7940879
Epochs 80	0.610576928	0	7.01754386	90.44117647	26.66666667	52.63157895	85.18518519	253.725478	678.7940879
Epochs 100	0.668269217	0	4.347826087	90.13157895	40	50	84.76821192	88.38733462	678.7940879
Epochs 120	0.725961566	0	5.405405405	90.85365854	0	51.35135135	84.66257669	81.25619511	678.7940879
Epochs 140	0.730769217	0	5.714285714	90.90909091	0	48.57142857	84.75609756	81.25619511	678.7940879
Epochs 160	0.778846145	0	4.166666667	90.4494382	0	50	84.74576271	39.67385489	678.7940879
Epochs 180	0.798076928	0	4.761904762	90.65934066	0	52.38095238	85.08287293	20.8197197	678.7940879
Epochs 200	0.788461566	0	4.347826087	90.55555556	20	52.17391304	84.91620112	24.1486827	678.7940879
Bear Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.54285717	10.05586592	10.52631579	91.90031153	49.72067039	53.68421053	84.6875	70.88381224	-91.88465799
Epochs 40	0.482352942	16.78321678	10.5	96.03174603	61.53846154	55	87.25099602	684.9704877	-91.88465799
Epochs 60	0.591596663	20.53571429	13.85542169	96.52996845	66.07142857	57.8313253	87.34177215	858.8269787	-91.88465799
Epochs 80	0.687394977	25.84269663	17.55725191	96.8	65.16853933	60.30534351	87.70053476	802.296369	-91.88465799
Epochs 100	0.746218503	30.26315789	20	96.61835749	64.47368421	58.0952381	87.65133172	1398.852578	-91.88465799
Epochs 120	0.818487406	37.09677419	27.63157895	96.93654267	70.96774194	68.42105263	89.03508772	2909.403406	-91.88465799
Epochs 140	0.853781521	45.09803922	31.81818182	97.07112971	74.50980392	69.6969697	89.3081761	4781.963336	-91.88465799
Epochs 160	0.892436981	57.5	38.46153846	97.01789264	82.5	76.92307692	88.84462151	14843.95225	-91.88465799
Epochs 180	0.912605047	70.96774194	42.55319149	96.90522244	87.09677419	78.72340426	88.95348837	11326.44502	-91.88465799
Epochs 200	0.910924375	61.76470588	46.51162791	96.71814672	85.29411765	79.06976744	88.78143133	12139.71592	-91.88465799
Full Cycle test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.558342397	6.439393939	11.71875	91.42857143	45.45454545	53.125	84.16030534	384.0269117	-96.00669322
Epochs 40	0.479825526	11.8852459	10.60606061	93.64303178	54.32098765	52.27272727	85.57457213	-64.32749586	-96.00669322
Epochs 60	0.613958538	13.96648045	13.47150259	93.94495413	58.98876404	52.33160622	86.60550459	-56.67601247	-96.00669322
Epochs 80	0.694656491	16.66666667	17.12328767	94.52495974	57.71812081	57.53424658	87.76167472	-60.9074206	-96.00669322
Epochs 100	0.761177778	20.33898305	20.37037037	94.35600579	58.97435897	60.18518519	87.40955137	115.4583261	-96.00669322
Epochs 120	0.811341345	23.40425532	25.97402597	94.10187668	63.44086022	62.33766234	87.66756032	322.3693189	-96.00669322
Epochs 140	0.842966199	26.66666667	31.74603175	94.09499358	63.51351351	73.01587302	87.80487805	316.9327059	-96.00669322
Epochs 160	0.873500526	32.75862069	38.63636364	93.86503067	65.51724138	75	87.59213759	382.0595357	-96.00669322
Epochs 180	0.886586666	38	42.85714286	94.06060606	66	76.19047619	87.62135922	236.5403055	-96.00669322
Epochs 200	0.886586666	38	42.5	93.95405079	68	77.5	87.53026634	324.8805237	-96.00669322

Table 15-11 Mark Down Phase Data Trained LSTM Model Results

LSTM Bull Phase Model									
Accumulation Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.580645144	12	7.142857143	94.36619718	52	47.27272727	85.21126761	522.8310743	82.55793694
Epochs 40	0.435483873	12.22222222	6.25	98.93617021	52.22222222	51.5625	87.09677419	670.7736688	82.55793694
Epochs 60	0.495967746	13.69863014	6.25	98.1981982	52.05479452	56.25	90	198.6271963	82.55793694
Epochs 80	0.564516127	16.94915254	8.196721311	97.65625	52.54237288	62.29508197	88.18897638	416.7056228	82.55793694
Epochs 100	0.629032254	20.40816327	7.692307692	96.59863946	57.14285714	61.53846154	86.30136986	1080.735763	82.55793694
Epochs 120	0.689516127	18.18181818	8.888888889	94.70588235	57.57575758	60	85.20710059	1298.976844	82.55793694
Epochs 140	0.741935492	17.85714286	11.42857143	94.59459459	60.71428571	60	84.7826087	2264.341324	82.55793694
Epochs 160	0.745967746	12.5	11.76470588	93.68421053	58.33333333	61.76470588	83.5978836	2110.120945	82.55793694
Epochs 180	0.77822578	5.263157895	14.81481481	93.06930693	52.63157895	59.25925926	82.58706468	975.4472956	82.55793694
Epochs 200	0.818548381	6.25	20	93.39622642	43.75	60	83.41232227	154.5617342	82.55793694
Mark-up Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.561643839	9.433962264	9.090909091	93.44262295	57.69230769	50	86.8852459	147.7849724	255.7316817
Epochs 40	0.515981734	9.375	13.7254902	96.15384615	52.38095238	54.90196078	86.53846154	41.39583586	255.7316817
Epochs 60	0.616438329	9.615384615	20	96.06299213	52.94117647	60	88.18897638	81.626754	255.7316817
Epochs 80	0.671232879	11.11111111	22.85714286	96.4028777	56.81818182	60	87.76978417	124.3534141	255.7316817
Epochs 100	0.712328792	10.25641026	18.18181818	93.67088608	57.89473684	59.09090909	86.07594937	225.4360813	255.7316817
Epochs 120	0.780821919	14.28571429	14.28571429	93.22033898	66.66666667	57.14285714	85.87570621	798.3534298	255.7316817
Epochs 140	0.812785387	11.11111111	9.090909091	92.10526316	70.58823529	45.45454545	85.26315789	1092.254122	255.7316817
Epochs 160	0.831050217	11.76470588	20	92.70833333	75	70	85.41666667	963.8033553	255.7316817
Epochs 180	0.840182662	14.28571429	0	91.91919192	76.92307692	57.14285714	84.84848485	963.8033553	255.7316817
Epochs 200	0.858447492	18.18181818	0	92.07920792	70	50	85.14851485	1001.189498	255.7316817
Distribution Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.5	10.52631579	9.574468085	93.75	48.68421053	43.61702128	85.20179372	17548.51108	-35.06524102
Epochs 40	0.329787225	8.556149733	7.142857143	90.20979021	49.73262032	51.07913669	81.81818182	696.3584711	-35.06524102
Epochs 60	0.417021275	7.692307692	6.086956522	88.94472362	50	50.87719298	80.90452261	1464.548761	-35.06524102
Epochs 80	0.480851054	7.086614173	6.542056075	88.98305085	51.18110236	52.3364486	81.70212766	2756.44858	-35.06524102
Epochs 100	0.55531913	5.607476636	6.097560976	88.96797153	53.27102804	51.2195122	82.14285714	3062.592638	-35.06524102
Epochs 120	0.629787207	7.058823529	5.970149254	89.93710692	57.64705882	47.76119403	83.59621451	2833.01595	-35.06524102
Epochs 140	0.687234044	7.462686567	5.555555556	90.25787966	61.19402985	48.14814815	84.1954023	2034.898165	-35.06524102
Epochs 160	0.695744693	6.349206349	5.660377358	90.39548023	57.14285714	52.83018868	84.13597734	934.6969201	-35.06524102
Epochs 180	0.725531936	8	5.769230769	90.76086957	60	50	84.19618529	1241.549796	-35.06524102
Epochs 200	0.748936176	9.090909091	4.651162791	90.33942559	68.18181818	48.8372093	84.03141361	261.3337592	-35.06524102
Mark-down Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.467625886	8.333333333	12.5	89.23076923	48.59813084	42.5	83.07692308	-95.15127286	-97.60414084
Epochs 40	0.384892076	8.955223881	7.317073171	89.32038835	48.12030075	43.90243902	84.46601942	-96.11105677	-97.60414084
Epochs 60	0.510791361	9.473684211	5.555555556	89.11564626	48.93617021	44.44444444	84.3537415	-95.05896162	-97.60414084
Epochs 80	0.593525171	7.042253521	7.142857143	88.26815642	52.85714286	50	83.79888268	-96.70833119	-97.60414084

Epochs 100	0.640287757	6.779661017	8	88.65979381	55.17241379	52	83.50515464	-96.51727838	-97.60414084
Epochs 120	0.697841704	8.333333333	10	89.52380952	58.33333333	50	84.21052632	-96.79242254	-97.60414084
Epochs 140	0.766187072	11.42857143	8.333333333	90.04329004	57.14285714	33.33333333	83.91304348	-97.02381371	-97.60414084
Epochs 160	0.769784153	11.11111111	11.11111111	89.69957082	58.33333333	44.44444444	84.05172414	-96.37008461	-97.60414084
Epochs 180	0.784172654	0	0	88.25910931	39.13043478	37.5	82.11382114	-96.52115282	-97.60414084
Epochs 200	0.787769794	0	0	88.30645161	36.36363636	37.5	81.78137652	-96.52115282	-97.60414084
Bull Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.644230783	8.823529412	8.823529412	91.42857143	58.82352941	55.88235294	85.61151079	29.33881269	678.7940879
Epochs 40	0.379807681	8.620689655	5.633802817	88.60759494	53.44827586	50.70422535	80.76923077	382.0582999	678.7940879
Epochs 60	0.447115391	7.317073171	5.714285714	88.65979381	56.09756098	48.57142857	82.29166667	329.6658832	678.7940879
Epochs 80	0.514423072	9.375	6.153846154	90.09009009	53.125	47.69230769	83.63636364	76.70866902	678.7940879
Epochs 100	0.538461566	10	3.448275862	89.16666667	53.33333333	44.82758621	82.35294118	72.93175921	678.7940879
Epochs 120	0.625	13.04347826	4.255319149	90.57971014	52.17391304	44.68085106	83.94160584	2845.300249	678.7940879
Epochs 140	0.677884638	9.090909091	3.03030303	90.19607843	45.45454545	45.45454545	83.55263158	4575.939031	678.7940879
Epochs 160	0.697115362	9.090909091	3.448275862	90.44585987	45.45454545	48.27586207	83.97435897	4111.548111	678.7940879
Epochs 180	0.735576928	5.882352941	4.166666667	90.41916168	41.17647059	50	83.73493976	161.6264072	678.7940879
Epochs 200	0.783653855	6.666666667	6.25	90.96045198	40	50	84.65909091	171.7892905	678.7940879
Bear Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.512605071	9.756097561	9.090909091	92.64214047	43.90243902	44.6969697	84.56375839	-22.02222137	-91.88465799
Epochs 40	0.374789923	9.322033898	6.666666667	91.38755981	50.21276596	52.66666667	82.77511962	-41.06807508	-91.88465799
Epochs 60	0.455462188	10.05291005	7.746478873	91.28787879	52.65957447	54.22535211	82.57575758	-26.37062205	-91.88465799
Epochs 80	0.526050448	8.108108108	9.160305344	91.4556962	47.2972973	56.48854962	82.22222222	-85.45814353	-91.88465799
Epochs 100	0.588235319	7.56302521	9.649122807	91.16022099	45.37815126	54.38596491	83.10249307	-61.1498886	-91.88465799
Epochs 120	0.645378172	6.930693069	10.86956522	91.29353234	47.52475248	55.43478261	83.79052369	-66.71904153	-91.88465799
Epochs 140	0.707563043	10.25641026	10.81081081	91.4221219	52.56410256	58.10810811	83.71040724	-65.57193834	-91.88465799
Epochs 160	0.727731109	11.76470588	12.5	91.42857143	51.47058824	59.72222222	83.92070485	-41.91456138	-91.88465799
Epochs 180	0.756302536	13.79310345	11.29032258	91.57894737	53.44827586	61.29032258	84.17721519	-87.03787106	-91.88465799
Epochs 200	0.771428585	13.46153846	11.32075472	91.02040816	50	64.1509434	83.6400818	-95.07085837	-91.88465799
Full Cycle test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.503816783	8.802816901	6.586826347	91.41630901	50.17667845	47.90419162	83.26180258	-81.92867052	-96.00669322
Epochs 40	0.392584503	8.785529716	9	93.33333333	48.96373057	49.5	86.06060606	-88.70251464	-96.00669322
Epochs 60	0.484187573	8.805031447	8.928571429	93.03944316	48.58044164	48.21428571	86.07888631	-82.02374179	-96.00669322
Epochs 80	0.56052345	9.022556391	10.29411765	92.42718447	51.32075472	48.52941176	86.01941748	-92.02326965	-96.00669322
Epochs 100	0.629225731	9.545454545	11.00917431	92.5170068	51.14155251	52.29357798	85.37414966	-95.29507311	-96.00669322
Epochs 120	0.704471111	10.65088757	10.95890411	91.85185185	53.57142857	47.94520548	84.88888889	-97.63839541	-96.00669322
Epochs 140	0.740458012	12.4137931	7.272727273	91.63179916	53.79310345	50.90909091	84.91620112	-90.18807034	-96.00669322
Epochs 160	0.754634678	13.07692308	5.660377358	91.55313351	53.07692308	49.05660377	84.72032742	-96.8964954	-96.00669322
Epochs 180	0.779716492	14.41441441	8.163265306	91.80977543	54.05405405	53.06122449	85.05291005	-95.18297253	-96.00669322
Epochs 200	0.788440585	13.7254902	8.695652174	91.67750325	51.96078431	54.34782609	85.02604167	-95.23099833	-96.00669322

Table 15-12 Bull Phase Data Trained LSTM Model Results

LSTM Bear Phase Model									
Accumulation Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.375	8.571428571	3.571428571	94.25287356	40.95238095	42.85714286	83.72093023	-23.47163838	82.55793694
Epochs 40	0.383064508	14.03508772	4.807692308	94.25287356	47.36842105	48.07692308	80.23255814	943.3717338	82.55793694
Epochs 60	0.42338711	12.76595745	2.083333333	92.38095238	48.93617021	44.79166667	76.92307692	80.88672205	82.55793694
Epochs 80	0.52822578	6.666666667	1.315789474	90.14084507	50	43.42105263	77.30496454	-10.27897381	82.55793694
Epochs 100	0.564516127	6.896551724	0	90.19607843	51.72413793	42.42424242	78.28947368	29.76537018	82.55793694
Epochs 120	0.657258093	9.523809524	0	91.47727273	52.38095238	41.17647059	80	374.1478802	82.55793694
Epochs 140	0.685483873	5.555555556	0	90.86021505	50	43.18181818	80	-61.17315983	82.55793694
Epochs 160	0.717741907	5.882352941	0	91.2371134	52.94117647	45.94594595	80.31088083	-20.96413586	82.55793694
Epochs 180	0.745967746	8.333333333	0	91.54228856	50	42.85714286	81	-18.54509592	82.55793694
Epochs 200	0.786290348	8.333333333	0	91.94312796	50	36	81.9047619	-63.16837203	82.55793694
Mark-up Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.465753436	7.446808511	11.11111111	93.87755102	49.46236559	51.85185185	87.75510204	86.89056041	255.7316817
Epochs 40	0.424657524	10	11.53846154	96.2962963	61.01694915	51.28205128	85.18518519	9217.682376	255.7316817
Epochs 60	0.502283096	12.24489796	12.5	96.93877551	64.58333333	54.16666667	87.75510204	10224.29263	255.7316817
Epochs 80	0.639269412	15.38461538	12.76595745	96.2406015	61.53846154	53.19148936	87.87878788	47068.60779	255.7316817
Epochs 100	0.689497709	14.28571429	15.78947368	95.89041096	62.85714286	52.63157895	88.96551724	19518.57187	255.7316817
Epochs 120	0.712328792	11.53846154	15.78947368	94.83870968	56	52.63157895	86.4516129	17552.79308	255.7316817
Epochs 140	0.739726007	11.11111111	14.81481481	93.93939394	61.53846154	55.55555556	86.06060606	31671.53262	255.7316817
Epochs 160	0.789954364	12	14.28571429	93.33333333	62.5	57.14285714	86.66666667	38765.89581	255.7316817
Epochs 180	0.79908675	9.090909091	15.38461538	92.93478261	66.66666667	61.53846154	86.41304348	32601.16457	255.7316817
Epochs 200	0.789954364	0	13.33333333	91.93548387	58.82352941	60	85.48387097	791.8716272	255.7316817
Distribution Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.404255331	7.174887892	6.896551724	89.94708995	41.70403587	40.35087719	85.71428571	-0.48838941	-35.06524102
Epochs 40	0.351063818	9.615384615	6.329113924	89.74358974	48.71794872	53.50318471	84.61538462	263.1694765	-35.06524102
Epochs 60	0.46808511	11.42857143	6.802721088	90.82568807	50.47619048	50.68493151	87.1559633	23758.38807	-35.06524102
Epochs 80	0.64255321	11.11111111	7.777777778	90.85173502	52.38095238	49.43820225	86.11987382	31796.71367	-35.06524102
Epochs 100	0.710638285	10.41666667	7.692307692	90.75630252	50	50.76923077	86.23595506	4345.490601	-35.06524102
Epochs 120	0.755319178	8.823529412	10.71428571	91.05263158	38.23529412	53.57142857	85.75197889	114.8827447	-35.06524102
Epochs 140	0.782978714	6.451612903	11.9047619	90.93198992	45.16129032	54.76190476	85.1010101	32.57734082	-35.06524102
Epochs 160	0.817021251	4.347826087	15.625	91.08433735	47.82608696	53.125	85.26570048	-35.51570901	-35.06524102
Epochs 180	0.821276605	4	17.85714286	91.12709832	44	53.57142857	85.33653846	87.22354599	-35.06524102
Epochs 200	0.836170197	9.090909091	16.66666667	91.27358491	45.45454545	54.16666667	85.57919622	58.3205343	-35.06524102
Mark-down Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.312949628	6	7.317073171	86.20689655	40.26845638	43.90243902	80.45977011	-95.9996004	-97.60414084
Epochs 40	0.384892076	10.30927835	11.62790698	91.57894737	51.04166667	52.3255814	84.21052632	-93.75747998	-97.60414084
Epochs 60	0.460431665	12.65822785	11.11111111	92.37288136	50	54.32098765	84.74576271	-89.24477885	-97.60414084
Epochs 80	0.58273381	13.33333333	9.259259259	90.85365854	47.45762712	51.85185185	84.75609756	-93.37229938	-97.60414084

Epochs 100	0.640287757	14.81481481	7.5	90.76086957	52.83018868	52.5	84.23913043	-93.98650204	-97.60414084
Epochs 120	0.683453262	17.94871795	5.128205128	90.5	50	46.15384615	84.5	-92.08840119	-97.60414084
Epochs 140	0.726618707	16.66666667	3.333333333	89.90825688	50	50	83.41013825	-71.01845547	-97.60414084
Epochs 160	0.74820143	14.28571429	0	89.47368421	48.14814815	50	83.33333333	-71.13572177	-97.60414084
Epochs 180	0.773381293	16.66666667	0	89.78723404	56.52173913	47.36842105	83.40425532	-69.26642094	-97.60414084
Epochs 200	0.787769794	16.66666667	0	89.958159	52.17391304	53.33333333	83.26359833	-75.87168297	-97.60414084
Bull Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.576923072	8	8.333333333	92.62295082	42	52.77777778	86.7768595	313.4926967	678.7940879
Epochs 40	0.25	10.20408163	5.982905983	95.23809524	57.14285714	46.55172414	88.0952381	268.9884941	678.7940879
Epochs 60	0.302884609	8.571428571	6.034482759	92.98245614	51.42857143	47.82608696	89.47368421	260.2853441	678.7940879
Epochs 80	0.466346145	4.545454545	7.777777778	92.70833333	54.54545455	51.68539326	88.54166667	131.3990667	678.7940879
Epochs 100	0.557692289	5.263157895	9.333333333	94.73684211	52.63157895	53.33333333	88.49557522	156.0017841	678.7940879
Epochs 120	0.625	11.11111111	10.29411765	93.12977099	66.66666667	50	88.46153846	89.0744115	678.7940879
Epochs 140	0.692307711	11.11111111	11.53846154	93.19727891	77.77777778	51.92307692	88.35616438	1459.270201	678.7940879
Epochs 160	0.721153855	14.28571429	10.86956522	92.90322581	85.71428571	52.17391304	87.66233766	108.5632346	678.7940879
Epochs 180	0.740384638	12.5	10.52631579	91.97530864	100	52.63157895	86.95652174	1768.857814	678.7940879
Epochs 200	0.764423072	14.28571429	11.76470588	92.21556886	100	50	86.74698795	125.0044911	678.7940879
Bear Phase test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.400000006	7.913669065	10.52631579	92.79279279	47.29241877	53.68421053	85.13513514	14.53368927	-91.88465799
Epochs 40	0.35630253	9.625668449	7.87037037	92.1875	54.01069519	50.46296296	83.2460733	-82.03869623	-91.88465799
Epochs 60	0.428571433	7.843137255	8.29015544	91.16465863	54.24836601	49.22279793	81.85483871	-63.53021166	-91.88465799
Epochs 80	0.547899187	8.910891089	7.051282051	90.53254438	49.5049505	50	82.4925816	-54.07655568	-91.88465799
Epochs 100	0.593277335	9.090909091	6.451612903	90.32258065	49.49494949	48.38709677	82.21024259	-82.28645628	-91.88465799
Epochs 120	0.628571451	8.333333333	5.833333333	89.57816377	45.83333333	48.33333333	82.33830846	-74.79420832	-91.88465799
Epochs 140	0.687394977	8.333333333	7.291666667	90.43280182	40	46.875	83.78995434	-85.2926737	-91.88465799
Epochs 160	0.729411781	4.444444444	8.860759494	90.23354565	37.77777778	49.36708861	83.40425532	-88.80773315	-91.88465799
Epochs 180	0.754621863	5.714285714	8.333333333	90.36885246	34.28571429	48.61111111	83.16221766	-79.86118774	-91.88465799
Epochs 200	0.773109257	5.263157895	10	90.94567404	31.57894737	46.66666667	83.66935484	-87.21582724	-91.88465799
Full Cycle test Data	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.338058889	6.160164271	12.05673759	91.00346021	43.32648871	51.06382979	83.68055556	78.54982589	-96.00669322
Epochs 40	0.377317339	9.060402685	8.108108108	91.33126935	48.65771812	48.31081081	85.0931677	-84.7488872	-96.00669322
Epochs 60	0.474372953	9.170305677	9.36329588	92.39904988	50.21834061	50.93632959	85.71428571	-90.97533442	-96.00669322
Epochs 80	0.591057777	8.588957055	9.183673469	91.39784946	49.69325153	50	85.63734291	-93.21646477	-96.00669322
Epochs 100	0.670665205	9.090909091	10.56338028	91.44634526	47.72727273	51.4084507	85.66978193	-91.13697595	-96.00669322
Epochs 120	0.691384971	8.928571429	9.701492537	91.05812221	51.78571429	48.50746269	85.67164179	-86.47612912	-96.00669322
Epochs 140	0.744820058	10.46511628	11.32075472	91.31034483	54.65116279	48.11320755	85.63535912	-73.82825745	-96.00669322
Epochs 160	0.777535439	10	10.97560976	91.11111111	55.71428571	45.12195122	85.47120419	-78.9120966	-96.00669322
Epochs 180	0.785169005	13.04347826	10.25641026	91.2987013	56.52173913	47.43589744	85.5656697	-81.06492635	-96.00669322
Epochs 200	0.797164679	13.1147541	7.575757576	90.88607595	52.45901639	46.96969697	84.91761724	-81.83138891	-96.00669322

Table 15-13 Bear Phase Data Trained LSTM Model Results

LSTM Full Cycle Model									
Accumulation Phase test Data	Test_accuracy	correct_buys	correct_sells	correct_holds	correct_low_buys	correct_high_sells	correct_mid_holds	Profit gained	buy_n_hold profit
Epochs 20	0.391129047	8.474576271	4.761904762	96.59090909	44.06779661	45.23809524	86.20689655	-18.98806749	82.55793694
Epochs 40	0.524193525	10.90909091	4.615384615	94.53125	45.45454545	53.84615385	85.03937008	198.7611427	82.55793694
Epochs 60	0.584677398	12.76595745	3.50877193	95.13888889	48.93617021	50.87719298	85.31468531	88.35778937	82.55793694
Epochs 80	0.612903237	10.25641026	3.773584906	93.58974359	46.15384615	47.16981132	83.87096774	856.9402224	82.55793694
Epochs 100	0.665322602	8.823529412	2.5	92.52873563	47.05882353	50	83.8150289	618.2947832	82.55793694
Epochs 120	0.737903237	10.34482759	0	92.78350515	51.72413793	56	83.93782383	705.3885636	82.55793694
Epochs 140	0.770161271	7.692307692	0	92.64705882	42.30769231	50	82.75862069	1308.191495	82.55793694
Epochs 160	0.774193525	8.695652174	0	92.68292683	39.13043478	60	82.84313725	1257.380862	82.55793694
Epochs 180	0.818548381	8.333333333	0	92.23744292	41.66666667	58.82352941	83.02752294	1583.714221	82.55793694
Epochs 200	0.818548381	10	0	92.23744292	30	52.63157895	83.02752294	766.9447892	82.55793694
Mark-up Phase test Data	Test_accuracy	correct_buys	correct_sells	correct_holds	correct_low_buys	correct_high_sells	correct_mid_holds	Profit gained	buy_n_hold profit
Epochs 20	0.324200898	5.172413793	10.81081081	92.42424242	50.43478261	56.75675676	84.84848485	708.841119	255.7316817
Epochs 40	0.602739751	5.128205128	16	93.84615385	52.63157895	58	87.69230769	123.1185334	255.7316817
Epochs 60	0.625570774	5.405405405	15.55555556	93.43065693	44.44444444	53.33333333	86.86131387	156.1884175	255.7316817
Epochs 80	0.616438329	5.128205128	13.95348837	92.70072993	47.36842105	44.18604651	86.13138686	254.8683618	255.7316817
Epochs 100	0.716894984	8.333333333	14.70588235	93.16770186	50	50	86.25	298.6779872	255.7316817
Epochs 120	0.767123282	10	16	93.10344828	55	52	86.12716763	1963.140782	255.7316817
Epochs 140	0.780821919	11.11111111	16.66666667	93.22033898	50	50	86.36363636	1529.053376	255.7316817
Epochs 160	0.776255727	12.5	14.81481481	93.18181818	50	44.44444444	85.71428571	1195.293075	255.7316817
Epochs 180	0.79908675	13.33333333	17.39130435	93.37016575	60	47.82608696	86.11111111	2019.208114	255.7316817
Epochs 200	0.803652942	16.66666667	16	93.40659341	58.33333333	52	86.1878453	1855.581501	255.7316817
Distribution Phase test Data	Test_accuracy	correct_buys	correct_sells	correct_holds	correct_low_buys	correct_high_sells	correct_mid_holds	Profit gained	buy_n_hold profit
Epochs 20	0.361702114	7.203389831	10.66666667	91.19496855	43.82978723	50.66666667	86.16352201	341.0056988	-35.06524102
Epochs 40	0.548936188	9.278350515	5	89.37728938	55.67010309	54.54545455	84.24908425	2935.93837	-35.06524102
Epochs 60	0.61914891	5.555555556	7.228915663	89.20634921	54.16666667	58.53658537	83.49206349	881.823551	-35.06524102
Epochs 80	0.651063859	5.555555556	7.462686567	89.72809668	52.77777778	54.54545455	84.29003021	564.3597883	-35.06524102
Epochs 100	0.685106397	7.8125	5.263157895	89.9713467	53.125	57.14285714	84.52722063	460.1430921	-35.06524102
Epochs 120	0.719148934	6.779661017	6.818181818	90.19073569	50.84745763	50	84.42622951	205.2513097	-35.06524102
Epochs 140	0.721276581	6.557377049	5.128205128	90	49.18032787	51.28205128	84.01084011	121.0975079	-35.06524102
Epochs 160	0.731914878	8.771929825	7.317073171	90.32258065	52.63157895	48.7804878	83.82749326	-44.95904667	-35.06524102
Epochs 180	0.774468064	7.5	8.823529412	90.4040404	52.5	52.94117647	83.79746835	42.81120735	-35.06524102
Epochs 200	0.782978714	6.25	8.333333333	90.29850746	46.875	52.77777778	84.03990025	43.02857467	-35.06524102
Mark-down Phase test Data	Test_accuracy	correct_buys	correct_sells	correct_holds	correct_low_buys	correct_high_sells	correct_mid_holds	Profit gained	buy_n_hold profit
Epochs 20	0.374100715	8.510638298	13.95348837	91.4893617	46.42857143	58.13953488	81.91489362	-95.05212057	-97.60414084
Epochs 40	0.507194221	10.46511628	13.79310345	92.53731343	55.29411765	53.44827586	86.56716418	-91.91669359	-97.60414084
Epochs 60	0.593525171	8.955223881	15.90909091	91.01796407	46.96969697	61.36363636	85.02994012	-92.55609165	-97.60414084
Epochs 80	0.622302175	9.523809524	9.375	89.61748634	46.77419355	56.25	83.60655738	-91.87823054	-97.60414084
Epochs 100	0.679856122	10	4.347826087	89.26829268	46	52.17391304	83.33333333	-91.81864343	-97.60414084

Epochs 120	0.712230206	11.11111111	5.263157895	89.71962617	42.22222222	42.10526316	84.50704225	-95.964081	-97.60414084
Epochs 140	0.733812928	13.95348837	6.25	89.9543379	46.51162791	50	83.94495413	-94.55493534	-97.60414084
Epochs 160	0.737410069	15.38461538	5.263157895	90	43.58974359	47.36842105	84.47488584	-94.44259367	-97.60414084
Epochs 180	0.766187072	10.71428571	0	88.98305085	35.71428571	42.85714286	83.40425532	-96.15427581	-97.60414084
Epochs 200	0.762589931	8.333333333	0	88.60759494	33.33333333	35.29411765	82.62711864	-96.44631622	-97.60414084
Bull Phase test Data	Test_accuracy	correct_buys	correct_sells	correct_holds	correct_low_buys	correct_high_sells	correct_mid_holds	Profit gained	buy_n_hold profit
Epochs 20	0.504807711	9.259259259	11.11111111	94	42.59259259	59.25925926	89.8989899	870.8669601	678.7940879
Epochs 40	0.514423072	17.24137931	8.974358974	94.05940594	51.72413793	51.28205128	88	142.0711417	678.7940879
Epochs 60	0.567307711	20.83333333	9.722222222	94.64285714	54.16666667	51.38888889	88.28828829	97.043362	678.7940879
Epochs 80	0.615384638	17.39130435	11.47540984	94.35483871	43.47826087	54.09836066	86.99186992	202.4355151	678.7940879
Epochs 100	0.673076928	22.22222222	11.53846154	94.20289855	50	55.76923077	86.86131387	320.5018229	678.7940879
Epochs 120	0.697115362	13.63636364	12.82051282	93.19727891	40.90909091	57.89473684	85.71428571	458.5442252	678.7940879
Epochs 140	0.735576928	15.78947368	14.70588235	93.5483871	42.10526316	57.57575758	85.80645161	405.4206627	678.7940879
Epochs 160	0.721153855	17.64705882	12.82051282	93.42105263	47.05882353	63.15789474	86.18421053	375.7158735	678.7940879
Epochs 180	0.769230783	9.090909091	13.79310345	92.26190476	54.54545455	58.62068966	85.02994012	3280.043107	678.7940879
Epochs 200	0.798076928	16.66666667	14.28571429	92.52873563	50	57.14285714	85.54913295	2842.294702	678.7940879
Bear Phase test Data	Test_accuracy	correct_buys	correct_sells	correct_holds	correct_low_buys	correct_high_sells	correct_mid_holds	Profit gained	buy_n_hold profit
Epochs 20	0.270588249	6.358381503	9.708737864	88.35616438	44.34782609	56.31067961	79.45205479	-68.85254494	-91.88465799
Epochs 40	0.487394959	8.839779006	8.130081301	90.72164948	45.55555556	51.2195122	83.84879725	-94.20434875	-91.88465799
Epochs 60	0.564705908	8.904109589	11.00917431	91.47058824	44.13793103	55.04587156	86.17647059	-63.45289056	-91.88465799
Epochs 80	0.571428597	8.333333333	9.375	89.85915493	47.55244755	53.125	83.94366197	-72.77441466	-91.88465799
Epochs 100	0.618487418	8.870967742	7.594936709	89.54081633	46.34146341	49.36708861	83.16326531	-83.14701636	-91.88465799
Epochs 120	0.65882355	9.322033898	3.773584906	89.38679245	47.00854701	49.05660377	83.01886792	-83.30797548	-91.88465799
Epochs 140	0.689075649	9	2.127659574	89.28571429	45.45454545	46.80851064	83.03571429	-81.46409121	-91.88465799
Epochs 160	0.694117665	9.677419355	5.454545455	89.70917226	45.65217391	45.45454545	83.44519016	-84.57252065	-91.88465799
Epochs 180	0.73613447	8.823529412	2.222222222	89.41908714	47.05882353	46.66666667	83.16008316	-65.37568921	-91.88465799
Epochs 200	0.74453783	5.555555556	0	88.88888889	48.14814815	34.7826087	82.59109312	-39.62295717	-91.88465799
Full Cycle test Data	Test_accuracy	correct_buys	correct_sells	correct_holds	correct_low_buys	correct_high_sells	correct_mid_holds	Profit gained	buy_n_hold profit
Epochs 20	0.306434035	6.463878327	11.97183099	92.36947791	45.62737643	53.52112676	87.5	-25.10435403	-96.00669322
Epochs 40	0.496183217	8.896797153	9.042553191	92.1875	50.53380783	53.19148936	86.12975391	-8.611040626	-96.00669322
Epochs 60	0.545256257	8	10.3030303	92.2310757	47.2	50.3030303	86.42714571	-87.08548067	-96.00669322
Epochs 80	0.598691404	8.968609865	10.29411765	92.29390681	47.53363229	52.20588235	86.17594255	-77.06662809	-96.00669322
Epochs 100	0.679389298	11.73184358	10.41666667	92.21183801	48.04469274	46.875	85.80343214	-93.04704029	-96.00669322
Epochs 120	0.706652105	10.17964072	11.26760563	91.75257732	47.30538922	43.66197183	85.25073746	-94.12916375	-96.00669322
Epochs 140	0.741548538	11.02941176	9.677419355	91.6550765	47.79411765	45.16129032	85.2367688	-92.58847705	-96.00669322
Epochs 160	0.735005438	10.94890511	7.462686567	91.72510519	47.44525547	47.76119403	85.25280899	-88.27167983	-96.00669322
Epochs 180	0.773173392	11.11111111	8.064516129	91.66666667	48.48484848	43.5483871	85.29801325	-86.51917972	-96.00669322
Epochs 200	0.791712105	12.5	6.666666667	91.63449163	48.75	40	85.18041237	-82.91079408	-96.00669322

Table 15-14 Full Cycle Data Trained LSTM Model Results

16 Appendix 11

APA Corporation CNN Model (No Support Stock Data)																		
	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.068807341	8.333333333	5.737704918	0	46.875	42.97520661	0	478.3758274	-62.60600343	0.050228309	5.882352941	4.47761194	0	55.29411765	47.36842105	0	-92.81601667	-52.68267908
Epochs 40	0.059633028	5.084745763	5.128205128	100	42.04545455	56.41025641	100	-85.63090981	-62.60600343	0.050228309	4.678362573	6.25	0	47.05882353	54.16666667	0	-3.075329045	-52.68267908
Epochs 60	0.201834857	7.843137255	7.142857143	93.75	47.05882353	50	83.87096774	-45.24320364	-62.60600343	0.150684938	6.796116505	4.347826087	91.66666667	54.90196078	55.43478261	87.5	196.4059037	-52.68267908
Epochs 80	0.261467904	7.058823529	7.142857143	91.83673469	49.41176471	51.19047619	77.08333333	-27.74937156	-62.60600343	0.246575341	7.865168539	4.761904762	93.47826087	55.68181818	57.14285714	82.60869565	130.3298387	-52.68267908
Epochs 100	0.344036698	5.405405405	7.042253521	90.4109589	48.64864865	50.70422535	77.77777778	-49.32296944	-62.60600343	0.410958916	9.722222222	6.060606061	97.5308642	59.15492958	60.60606061	88.88888889	321.1329457	-52.68267908
Epochs 120	0.477064222	5	4.255319149	89.18918919	48.33333333	48.93617021	79.09090909	-28.50695785	-62.60600343	0.598173499	9.615384615	7.894736842	95.34883721	61.53846154	65.78947368	87.5	162.4607527	-52.68267908
Epochs 140	0.587155938	3.846153846	0	89.36170213	48.07692308	44	80	-78.92503337	-62.60600343	0.657534242	6.52173913	0	92.76315789	60.86956522	66.66666667	83.44370861	-62.94497125	-52.68267908
Epochs 160	0.678899109	3.03030303	0	90.18404908	42.42424242	45.45454545	79.62962963	-75.69955726	-62.60600343	0.735159814	4.166666667	0	91.95402299	50	66.66666667	82.65895954	-96.2526798	-52.68267908
Epochs 180	0.779816508	4.545454545	0	91.35135135	50	27.27272727	80.43478261	10.53661101	-62.60600343	0.803652942	6.666666667	0	92.59259259	46.66666667	66.66666667	82.9787234	-77.91710329	-52.68267908
Epochs 200	0.821100891	5.882352941	0	91.75257732	41.17647059	28.57142857	81.34715026	15.41535466	-62.60600343	0.831050217	7.692307692	0	92.82051282	46.15384615	63.63636364	83.50515464	-74.43444854	-52.68267908

APA Corporation CNN Model (With Support Stock Data)																		
	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.376146793	7.142857143	6.666666667	93.50649351	43.65079365	53.33333333	84.21052632	-55.90737768	-62.60600343	0.374429226	5.833333333	4.761904762	94.87179487	46.66666667	42.85714286	88.31168831	-82.39871677	-52.68267908
Epochs 40	0.155963302	6.428571429	7.142857143	95.45454545	45.71428571	50	85.71428571	-71.31027139	-62.60600343	0.155251145	5.46875	4.545454545	96	48.03149606	51.51515152	96	-53.27727158	-52.68267908
Epochs 60	0.266055048	9.278350515	7.792207792	97.72727273	52.57731959	46.75324675	88.37209302	-71.35220736	-62.60600343	0.287671238	8.139534884	5.128205128	94.54545455	57.64705882	57.69230769	87.27272727	-26.29577018	-52.68267908
Epochs 80	0.270642191	8	6.451612903	94	50.66666667	46.73913043	80	868.8528633	-62.60600343	0.246575341	9.459459459	4.04040404	93.47826087	61.64383562	53.53535354	84.7826087	-1.240486981	-52.68267908
Epochs 100	0.302752286	5.479452055	6.097560976	90.47619048	47.94520548	47.56097561	79.03225806	910.8594327	-62.60600343	0.301369876	8.823529412	5.376344086	94.82758621	58.20895522	55.91397849	91.37931034	358.7124584	-52.68267908
Epochs 120	0.449541271	6.382978723	6.756756757	92.78350515	46.80851064	47.2972973	82.29166667	600.7862472	-62.60600343	0.470319629	10.52631579	6.172839506	94	65.78947368	59.25925926	84.84848485	0.181461648	-52.68267908
Epochs 140	0.559633017	6.12244898	2.5	91.47286822	42.85714286	42.5	80.46875	523.9761812	-62.60600343	0.630136967	9.375	8.333333333	94.24460432	59.375	64.58333333	84.05797101	-45.62391879	-52.68267908
Epochs 160	0.665137589	4.761904762	0	91.08280255	40.47619048	57.89473684	80.12820513	176.0014823	-62.60600343	0.716894984	7.692307692	3.703703704	92.77108434	57.69230769	74.07407407	83.03030303	-75.45387039	-52.68267908
Epochs 180	0.738532126	7.142857143	0	90.90909091	57.14285714	53.57142857	81.14285714	996.4395771	-62.60600343	0.726027369	0	5.714285714	92.35294118	57.14285714	71.42857143	82.84023669	-75.47129465	-52.68267908
Epochs 200	0.798165143	9.090909091	0	91.53439153	63.63636364	55.55555556	80.31914894	886.309762	-62.60600343	0.812785387	0	0	92.22797927	55.55555556	70.58823529	83.33333333	-83.90387624	-52.68267908

Table 16-1 CNN Models Results for Variation 5

JetBlue Airways Corporation CNN Model (No Support Stock Data)																		
	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.25688073	7.826086957	3.703703704	91.83673469	48.69565217	52.83018868	83.67346939	203.8220843	19.48199225	0.251141548	7	7.042253521	89.58333333	47.47474747	53.52112676	81.25	240.805053	-44.84408332
Epochs 40	0.174311921	9.756097561	5.454545455	92.30769231	51.2195122	51.37614679	84.61538462	330.2009678	19.48199225	0.196347028	5.882352941	6.956521739	86.11111111	47.76119403	47.82608696	83.33333333	193.7911112	-44.84408332
Epochs 60	0.238532111	10	4.301075269	88.88888889	53.75	55.43478261	75.55555556	166.605162	19.48199225	0.246575341	8.823529412	6.730769231	87.23404255	52.23880597	49.03846154	82.9787234	622.7561012	-44.84408332
Epochs 80	0.302752286	10.95890411	3.488372093	93.22033898	53.42465753	50.58823529	79.66101695	227.4564712	19.48199225	0.283105016	8.196721311	6.930693069	87.71929825	51.66666667	52.47524752	82.45614035	207.7829499	-44.84408332
Epochs 100	0.403669715	10.52631579	4	91.86046512	54.38596491	48.64864865	81.39534884	243.161828	19.48199225	0.415525109	8.695652174	8.333333333	89.88764045	51.11111111	55.95238095	84.26966292	363.2814282	-44.84408332
Epochs 120	0.573394477	10.86956522	4.444444444	92.91338583	58.69565217	46.66666667	82.53968254	110.607472	19.48199225	0.547945201	9.523809524	7.843137255	88.88888889	53.65853659	58.82352941	84.92063492	420.3368486	-44.84408332
Epochs 140	0.683486223	12.12121212	6.25	93.46405229	51.51515152	43.75	84.21052632	-30.19693277	19.48199225	0.630136967	8.823529412	5.714285714	88.66666667	54.54545455	62.85714286	84.66666667	-26.40033501	-44.84408332
Epochs 160	0.747706413	11.76470588	6.896551724	92.44186047	47.05882353	48.27586207	83.04093567	-27.85189476	19.48199225	0.739726007	5.882352941	11.53846154	89.77272727	52.94117647	69.23076923	84.57142857	-56.39487552	-44.84408332
Epochs 180	0.775229335	5.882352941	5.555555556	91.2568306	41.17647059	55.55555556	82.96703297	-50.3111865	19.48199225	0.794520557	5.882352941	10	89.58333333	58.82352941	60	83.76963351	-68.5248527	-44.84408332
Epochs 200	0.784403682	6.666666667	5.555555556	91.35135135	40	50	82.60869565	-8.390272182	19.48199225	0.794520557	7.692307692	0	89.17525773	61.53846154	50	83.93782383	-66.40313057	-44.84408332

JetBlue Airways Corporation CNN Model (With Support Stock Data)																		
	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.284403682	6.097560976	0	96.2962963	40.49079755	0	92.59259259	19.48199225	19.48199225	0.369863003	6.382978723	0	92.30769231	45.71428571	0	85.8974359	-44.84408332	-44.84408332
Epochs 40	0.105504587	6.944444444	4.6875	100	42.36111111	45.3125	100	-49.15703854	19.48199225	0.077625573	6.474820144	6.578947368	75	47.82608696	50	75	-38.27647392	-44.84408332
Epochs 60	0.105504587	7.352941176	2.857142857	91.66666667	43.38235294	46.37681159	91.66666667	6.913048362	19.48199225	0.091324203	6.923076923	6.097560976	85.71428571	49.6124031	48.7804878	85.71428571	68.4383597	-44.84408332
Epochs 80	0.151376143	8.547008547	2.631578947	84	47.00854701	44	76	-25.12501298	19.48199225	0.182648405	7.368421053	6.593406593	81.81818182	46.80851064	50.54945055	78.78787879	-37.6692021	-44.84408332
Epochs 100	0.261467904	9.615384615	3.076923077	91.83673469	49.03846154	45.3125	79.59183673	413.3216708	19.48199225	0.292237431	8.235294118	6.756756757	86.66666667	50	47.2972973	83.33333333	-57.98614423	-44.84408332
Epochs 120	0.32110092	8.910891089	3.773584906	92.1875	45.54455446	42.30769231	81.25	102.1990941	19.48199225	0.369863003	8.641975309	8.196721311	89.61038961	53.75	54.09836066	85.71428571	-62.66992614	-44.84408332
Epochs 140	0.504587173	10.76923077	4.444444444	93.51851852	55.38461538	40.90909091	82.40740741	220.2207502	19.48199225	0.511415541	10.90909091	9.433962264	90.99099099	57.40740741	58.49056604	88.28828829	-13.72614445	-44.84408332
Epochs 160	0.642201841	14.89361702	3.225806452	94.28571429	53.19148936	41.93548387	84.89208633	146.8051473	19.48199225	0.584474862	9.523809524	7.142857143	89.62962963	60.97560976	59.52380952	86.66666667	-22.31992808	-44.84408332
Epochs 180	0.775229335	8.695652174	6.666666667	92.22222222	56.52173913	46.66666667	83.24022346	20.85130002	19.48199225	0.739726007	8.695652174	13.63636364	90.22988506	63.63636364	77.27272727	85.63218391	191.2407305	-44.84408332
Epochs 200	0.766055048	9.090909091	5.555555556	92.13483146	54.54545455	44.44444444	83.05084746	-35.92347607	19.48199225	0.726027369	7.407407407	14.28571429	90.05847953	65.38461538	71.42857143	84.79532164	28.85888806	-44.84408332

Table 16-2 CNN Models Results for Variation 5

The Kroger Co. CNN Model (No Support Stock Data)																		
	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.050458714	5.172413793	5	0	44.82758621	40.88050314	0	-63.04418661	10.8001597	0.077625573	8.620689655	7.453416149	0	43.85964912	42.85714286	0	7761.483425	411.3597623
Epochs 40	0.059633028	6.481481481	5.454545455	0	46.2962963	45.87155963	0	535.1157708	10.8001597	0.073059358	7.920792079	6.779661017	0	47	44.91525424	0	1909.021055	411.3597623
Epochs 60	0.077981651	6.363636364	5.769230769	100	45.45454545	46.60194175	100	-49.99297187	10.8001597	0.100456618	7.070707071	8.771929825	83.33333333	51.02040816	48.24561404	83.33333333	1989.498841	411.3597623
Epochs 80	0.155963302	7	4.301075269	92	45	46.73913043	92	-65.631493	10.8001597	0.150684938	7.920792079	8.163265306	85	55	51.02040816	80	13345.67213	411.3597623
Epochs 100	0.233944952	7.291666667	5	95.23809524	45.83333333	46.83544304	92.85714286	-59.31548485	10.8001597	0.273972601	8.43373494	9.302325581	90	56.09756098	53.48837209	84	7140.282033	411.3597623
Epochs 120	0.376146793	9.230769231	4.166666667	90.12345679	46.15384615	47.22222222	86.25	60.56437526	10.8001597	0.410958916	10.76923077	11.11111111	91.46341463	54.6875	52.77777778	81.70731707	6509.009432	411.3597623
Epochs 140	0.577981651	10	6.25	91.53846154	47.5	52.08333333	83.72093023	1100.094968	10.8001597	0.529680371	15.90909091	8.620689655	88.88888889	58.13953488	56.89655172	80.34188034	5496.271249	411.3597623
Epochs 160	0.747706413	10	11.53846154	91.86046512	55	53.84615385	84.21052632	1326.460214	10.8001597	0.689497709	19.04761905	8.571428571	88.34355828	50	42.85714286	80.36809816	1614.931121	411.3597623
Epochs 180	0.766055048	12.5	8.333333333	91.57303371	62.5	45.83333333	84.18079096	-27.18444922	10.8001597	0.735159814	11.76470588	12	88.13559322	47.05882353	40	80.11363636	561.9040389	411.3597623
Epochs 200	0.811926603	20	5.555555556	91.57894737	60	50	83.5978836	-64.68796901	10.8001597	0.776255727	8.333333333	11.76470588	87.89473684	50	47.05882353	79.89417989	52.5469936	411.3597623

The Kroger Co. CNN Model (With Support Stock Data)																		
	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.055045873	4.761904762	5.970149254	0	47.61904762	43.60902256	0	-21.94062242	10.8001597	0.063926943	5.747126437	6.818181818	0	47.6744186	43.18181818	0	2250.217732	411.3597623
Epochs 40	0.059633028	6.140350877	5.769230769	0	46.49122807	46.60194175	0	930.1180719	10.8001597	0.077625573	8.849557522	6.603773585	0	48.21428571	46.22641509	0	1972.323678	411.3597623
Epochs 60	0.073394492	6.611570248	6.315789474	100	46.28099174	46.80851064	100	-58.88508394	10.8001597	0.08219178	8.474576271	7.920792079	0	48.71794872	46.53465347	0	10266.23155	411.3597623
Epochs 80	0.119266056	7	5.769230769	92.85714286	46	46.60194175	92.85714286	-37.99211435	10.8001597	0.1369863	8.421052632	8.181818182	92.85714286	51.06382979	49.09090909	78.57142857	2537.145388	411.3597623
Epochs 100	0.215596333	6.52173913	6.741573034	94.59459459	44.56521739	48.86363636	94.59459459	-69.82210025	10.8001597	0.210045666	8.235294118	8.823529412	93.75	53.57142857	50	81.25	2250.778413	411.3597623
Epochs 120	0.362385333	8.571428571	6.756756757	91.89189189	51.42857143	46.57534247	86.48648649	-74.44897523	10.8001597	0.305936068	9.85915493	9.782608696	91.07142857	57.14285714	53.26086957	80.35714286	4375.527142	411.3597623
Epochs 140	0.431192666	11.32075472	4.225352113	90.42553191	50.94339623	45.71428571	86.17021277	-69.72916878	10.8001597	0.360730588	12.96296296	7.777777778	86.66666667	58.49056604	51.11111111	80	4778.131154	411.3597623
Epochs 160	0.545871556	14.70588235	4.838709677	90.98360656	58.82352941	47.54098361	84.42622951	216.8877035	10.8001597	0.493150681	15	9.589041096	89.62264151	55	53.42465753	82.85714286	4717.460909	411.3597623
Epochs 180	0.697247684	11.11111111	9.375	91.82389937	59.25925926	53.125	84.17721519	166.8127708	10.8001597	0.598173499	18.75	9.433962264	89.55223881	59.375	54.71698113	82.70676692	7152.002518	411.3597623
Epochs 200	0.733944952	10.52631579	10	91.71597633	68.42105263	56.66666667	84.52380952	143.4171574	10.8001597	0.648401797	20.83333333	10.41666667	89.79591837	54.16666667	54.16666667	82.87671233	146265.7657	411.3597623

Table 16-3 CNN Models Results for Variation 5

Manulife Financial Corporation CNN Model (No Support Stock Data)																		
	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.073394492	6.923076923	7.954545455	0	45.38461538	45.97701149	0	887.3332185	9944.02854	0.06849315	4.958677686	9.183673469	0	47.5	46.93877551	0	-57.737355	-25.17142705
Epochs 40	0.188073397	9.900990099	6.666666667	92.59259259	49.5049505	47.19101124	81.48148148	1255.307982	9944.02854	0.127853885	5.714285714	9	92.85714286	52.88461538	49	92.85714286	-58.30046844	-25.17142705
Epochs 60	0.165137619	8.823529412	6.52173913	87.5	51.96078431	48.35164835	83.33333333	1592.243909	9944.02854	0.1369863	5.882352941	9.708737864	100	52.47524752	49.51456311	92.85714286	-53.23353761	-25.17142705
Epochs 80	0.270642191	9.411764706	8.235294118	91.66666667	55.29411765	52.38095238	89.58333333	3216.856928	9944.02854	0.214611873	5.376344086	10.75268817	96.96969697	52.17391304	49.46236559	93.93939394	-58.50705237	-25.17142705
Epochs 100	0.362385333	7.692307692	8.860759494	90.54054054	55.38461538	53.84615385	85.13513514	5372.633572	9944.02854	0.324200898	5.063291139	10.38961039	93.65079365	51.28205128	50.64935065	90.47619048	-47.07769965	-25.17142705
Epochs 120	0.454128444	8	7.462686567	89.10891089	58	53.03030303	82.17821782	3890.860749	9944.02854	0.429223746	4.347826087	10.34482759	92.39130435	51.47058824	46.55172414	86.95652174	-58.13625229	-25.17142705
Epochs 140	0.646789014	10.71428571	9.302325581	91.15646259	53.57142857	59.52380952	83.67346939	2851.458668	9944.02854	0.543379009	4	11.11111111	90.32258065	48.97959184	51.11111111	85.48387097	-50.80206973	-25.17142705
Epochs 160	0.720183492	6.25	9.090909091	90.53254438	43.75	56.25	84.02366864	433.9208766	9944.02854	0.634703219	5.263157895	13.51351351	91.66666667	54.05405405	45.94594595	85.41666667	-40.25292793	-25.17142705
Epochs 180	0.80733943	10	15	91.4893617	40	57.89473684	85.63829787	271.669024	9944.02854	0.744292259	7.692307692	10.52631579	91.37931034	52	26.31578947	85.63218391	-55.39720432	-25.17142705
Epochs 200	0.821100891	9.090909091	8.333333333	90.76923077	36.36363636	63.63636364	85.12820513	377.9290677	9944.02854	0.748858452	6.896551724	13.33333333	91.42857143	53.57142857	26.66666667	86.28571429	-24.50239893	-25.17142705

Manulife Financial Corporation CNN Model (With Support Stock Data)																		
	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.073394492	7.194244604	7.594936709	0	43.88489209	44.87179487	0	4370.112501	9944.02854	0.063926943	4.545454545	9.195402299	0	45.80152672	45.97701149	0	-47.82365808	-25.17142705
Epochs 40	0.082568809	8.695652174	7.766990291	0	49.56521739	46.07843137	0	3454.002183	9944.02854	0.06849315	5.357142857	8.411214953	0	49.54954955	46.72897196	0	-61.35436029	-25.17142705
Epochs 60	0.137614682	9.183673469	6.603773585	100	51.02040816	44.76190476	92.85714286	1905.872937	9944.02854	0.100456618	5.882352941	9.009009009	100	50.4950495	48.64864865	100	-52.60764555	-25.17142705
Epochs 80	0.155963302	9.433962264	7.446808511	94.44444444	53.77358491	49.46236559	88.88888889	1531.178148	9944.02854	0.114155248	4.901960784	8.653846154	84.61538462	49.5049505	48.07692308	84.61538462	-51.81953798	-25.17142705
Epochs 100	0.238532111	6.756756757	8.080808081	86.66666667	56.75675676	51.02040816	77.77777778	3167.538945	9944.02854	0.200913236	5.194805195	8.256880734	93.93939394	53.94736842	46.78899083	90.90909091	-98.00836944	-25.17142705
Epochs 120	0.298165143	6.25	7.608695652	87.09677419	59.375	53.84615385	79.03225806	6491.445259	9944.02854	0.264840186	5.555555556	8.163265306	93.87755102	50.70422535	46.93877551	85.71428571	-96.75804603	-25.17142705
Epochs 140	0.389908254	7.246376812	7.692307692	89.28571429	59.42028986	53.125	82.14285714	4457.230193	9944.02854	0.388127863	6.666666667	10.44776119	94.80519481	48.64864865	52.23880597	87.01298701	-50.46312101	-25.17142705
Epochs 160	0.532110095	8.333333333	9.230769231	91.45299145	52.77777778	56.25	83.76068376	4456.665844	9944.02854	0.525114179	6.52173913	10	93.80530973	48.88888889	51.66666667	87.61061947	-54.50432668	-25.17142705
Epochs 180	0.582568824	8.108108108	9.803921569	91.53846154	54.05405405	56	84.61538462	8364.991721	9944.02854	0.552511394	6.25	8.333333333	92.68292683	48.93617021	50	86.17886179	-63.79746813	-25.17142705
Epochs 200	0.688073397	7.407407407	6.896551724	90.12345679	59.25925926	55.17241379	84.47204969	743.6160873	9944.02854	0.666666687	5.555555556	7.142857143	91.61290323	47.22222222	53.57142857	84.41558442	0.545854745	-25.17142705

Table 16-4 CNN Models Results for Variation 5

ON Semiconductor Corporation CNN Model (No Support Stock Data)																		
	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.055045873	4.545454545	9.523809524	0	45.14285714	52.38095238	0	422.8746436	27.5784763	0.05479452	5.084745763	7.142857143	0	42.04545455	42.85714286	0	126.0968804	75.89343906
Epochs 40	0.068807341	5.714285714	8.974358974	0	47.14285714	48.05194805	0	71.0652734	27.5784763	0.073059358	7.5	7.070707071	0	45.37815126	48.48484848	0	267.1481394	75.89343906
Epochs 60	0.114678897	5.785123967	7.228915663	85.71428571	48.76033058	45.12195122	71.42857143	-38.96855368	27.5784763	0.16438356	8.421052632	6.930693069	91.30434783	45.26315789	50.4950495	81.81818182	186.4282131	75.89343906
Epochs 80	0.169724777	6.194690265	7.792207792	85.71428571	46.90265487	48.68421053	78.57142857	-34.4905172	27.5784763	0.205479458	6.976744186	7.216494845	88.88888889	44.18604651	49.48453608	85.71428571	182.5875349	75.89343906
Epochs 100	0.270642191	6.849315068	7.608695652	88.67924528	52.05479452	45.05494505	83.01886792	-51.75574873	27.5784763	0.251141548	9.230769231	7.207207207	95.34883721	47.69230769	51.35135135	90.47619048	200.9874323	75.89343906
Epochs 120	0.334862381	4.47761194	8.860759494	87.5	47.76119403	48.71794872	80.55555556	-8.896406064	27.5784763	0.342465758	8.333333333	7.608695652	94.02985075	50	52.17391304	87.87878788	207.1393967	75.89343906
Epochs 140	0.458715588	4.347826087	7.462686567	88.57142857	54.34782609	49.25373134	81.73076923	55.87527376	27.5784763	0.479452044	10.41666667	8.333333333	94.94949495	52.08333333	51.38888889	88.7755102	164.6426897	75.89343906
Epochs 160	0.555045843	5.714285714	5.660377358	89.23076923	54.28571429	50.94339623	82.94573643	225.1626826	27.5784763	0.557077646	10.52631579	8.333333333	93.38842975	57.89473684	56.66666667	85	187.0265087	75.89343906
Epochs 180	0.669724762	4.347826087	5.714285714	89.375	47.82608696	54.28571429	83.01886792	31.44527264	27.5784763	0.662100434	8.333333333	7.317073171	90.90909091	62.5	63.41463415	82.35294118	119.02507	75.89343906
Epochs 200	0.720183492	6.25	6.451612903	90.05847953	43.75	51.61290323	84.11764706	1.175855106	27.5784763	0.680365324	9.090909091	2.777777778	90.68322981	59.09090909	61.11111111	82.5	105.8164827	75.89343906

ON Semiconductor Corporation CNN Model (With Support Stock Data)																		
	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.596330285	7.246376812	0	89.92805755	44.92753623	60	84.05797101	35.32700449	27.5784763	0.621004581	6.451612903	10	89.11564626	46.77419355	50	80.82191781	92.45629991	75.89343906
Epochs 40	0.266055048	8.219178082	6.382978723	90.19607843	45.20547945	39.78494624	88.23529412	-75.27168545	27.5784763	0.251141548	9.677419355	7.207207207	89.13043478	50	49.09090909	84.7826087	294.0962395	75.89343906
Epochs 60	0.146788985	5.607476636	6.896551724	83.33333333	44.85981308	44.18604651	70.83333333	-77.19503989	27.5784763	0.16438356	9.574468085	6.796116505	90.90909091	48.38709677	49.51456311	86.36363636	233.5253965	75.89343906
Epochs 80	0.408256888	8.333333333	8.196721311	91.76470588	51.38888889	50	84.70588235	-70.69062141	27.5784763	0.360730588	7.575757576	7.692307692	90.66666667	48.48484848	52.56410256	83.78378378	108.8340896	75.89343906
Epochs 100	0.348623842	8.064516129	6.024096386	90.4109589	53.22580645	43.90243902	83.56164384	-65.7433089	27.5784763	0.305936068	7.575757576	8.421052632	93.10344828	51.51515152	53.68421053	89.47368421	145.0877472	75.89343906
Epochs 120	0.463302761	6.666666667	6.060606061	87.85046729	53.33333333	45.45454545	80.18867925	-84.66199317	27.5784763	0.465753436	9.615384615	7.352941176	92.92929293	57.69230769	57.35294118	85.71428571	5888.758119	75.89343906
Epochs 140	0.596330285	8.333333333	4.761904762	89.28571429	58.33333333	45.23809524	82.73381295	22.73911683	27.5784763	0.584474862	8.888888889	7.142857143	91.66666667	60	52.38095238	82.44274809	209.1758553	75.89343906
Epochs 160	0.688073397	10.52631579	5.405405405	90.12345679	63.15789474	43.24324324	83.85093168	56.04956007	27.5784763	0.726027369	16	9.677419355	93.25153374	60	48.38709677	85.18518519	129.4115961	75.89343906
Epochs 180	0.715596318	10.52631579	3.448275862	90	57.89473684	34.48275862	83.43195266	103.948919	27.5784763	0.744292259	12	9.090909091	91.86046512	52	54.54545455	83.62573099	61.64606164	75.89343906
Epochs 200	0.752293587	0	4.761904762	89.56043956	53.33333333	38.0952381	82.32044199	208.7700458	27.5784763	0.785388112	9.523809524	7.692307692	91.35135135	66.66666667	46.15384615	84.23913043	29.2495275	75.89343906

Table 16-5 CNN Models Results for Variation 5

APA Corporation LSTM Model (No Support Stock Data)																		
	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.041284405	4.128440367	0	0	39.17050691	0	0	-62.60600343	-62.60600343	0.036529679	3.652968037	0	0	43.11926606	0	0	-52.68267908	-52.68267908
Epochs 40	0.041284405	4.128440367	0	0	39.17050691	0	0	-62.60600343	-62.60600343	0.036529679	3.652968037	0	0	43.11926606	0	0	-52.68267908	-52.68267908
Epochs 60	0.082568809	10.12658228	5.839416058	100	55.69620253	44.85294118	50	206.9671953	-62.60600343	0.05479452	8	4.166666667	0	53.33333333	48.25174825	0	-60.36417581	-52.68267908
Epochs 80	0.073394492	9.411764706	6.015037594	0	51.76470588	45.45454545	0	72.31228473	-62.60600343	0.063926943	8.536585366	4.411764706	100	51.2195122	48.14814815	100	-70.43490404	-52.68267908
Epochs 100	0.142201841	8	7	88.88888889	50	48	70.58823529	-13.00089315	-62.60600343	0.100456618	6.862745098	4.672897196	100	50.98039216	48.11320755	90	-68.58945052	-52.68267908
Epochs 120	0.165137619	5.454545455	11.53846154	88.88888889	43.03030303	50	84.61538462	-66.28793057	-62.60600343	0.168949768	4.87804878	7.692307692	93.10344828	47.85276074	57.69230769	79.31034483	-74.17898471	-52.68267908
Epochs 140	0.344036698	7.368421053	7.407407407	92.75362319	49.47368421	44.44444444	82.35294118	-61.74184308	-62.60600343	0.365296811	7.368421053	4.081632653	94.66666667	49.47368421	46.93877551	85.13513514	-94.87839248	-52.68267908
Epochs 160	0.610091746	9.375	10	93.28358209	59.375	55	83.45864662	-65.83129218	-62.60600343	0.598173499	9.722222222	0	94.65648855	50	50	85.38461538	-84.74030086	-52.68267908
Epochs 180	0.550458729	9.090909091	6.451612903	92.56198347	53.03030303	41.93548387	80	4.460268919	-62.60600343	0.652968049	7.01754386	6.666666667	93.87755102	54.38596491	53.33333333	84.24657534	-94.29590267	-52.68267908
Epochs 200	0.293577969	8.823529412	7.291666667	94.44444444	54.41176471	48.42105263	81.48148148	109.2074443	-62.60600343	0.333333343	9.259259259	5.102040816	94.02985075	51.85185185	46.93877551	87.87878788	-91.58623985	-52.68267908

APA Corporation LSTM Model (With Support Stock Data)																		
	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.394495428	9.195402299	7.547169811	94.87179487	51.1627907	50.94339623	85.8974359	-72.93109424	-62.60600343	0.406392694	4.347826087	13.95348837	94.04761905	47.82608696	51.1627907	85.54216867	-89.69384772	-52.68267908
Epochs 40	0.490825683	10.71428571	9.677419355	95	54.54545455	48.38709677	84	-75.72330176	-62.60600343	0.438356161	7.01754386	5.970149254	92.63157895	50	46.26865672	81.05263158	-86.98736701	-52.68267908
Epochs 60	0.614678919	7.317073171	9.756097561	93.38235294	50	48.7804878	81.61764706	-81.35367457	-62.60600343	0.547945201	5.128205128	7.01754386	92.68292683	42.10526316	52.63157895	83.7398374	-85.28932312	-52.68267908
Epochs 80	0.655963302	7.317073171	0	90.90909091	42.5	56.52173913	79.22077922	-82.52887156	-62.60600343	0.666666687	6.060606061	10.81081081	93.95973154	40.625	56.75675676	85.23489933	223.4614162	-52.68267908
Epochs 100	0.752293587	9.090909091	0	91.52542373	61.9047619	57.89473684	80.2259887	-83.38840992	-62.60600343	0.744292259	4.347826087	11.53846154	93.52941176	39.13043478	50	84.61538462	155.7141296	-52.68267908
Epochs 120	0.793577969	7.142857143	0	91.4893617	64.28571429	68.75	80.21390374	-73.46158057	-62.60600343	0.767123282	7.142857143	7.142857143	93.22033898	42.85714286	53.57142857	84.09090909	31.01285813	-52.68267908
Epochs 140	0.811926603	0	0	91.2371134	54.54545455	66.66666667	80.41237113	-86.01478755	-62.60600343	0.821917832	11.11111111	9.523809524	93.65079365	55.55555556	57.14285714	84.57446809	-35.76721734	-52.68267908
Epochs 160	0.844036698	8.333333333	0	91.95979899	66.66666667	57.14285714	81.31313131	-85.76605522	-62.60600343	0.844748855	11.11111111	12.5	93.81443299	44.44444444	50	84.45595855	37.53366231	-52.68267908
Epochs 180	0.857798159	9.090909091	0	92.07920792	70	80	81.68316832	-83.87745247	-62.60600343	0.840182662	9.090909091	7.692307692	93.33333333	54.54545455	46.15384615	84.02061856	31.98447463	-52.68267908
Epochs 200	0.862385333	0	0	91.70731707	66.66666667	75	81.37254902	-84.40000272	-62.60600343	0.844748855	8.333333333	9.090909091	93.36734694	63.63636364	54.54545455	84.18367347	22.49311136	-52.68267908

Table 16-6 LSTM Models Results for Variation 5

JetBlue Airways Corporation LSTM Model (No Support Stock Data)																		
	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.394495428	8.955223881	7.042253521	93.75	53.03030303	50.70422535	85	20.52080036	19.48199225	0.360730588	9.615384615	9.473684211	90.27777778	50	50.52631579	84.50704225	190.1329665	-44.84408332
Epochs 40	0.403669715	10.66666667	4.918032787	93.90243902	52	60	85.36585366	57.84256944	19.48199225	0.584474862	13.15789474	12.5	92.8	55.26315789	55.35714286	86.29032258	-0.002529946	-44.84408332
Epochs 60	0.444954127	10.44776119	3.571428571	92.63157895	52.23880597	61.81818182	83.15789474	69.83387184	19.48199225	0.621004581	7.692307692	14.63414634	91.36690647	48.71794872	58.53658537	85.50724638	25.44898873	-44.84408332
Epochs 80	0.481651366	6.779661017	4.166666667	89.18918919	49.15254237	65.95744681	80.18018018	188.3039072	19.48199225	0.689497709	10.34482759	12.5	91.13924051	55.17241379	53.125	85.35031847	-25.97233158	-44.84408332
Epochs 100	0.527522922	7.142857143	2.564102564	89.43089431	44.64285714	63.15789474	80.48780488	27.80192126	19.48199225	0.735159814	8	16.66666667	91.17647059	56	54.16666667	85.79881657	-17.40137115	-44.84408332
Epochs 120	0.591743112	8.510638298	2.941176471	90.51094891	42.55319149	63.63636364	82.48175182	316.0579343	19.48199225	0.744292259	9.523809524	16	90.75144509	57.14285714	64	85.46511628	-18.62662968	-44.84408332
Epochs 140	0.642201841	9.302325581	3.703703704	91.21621622	46.51162791	69.23076923	83.10810811	6.524223596	19.48199225	0.767123282	5.882352941	11.11111111	89.67391304	58.82352941	61.11111111	84.69945355	50.36021808	-44.84408332
Epochs 160	0.688073397	11.11111111	4.166666667	91.7721519	50	70.83333333	82.80254777	6.524223596	19.48199225	0.776255727	6.666666667	6.25	89.36170213	60	56.25	85.02673797	49.40999334	-44.84408332
Epochs 180	0.720183492	9.375	5.263157895	91.61676647	50	78.94736842	83.13253012	-1.622287245	19.48199225	0.803652942	0	8.333333333	89.28571429	63.63636364	66.66666667	84.61538462	226.9940072	-44.84408332
Epochs 200	0.715596318	9.375	5	91.56626506	46.875	80	82.42424242	18.79320927	19.48199225	0.789954364	0	7.692307692	89.11917098	53.84615385	61.53846154	84.89583333	226.9940072	-44.84408332

JetBlue Airways Corporation LSTM Model (With Support Stock Data)																		
	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.24311927	6.756756757	3.703703704	97.6744186	44.21768707	44.44444444	88.37209302	-41.21258652	19.48199225	0.19178082	4.615384615	4.081632653	85	46.92307692	44.89795918	79.48717949	-49.36838051	-44.84408332
Epochs 40	0.536697268	10	5.128205128	91.59663866	55	51.28205128	83.05084746	-51.85935387	19.48199225	0.538812757	11.53846154	6.382978723	90.83333333	55.76923077	53.19148936	84.87394958	-23.28695675	-44.84408332
Epochs 60	0.614678919	8	3.846153846	90.84507042	56	50	82.26950355	7.242155035	19.48199225	0.643835604	14.28571429	5.263157895	91.78082192	68.57142857	50	87.5862069	-6.629220887	-44.84408332
Epochs 80	0.669724762	11.62790698	4.347826087	92.10526316	53.48837209	47.82608696	83.44370861	66.09547825	19.48199225	0.730593622	19.23076923	4	91.66666667	61.53846154	52	87.4251497	-7.070603354	-44.84408332
Epochs 100	0.711009145	8.571428571	5.555555556	91.51515152	51.42857143	50	83.53658537	160.3153788	19.48199225	0.762557089	15.78947368	4.761904762	91.06145251	57.89473684	57.14285714	85.95505618	-57.40872763	-44.84408332
Epochs 120	0.775229335	7.692307692	0	91.2568306	50	55.55555556	84.06593407	243.9692736	19.48199225	0.831050217	20	0	91.32653061	60	62.5	86.15384615	15.61480023	-44.84408332
Epochs 140	0.770642221	4.166666667	0	90.76086957	37.5	40	83.06010929	138.9630696	19.48199225	0.79908675	16.66666667	0	91.00529101	55.55555556	58.33333333	86.17021277	-56.0224272	-44.84408332
Epochs 160	0.798165143	5.263157895	0	91.05263158	42.10526316	44.44444444	83.5978836	259.2585742	19.48199225	0.826484025	7.142857143	0	90.45226131	50	50	85.35353535	10.63552065	-44.84408332
Epochs 180	0.793577969	5	0	91.00529101	45	44.44444444	82.44680851	117.307398	19.48199225	0.812785387	6.25	0	90.30612245	50	57.14285714	85.12820513	-42.88088674	-44.84408332
Epochs 200	0.793577969	5.263157895	0	91.00529101	42.10526316	40	82.44680851	117.307398	19.48199225	0.844748855	8.333333333	0	90.64039409	41.66666667	25	85.64356436	-57.03482231	-44.84408332

Table 16-7 LSTM Models Results for Variation 5

The Kroger Co. LSTM Model (No Support Stock Data)																		
	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.275229365	7.594936709	7.058823529	88.88888889	44.30379747	47.05882353	86.79245283	118.3406256	10.8001597	0.273972601	6.849315068	8.791208791	85.45454545	50	43.95604396	80	5358.77562	411.3597623
Epochs 40	0.334862381	7.792207792	5.479452055	92.64705882	44.15584416	43.83561644	82.08955224	-73.65314143	10.8001597	0.328767121	9.210526316	10.12658228	89.0625	51.31578947	42.30769231	81.25	5283.668835	411.3597623
Epochs 60	0.449541271	6.451612903	7.01754386	90.90909091	43.5483871	40.35087719	80.6122449	-35.26136691	10.8001597	0.465753436	7.272727273	11.47540984	88.34951456	49.09090909	49.18032787	81.37254902	942.9332538	411.3597623
Epochs 80	0.518348634	4	6.382978723	89.25619835	46	42.55319149	79.16666667	-27.57509861	10.8001597	0.538812757	6.976744186	12.96296296	88.52459016	51.1627907	50	80.99173554	1008.784633	411.3597623
Epochs 100	0.577981651	2.325581395	5.263157895	89.7810219	37.20930233	42.10526316	79.41176471	-61.04937011	10.8001597	0.575342476	8.108108108	8.695652174	87.5	51.35135135	47.82608696	79.25925926	304.8285068	411.3597623
Epochs 120	0.651376128	2.941176471	3.571428571	89.74358974	35.29411765	42.85714286	80.64516129	-19.34994863	10.8001597	0.671232879	8.695652174	12.82051282	89.17197452	47.82608696	48.71794872	81.41025641	0.102873478	411.3597623
Epochs 140	0.678899109	3.225806452	4.166666667	89.57055215	38.70967742	45.83333333	81.48148148	-20.29622549	10.8001597	0.694063902	10	13.51351351	89.50617284	60	48.64864865	81.36645963	26.6933092	411.3597623
Epochs 160	0.715596318	3.703703704	5	90.05847953	33.33333333	55	81.76470588	15.59206611	10.8001597	0.735159814	7.692307692	12.90322581	89.14285714	46.15384615	48.38709677	81.6091954	5456.133712	411.3597623
Epochs 180	0.720183492	3.571428571	5.555555556	90.11627907	32.14285714	61.11111111	81.87134503	-18.07025048	10.8001597	0.730593622	6.666666667	10.71428571	88.63636364	53.33333333	50	80.57142857	5215.954689	411.3597623
Epochs 200	0.724770665	3.703703704	5.555555556	90.1734104	40.74074074	61.11111111	82.55813953	-8.649321766	10.8001597	0.721461177	7.142857143	10	88	42.85714286	50	79.88505747	6373.194304	411.3597623

The Kroger Co. LSTM Model (With Support Stock Data)																		
	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.348623842	2.564102564	5.714285714	93.24324324	38.46153846	43.26923077	87.83783784	-85.19125876	10.8001597	0.415525109	5.882352941	10.52631579	86.95652174	50.98039216	48	79.34782609	43079.47565	411.3597623
Epochs 40	0.426605493	4.166666667	6.41025641	93.47826087	45.83333333	43.58974359	84.61538462	-73.88572362	10.8001597	0.570776284	8.333333333	17.39130435	90.4	52.08333333	56.52173913	83.87096774	154362.7869	411.3597623
Epochs 60	0.587155938	5	8.510638298	93.12977099	47.5	40.42553191	83.07692308	-29.07200261	10.8001597	0.648401797	11.42857143	14.28571429	89.26174497	57.14285714	60	80.40540541	61997.39927	411.3597623
Epochs 80	0.729357779	5.263157895	3.703703704	91.27906977	52.63157895	37.03703704	83.04093567	28.85522758	10.8001597	0.762557089	9.090909091	21.42857143	88.52459016	59.09090909	71.42857143	79.67032967	84635.12957	411.3597623
Epochs 100	0.747706413	0	4.347826087	91.01123596	41.17647059	34.7826087	83.05084746	7.467808788	10.8001597	0.789954364	11.11111111	20	88.48167539	55.55555556	80	79.47368421	1646.390153	411.3597623
Epochs 120	0.80733943	0	10	91.62303665	41.17647059	40	83.68421053	-71.57967003	10.8001597	0.803652942	12.5	22.22222222	88.65979381	50	77.77777778	79.79274611	1012.306381	411.3597623
Epochs 140	0.839449525	0	16.66666667	91.45728643	46.15384615	50	83.83838384	-60.65295735	10.8001597	0.79908675	6.25	16.66666667	87.81725888	50	83.33333333	79.08163265	1012.306381	411.3597623
Epochs 160	0.857798159	0	25	91.62561576	45.45454545	50	84.15841584	-43.29649821	10.8001597	0.794520557	5.882352941	16.66666667	87.75510204	52.94117647	66.66666667	78.97435897	1066.931553	411.3597623
Epochs 180	0.853210986	0	20	91.58415842	54.54545455	60	84.07960199	-34.41375525	10.8001597	0.79908675	6.25	16.66666667	87.81725888	56.25	66.66666667	79.08163265	48.09197434	411.3597623
Epochs 200	0.853210986	0	14.28571429	92.039801	60	57.14285714	84	-34.41375525	10.8001597	0.79908675	0	20	87.43718593	53.33333333	80	78.78787879	73.41166296	411.3597623

Table 16-8 LSTM Models Results for Variation 5

Manulife Financial Corporation LSTM Model (No Support Stock Data)																		
	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.408256888	8	7.407407407	88.76404494	48	41.50943396	83.14606742	4747.761683	9944.02854	0.324200898	6.315789474	7.142857143	89.70588235	52.12765957	50	82.35294118	-37.32017077	-25.17142705
Epochs 40	0.339449555	7.272727273	6.666666667	87.67123288	52.72727273	41.57303371	80.82191781	5323.869164	9944.02854	0.401826471	6.25	8.823529412	89.65517241	60.31746032	54.41176471	79.31034483	-5.573297912	-25.17142705
Epochs 60	0.532110095	10.86956522	7.272727273	91.45299145	69.56521739	40.74074074	83.76068376	21442.58928	9944.02854	0.552511394	4.166666667	11.11111111	90.47619048	60.41666667	60	80	10.92163337	-25.17142705
Epochs 80	0.678899109	14.70588235	6.666666667	91.55844156	70.58823529	44.82758621	82.46753247	11837.15861	9944.02854	0.643835604	3.125	10.81081081	90.66666667	62.5	62.16216216	80.53691275	-30.88630237	-25.17142705
Epochs 100	0.697247684	15.78947368	8.333333333	92.30769231	71.05263158	47.82608696	84.61538462	17874.62994	9944.02854	0.680365324	3.571428571	12.12121212	91.13924051	60.71428571	57.57575758	82.1656051	-10.93359286	-25.17142705
Epochs 120	0.766055048	20.68965517	11.11111111	92.98245614	65.51724138	47.05882353	85.38011696	11909.24381	9944.02854	0.767123282	4.761904762	19.04761905	92.09039548	66.66666667	61.9047619	83.52272727	-13.00120824	-25.17142705
Epochs 140	0.770642221	14.81481481	7.692307692	91.57303371	62.96296296	50	84.26966292	377.9345941	9944.02854	0.79908675	5.882352941	22.22222222	92.39130435	58.82352941	72.22222222	84.15300546	-13.00120824	-25.17142705
Epochs 160	0.793577969	16	16.66666667	92.26519337	64	54.54545455	85.08287293	310.98975	9944.02854	0.789954364	11.11111111	11.76470588	91.84782609	61.11111111	64.70588235	83.60655738	-1.928543208	-25.17142705
Epochs 180	0.816513777	11.76470588	18.18181818	91.57894737	58.82352941	50	83.68421053	109.5743286	9944.02854	0.785388112	11.11111111	11.11111111	91.80327869	55.55555556	66.66666667	83.51648352	-3.191989715	-25.17142705
Epochs 200	0.816513777	6.25	0	90.30612245	62.5	40	83.16326531	116.5921394	9944.02854	0.83561641	16.66666667	15.38461538	92.26804124	66.66666667	69.23076923	83.93782383	1.979751982	-25.17142705

Manulife Financial Corporation LSTM Model (With Support Stock Data)																		
	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.344036698	10.60606061	6.976744186	93.93939394	46.96969697	41.17647059	86.36363636	1081.546161	9944.02854	0.388127863	4.615384615	6.060606061	88.63636364	53.125	46.96969697	80.68181818	-47.55891704	-25.17142705
Epochs 40	0.431192666	11.76470588	6.578947368	91.20879121	52.94117647	41.33333333	82.41758242	2215.150475	9944.02854	0.433789968	6.451612903	6.779661017	88.7755102	60.6557377	47.45762712	80.6122449	-0.538617987	-25.17142705
Epochs 60	0.536697268	9.302325581	5.660377358	90.16393443	55.81395349	42.30769231	81.96721311	405.0467786	9944.02854	0.557077646	5.882352941	7.692307692	89.92248062	58.82352941	48.71794872	82.8125	-54.21477051	-25.17142705
Epochs 80	0.655963302	13.88888889	5.882352941	91.89189189	58.33333333	36.36363636	83.10810811	394.9844803	9944.02854	0.648401797	7.5	10	91.27516779	57.5	53.33333333	83.10810811	-29.87320264	-25.17142705
Epochs 100	0.697247684	10	7.692307692	90.74074074	56.66666667	32	82.09876543	491.8390144	9944.02854	0.698630154	6.060606061	12.5	91.35802469	57.57575758	45.83333333	83.85093168	-41.32518387	-25.17142705
Epochs 120	0.74311924	13.63636364	8.333333333	91.27906977	45.45454545	34.7826087	82.55813953	26.17393664	9944.02854	0.730593622	8	8.695652174	91.22807018	72	39.13043478	84.11764706	-39.71836187	-25.17142705
Epochs 140	0.75688076	5.555555556	9.523809524	90.5027933	38.88888889	30	82.68156425	-63.20447244	9944.02854	0.789954364	10.52631579	16.66666667	92.30769231	63.15789474	44.44444444	84.53038674	-45.89918517	-25.17142705
Epochs 160	0.80733943	5.882352941	18.18181818	91.05263158	41.17647059	30	83.68421053	45.5663518	9944.02854	0.794520557	4.545454545	20	91.44385027	63.63636364	30	83.87096774	-9.786146976	-25.17142705
Epochs 180	0.816513777	6.25	20	91.14583333	37.5	33.33333333	83.33333333	45.5663518	9944.02854	0.81735158	5.882352941	12.5	91.2371134	58.82352941	25	83.93782383	-32.73349713	-25.17142705
Epochs 200	0.834862411	0	18.18181818	90.90909091	33.33333333	30	83.33333333	47.79077534	9944.02854	0.840182662	0	12.5	91.04477612	40	25	84	-44.34937026	-25.17142705

Table 16-9 LSTM Models Results for Variation 5

ON Semiconductor Corporation LSTM Model (No Support Stock Data)																		
	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.527522922	5.172413793	11.9047619	90.6779661	50	53.65853659	83.05084746	356.6550763	27.5784763	0.570776284	7.692307692	8.333333333	90.07633588	50.98039216	55.55555556	81.67938931	160.4033811	75.89343906
Epochs 40	0.454128444	5.063291139	12.82051282	90	49.36708861	55.26315789	83	-34.73509404	27.5784763	0.497716904	10.16949153	6.12244898	90.09009009	50.84745763	55.10204082	80.90909091	81.96231197	75.89343906
Epochs 60	0.481651366	5.479452055	12.82051282	90.56603774	47.94520548	57.89473684	83.96226415	86.28684257	27.5784763	0.534246564	12.5	10.20408163	92.10526316	51.78571429	48.97959184	83.18584071	45.39425684	75.89343906
Epochs 80	0.518348634	5.714285714	14.70588235	91.22807018	52.85714286	57.57575758	84.21052632	113.0149747	27.5784763	0.566210032	14.58333333	10	92.56198347	52.08333333	50	84.16666667	100.5491673	75.89343906
Epochs 100	0.568807364	5.084745763	13.79310345	90	55.93220339	60.71428571	82.30769231	110.9321329	27.5784763	0.611872137	12.12121212	8.510638298	90.64748201	45.45454545	48.93617021	82.60869565	54.62247696	75.89343906
Epochs 120	0.573394477	5.357142857	7.407407407	88.88888889	53.57142857	57.69230769	81.48148148	213.5084601	27.5784763	0.657534242	16.66666667	9.523809524	91.83673469	53.33333333	50	83.56164384	71.42294315	75.89343906
Epochs 140	0.600917459	5.454545455	9.090909091	89.36170213	54.54545455	61.9047619	82.26950355	263.4015243	27.5784763	0.689497709	20	10	92.20779221	52	52.5	84.31372549	253.584632	75.89343906
Epochs 160	0.646789014	4.255319149	6.25	89.03225806	57.44680851	62.5	81.81818182	130.6985685	27.5784763	0.689497709	19.23076923	3.03030303	90.625	53.84615385	51.51515152	83.01886792	336.3617672	75.89343906
Epochs 180	0.669724762	2.564102564	5.882352941	88.88888889	53.84615385	58.82352941	81.98757764	123.5787734	27.5784763	0.730593622	16.66666667	6.666666667	90.64327485	50	53.33333333	83.52941176	284.4515166	75.89343906
Epochs 200	0.724770665	3.333333333	7.142857143	89.65517241	60	64.28571429	82.65895954	88.21907609	27.5784763	0.776255727	20	4.761904762	90.71038251	53.33333333	52.38095238	83.51648352	188.0886885	75.89343906

ON Semiconductor Corporation LSTM Model (With Support Stock Data)																		
	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.504587173	9.523809524	10.41666667	92.52336449	49.20634921	55.31914894	85.04672897	407.4113259	27.5784763	0.497716904	5	8.695652174	90.26548673	46.66666667	48.88888889	84.07079646	-39.22944249	75.89343906
Epochs 40	0.454128444	6.153846154	7.843137255	89.21568627	47.69230769	50	82.35294118	-5.620132783	27.5784763	0.488584489	15.2173913	7.246376812	91.34615385	54.34782609	50	82.69230769	63.47442936	75.89343906
Epochs 60	0.587155938	4.444444444	10.52631579	90.37037037	48.88888889	45.94594595	83.7037037	-31.91911171	27.5784763	0.634703219	9.677419355	5.263157895	89.33333333	54.83870968	47.36842105	82.55033557	73.98351183	75.89343906
Epochs 80	0.674311936	3.225806452	7.692307692	89.44099379	54.83870968	44	82.60869565	-62.31576538	27.5784763	0.744292259	5.555555556	8.695652174	89.88764045	44.44444444	52.17391304	81.92090395	67.8679152	75.89343906
Epochs 100	0.729357779	4.347826087	9.090909091	90.1734104	56.52173913	47.61904762	83.23699422	17.62981805	27.5784763	0.79908675	8.333333333	11.76470588	90.52631579	41.66666667	52.94117647	83.06878307	61.62945828	75.89343906
Epochs 120	0.75688076	4.761904762	11.11111111	90.5027933	57.14285714	41.17647059	83.79888268	-20.19198416	27.5784763	0.79908675	8.333333333	6.666666667	90.10416667	41.66666667	46.66666667	82.72251309	44.94658563	75.89343906
Epochs 140	0.825688064	7.142857143	20	91.2371134	57.14285714	50	84.45595855	156.1609205	27.5784763	0.831050217	0	11.11111111	90.04975124	33.33333333	55.55555556	83	84.79838439	75.89343906
Epochs 160	0.834862411	7.142857143	25	91.32653061	50	37.5	84.1025641	76.47136447	27.5784763	0.840182662	0	0	89.75609756	14.28571429	57.14285714	82.84313725	15.28220364	75.89343906
Epochs 180	0.830275238	7.142857143	14.28571429	90.86294416	50	28.57142857	83.67346939	76.47136447	27.5784763	0.826484025	0	0	89.6039604	30	57.14285714	82.58706468	59.86686732	75.89343906
Epochs 200	0.825688064	7.692307692	18.18181818	91.2371134	61.53846154	45.45454545	83.93782383	35.19413023	27.5784763	0.840182662	0	0	89.75609756	16.66666667	37.5	82.35294118	-11.81585331	75.89343906

Table 16-10 LSTM Models Results for Variation 5

17 Appendix 12

Hawaiian Airlines CNN Model																		
Hawaiian Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.169724777	6.603773585	6.896551724	96	48.11320755	47.6744186	88	337.0486981	-2.642012201	0.168949768	2.197802198	8.333333333	84.375	38.88888889	47.91666667	75	1580.949821	-51.27594162
Epochs 40	0.068807341	6.722689076	7.070707071	0	49.57983193	45.91836735	0	1318.970303	-2.642012201	0.077625573	7.2	8.510638298	0	45.96774194	50	0	1455.249755	-51.27594162
Epochs 60	0.073394492	5.755395683	4.166666667	71.42857143	47.48201439	46.47887324	71.42857143	245.7409036	-2.642012201	0.105022833	6.993006993	11.26760563	100	46.47887324	54.92957746	100	220.3444377	-51.27594162
Epochs 80	0.110091746	7.01754386	8.510638298	80	51.75438596	47.31182796	60	1389.437604	-2.642012201	0.114155248	6.504065041	9.302325581	90	45.90163934	53.48837209	80	982.6198577	-51.27594162
Epochs 100	0.17889908	7.547169811	9.195402299	92	51.88679245	47.6744186	64	1516.512214	-2.642012201	0.182648405	6.086956522	9.459459459	86.66666667	43.85964912	52.7027027	80	206.7164445	-51.27594162
Epochs 120	0.275229365	8.139534884	8.641975309	90.19607843	53.48837209	47.5	74.50980392	6726.348586	-2.642012201	0.283105016	5.319148936	10.14492754	89.28571429	39.78494624	50.72463768	82.14285714	16.33678202	-51.27594162
Epochs 140	0.394495428	8.695652174	10	92.40506329	52.17391304	49.27536232	79.74683544	10170.00588	-2.642012201	0.406392694	4.225352113	11.66666667	89.77272727	42.85714286	50	82.95454545	-12.62566349	-51.27594162
Epochs 160	0.600917459	7.692307692	9.756097561	89.85507246	58.97435897	51.2195122	81.02189781	93.44409667	-2.642012201	0.611872137	4.651162791	17.07317073	92.59259259	45.23809524	60.97560976	86.66666667	24.36645023	-51.27594162
Epochs 180	0.729357779	8.333333333	12.5	90.58823529	62.5	50	82.24852071	-21.96640283	-2.642012201	0.689497709	6.060606061	8.695652174	90.18404908	48.48484848	69.56521739	82.71604938	-68.59834184	-51.27594162
Epochs 200	0.766055048	8.333333333	11.53846154	90.55555556	50	57.69230769	81.56424581	71.04973332	-2.642012201	0.748858452	5.555555556	8.695652174	90.4494382	50	65.2173913	83.61581921	-90.13598873	-51.27594162
Jet blue Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.233944952	8.24742268	6.097560976	97.43589744	49.48453608	50.61728395	82.05128205	439.6586459	19.48199225	0.205479458	9.756097561	6.666666667	93.75	51.85185185	47.61904762	81.25	1813.027701	-44.84408332
Epochs 40	0.068807341	8	5.376344086	0	47.2	48.91304348	0	92.73714518	19.48199225	0.077625573	7.75862069	7.766990291	0	47.82608696	47.57281553	0	-11.15925199	-44.84408332
Epochs 60	0.105504587	7.092198582	3.076923077	91.66666667	41.84397163	40.625	91.66666667	-49.89743827	19.48199225	0.118721463	7.575757576	8.974358974	100	51.14503817	57.69230769	88.88888889	125.4397188	-44.84408332
Epochs 80	0.100917429	7.37704918	4.705882353	81.81818182	44.26229508	46.42857143	72.72727273	-25.98775	19.48199225	0.12328767	8.256880734	10.67961165	100	51.85185185	51.45631068	100	36.48076983	-44.84408332
Epochs 100	0.155963302	7.826086957	5.063291139	87.5	46.95652174	48.71794872	87.5	4.030688669	19.48199225	0.173515975	5.263157895	9.574468085	80	48.93617021	51.06382979	76.66666667	65.61555961	-44.84408332
Epochs 120	0.279816508	7.692307692	5.555555556	90.90909091	48.35164835	49.29577465	85.45454545	302.9636179	19.48199225	0.260273963	5.617977528	10.12658228	86.2745098	50	54.43037975	82.35294118	80.75474434	-44.84408332
Epochs 140	0.380733937	8.641975309	6.666666667	93.50649351	46.91358025	47.45762712	88.31168831	39.51436778	19.48199225	0.410958916	5.882352941	11.11111111	89.77272727	43.28358209	53.96825397	87.5	-43.87780288	-44.84408332
Epochs 160	0.573394477	5.882352941	5.555555556	91.60305344	50.98039216	45.71428571	83.20610687	21.59049129	19.48199225	0.611872137	10.25641026	11.62790698	91.24087591	52.63157895	55.81395349	86.86131387	182.1223203	-44.84408332
Epochs 180	0.715596318	9.375	0	91.61676647	56.25	50	83.23353293	-43.90059031	19.48199225	0.703196347	9.375	5	89.82035928	54.83870968	50	86.22754491	247.6868765	-44.84408332
Epochs 200	0.775229335	11.11111111	0	91.75824176	55.55555556	52.94117647	82.96703297	-6.514192862	19.48199225	0.730593622	4.761904762	4.761904762	89.26553672	45	52.38095238	85.31073446	337.0285799	-44.84408332
American Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit

Epochs 20	0.215596333	7.52688172	4.651162791	92.30769231	47.31182796	42.35294118	79.48717949	329.868466	-69.69637123	0.187214613	5.882352941	7.692307692	93.33333333	47.61904762	48.07692308	83.33333333	4180.827914	-63.19650348
Epochs 40	0.064220183	6.557377049	6.25	0	41.80327869	45.26315789	0	84.06757671	-69.69637123	0.073059358	6.140350877	8.571428571	0	48.67256637	49.52380952	0	1648.632273	-63.19650348
Epochs 60	0.082568809	5.970149254	5.128205128	100	40.29850746	44.15584416	83.33333333	293.5591327	-69.69637123	0.10958904	5.426356589	8.75	100	47.65625	52.5	90	1247.876724	-63.19650348
Epochs 80	0.105504587	7.079646018	5.263157895	100	43.36283186	45.74468085	80	270.3444376	-69.69637123	0.127853885	5.882352941	7.070707071	83.33333333	47.52475248	51.51515152	83.33333333	299.745261	-63.19650348
Epochs 100	0.16055046	7.339449541	5.813953488	95.65217391	42.20183486	43.52941176	82.60869565	653.0759597	-69.69637123	0.210045666	5.825242718	8.536585366	97.05882353	47.05882353	48.7804878	94.11764706	140.3424078	-63.19650348
Epochs 120	0.252293587	8.510638298	6.172839506	97.6744186	44.68085106	45	86.04651163	491.9517427	-69.69637123	0.273972601	5.813953488	8.860759494	88.88888889	45.88235294	49.36708861	85.18518519	55.02009227	-63.19650348
Epochs 140	0.353211015	8.974358974	5.714285714	94.28571429	48.71794872	44.28571429	85.50724638	621.1101369	-69.69637123	0.392694056	6.944444444	7.8125	91.56626506	43.66197183	46.875	84.3373494	-55.54027904	-63.19650348
Epochs 160	0.619266033	10.63829787	8.108108108	94.7761194	55.31914894	51.35135135	87.96992481	-59.53300719	-69.69637123	0.575342476	9.090909091	10.41666667	92.12598425	46.51162791	47.91666667	84.2519685	238.7521352	-63.19650348
Epochs 180	0.706422031	5.882352941	8.695652174	93.16770186	55.88235294	47.82608696	85	-94.20515548	-69.69637123	0.698630154	8.571428571	15.38461538	92.40506329	47.05882353	57.69230769	84.17721519	202.3826035	-63.19650348
Epochs 200	0.770642221	0	8	92.73743017	57.14285714	48	85.39325843	-77.65272467	-69.69637123	0.748858452	0	8.695652174	90	37.5	47.82608696	82.68156425	-46.82247549	-63.19650348

Jet Blue Airlines CNN Model

Hawaiian Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.261467904	4.807692308	5.454545455	83.05084746	44.23076923	57.40740741	76.27118644	354.2100266	-2.642012201	0.264840186	4.95049505	9.230769231	88.67924528	43	55.38461538	83.01886792	294.501812	-51.27594162
Epochs 40	0.183486238	6.976744186	8.653846154	89.28571429	47.6744186	47.57281553	75	4793.019092	-2.642012201	0.219178081	7.317073171	7.070707071	92.10526316	45.67901235	48.48484848	84.21052632	1921.984814	-51.27594162
Epochs 60	0.233944952	8.75	8.080808081	92.30769231	50	47.95918367	71.79487179	2549.681329	-2.642012201	0.255707771	7.407407407	7.692307692	91.4893617	45	49.45054945	80.85106383	1262.72108	-51.27594162
Epochs 80	0.270642191	7.462686567	6.25	87.27272727	52.23880597	48.42105263	67.27272727	7382.134711	-2.642012201	0.273972601	8.333333333	7.291666667	92.15686275	47.22222222	46.875	80	692.0284659	-51.27594162
Epochs 100	0.353211015	6.25	7.594936709	89.33333333	54.6875	45.56962025	70.27027027	641.5890089	-2.642012201	0.401826471	8.620689655	7.792207792	91.66666667	51.72413793	48.05194805	83.13253012	-29.27643509	-51.27594162
Epochs 120	0.472477078	4.081632653	8.064516129	89.71962617	57.14285714	45.16129032	74.52830189	285.9489806	-2.642012201	0.520547926	4.651162791	8.620689655	90.6779661	46.51162791	53.44827586	84.61538462	20.14884452	-51.27594162
Epochs 140	0.600917459	5.263157895	7.5	90	57.89473684	45	77.69784173	214.5138191	-2.642012201	0.643835604	3.03030303	11.11111111	90.66666667	51.51515152	63.88888889	83.89261745	141.9848946	-51.27594162
Epochs 160	0.669724762	3.846153846	8.571428571	90.44585987	61.53846154	45.71428571	79.48717949	450.9407373	-2.642012201	0.707762539	4.545454545	7.142857143	89.9408284	63.63636364	64.28571429	83.33333333	462.3508207	-51.27594162
Epochs 180	0.784403682	6.666666667	11.76470588	90.32258065	60	52.94117647	80.54054054	292.7466235	-2.642012201	0.771689475	0	10.52631579	90.27027027	53.33333333	63.15789474	83.69565217	182.6593003	-51.27594162
Epochs 200	0.793577969	0	11.11111111	90.47619048	54.54545455	44.44444444	80.85106383	32.40564445	-2.642012201	0.79908675	0	10	90.57591623	37.5	60	84.21052632	9.605350494	-51.27594162

Jet blue Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.284403682	7.407407407	5.454545455	92.72727273	49.07407407	51.85185185	83.63636364	95.9483776	19.48199225	0.283105016	6.666666667	8.108108108	90.90909091	49.43820225	55.40540541	83.63636364	488.4500944	-44.84408332
Epochs 40	0.206422016	9.411764706	3.191489362	87.17948718	50.58823529	50.53763441	82.05128205	150.8997283	19.48199225	0.232876718	7.246376812	6.666666667	86.66666667	47.05882353	48.57142857	84.44444444	199.5464289	-44.84408332
Epochs 60	0.266055048	10.12658228	4.545454545	90.19607843	54.43037975	52.87356322	76.47058824	275.8461921	19.48199225	0.269406378	7.462686567	7.070707071	88.67924528	51.51515152	49.49494949	84.90566038	126.2664597	-44.84408332
Epochs 80	0.270642191	10.66666667	3.296703297	92.30769231	53.33333333	53.33333333	76.92307692	554.4002448	19.48199225	0.310502291	10	7.142857143	90.16393443	54.23728814	52.04081633	86.8852459	340.9458154	-44.84408332

Epochs 100	0.394495428	10.76923077	4.225352113	92.68292683	55.38461538	48.57142857	81.70731707	161.8546595	19.48199225	0.415525109	11.11111111	8.75	91.76470588	52.83018868	56.25	85.88235294	69.03955212	-44.84408332
Epochs 120	0.555045843	10.63829787	6	93.38842975	57.44680851	52	82.5	192.6049357	19.48199225	0.520547926	9.090909091	7.142857143	89.07563025	53.48837209	58.92857143	84.87394958	264.7769843	-44.84408332
Epochs 140	0.651376128	10	6.25	93.15068493	60	50	84.13793103	18.96665278	19.48199225	0.616438329	10.52631579	5.555555556	88.96551724	54.05405405	61.11111111	84.82758621	-4.842761982	-44.84408332
Epochs 160	0.729357779	16	6.896551724	93.29268293	56	44.82758621	83.43558282	-50.80613061	19.48199225	0.671232879	7.407407407	6.451612903	88.81987578	48.14814815	61.29032258	84.375	-39.11221843	-44.84408332
Epochs 180	0.770642221	11.11111111	9.090909091	92.13483146	50	50	83.05084746	-25.19231613	19.48199225	0.771689475	5.263157895	7.692307692	89.30481283	52.63157895	69.23076923	83.87096774	-43.25964229	-44.84408332
Epochs 200	0.798165143	7.692307692	10.52631579	91.93548387	38.46153846	52.63157895	82.7027027	38.11419329	19.48199225	0.81735158	10	8.333333333	89.84771574	60	66.66666667	84.69387755	-44.31804584	-44.84408332
American Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.224770635	5.982905983	1.818181818	89.13043478	41.88034188	44.44444444	80.43478261	123.7908809	-69.69637123	0.260273963	7.070707071	8.108108108	95.65217391	47.95918367	47.2972973	86.95652174	197.5528245	-63.19650348
Epochs 40	0.17889908	6.18556701	5.555555556	90.32258065	44.32989691	44.94382022	80.64516129	186.4516142	-69.69637123	0.182648405	7.142857143	7.476635514	92.85714286	49.39759036	51.40186916	85.71428571	1375.619815	-63.19650348
Epochs 60	0.197247714	5.747126437	5.319148936	89.18918919	42.52873563	45.16129032	83.78378378	147.8088738	-69.69637123	0.255707771	7.692307692	9.183673469	95.34883721	51.94805195	56.12244898	86.04651163	4184.676251	-63.19650348
Epochs 80	0.215596333	5.063291139	5.208333333	88.37209302	45.56962025	46.31578947	81.39534884	-47.25137667	-69.69637123	0.292237431	8.219178082	9.473684211	96.07843137	54.16666667	56.84210526	86.2745098	13417.81664	-63.19650348
Epochs 100	0.330275238	6.25	5.813953488	92.64705882	51.5625	48.23529412	85.29411765	-64.48242198	-69.69637123	0.347031951	7.575757576	10.34482759	93.93939394	55.38461538	58.62068966	84.84848485	13099.73718	-63.19650348
Epochs 120	0.467889905	6.666666667	5.555555556	94.05940594	48.88888889	45.83333333	87	-75.80836997	-69.69637123	0.474885851	10	8.823529412	92.07920792	55.10204082	60.29411765	85.14851485	1647.699338	-63.19650348
Epochs 140	0.568807364	7.894736842	5.555555556	93.65079365	52.63157895	50	87.2	-30.81200887	-69.69637123	0.584474862	13.15789474	9.433962264	92.1875	64.86486486	58.49056604	85.15625	5332.44501	-63.19650348
Epochs 160	0.669724762	4.347826087	2.631578947	91.71974522	56.52173913	50	86.53846154	-25.11072061	-69.69637123	0.634703219	11.11111111	8.695652174	90.4109589	62.96296296	60.86956522	82.75862069	788.9419767	-63.19650348
Epochs 180	0.747706413	0	4	92.04545455	47.05882353	48	84.57142857	-36.47280848	-69.69637123	0.716894984	10	6.896551724	90	60	62.06896552	82.24852071	-84.46621261	-63.19650348
Epochs 200	0.779816508	0	4.545454545	92.34972678	53.84615385	45.45454545	84.06593407	-55.60141679	-69.69637123	0.744292259	12.5	7.407407407	90.34090909	62.5	59.25925926	82.28571429	-76.54182051	-63.19650348
American Airlines CNN Model																		
Hawaiian Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.119266056	6.666666667	7	92.30769231	47.61904762	44.44444444	84.61538462	1772.816893	-2.642012201	0.09589041	3.883495146	7.692307692	75	42.15686275	47.11538462	66.66666667	2946.690186	-51.27594162
Epochs 40	0.073394492	6.611570248	8.24742268	0	47.9338843	47.91666667	0	1480.033721	-2.642012201	0.073059358	6.25	8.791208791	0	45.66929134	49.45054945	0	1578.53076	-51.27594162
Epochs 60	0.068807341	5.263157895	9.411764706	0	48.12030075	52.38095238	0	683.0302689	-2.642012201	0.077625573	6.25	10.66666667	0	45.45454545	52	0	1281.052573	-51.27594162
Epochs 80	0.091743119	5.128205128	9.473684211	83.33333333	48.71794872	50	50	1251.583197	-2.642012201	0.09589041	6.451612903	8.045977011	75	43.90243902	48.27586207	75	880.0072968	-51.27594162
Epochs 100	0.16055046	5.691056911	8.695652174	84.61538462	48.7804878	48.52941176	84.61538462	195.7332755	-2.642012201	0.200913236	6.504065041	9.523809524	90.90909091	44.26229508	55.55555556	84.84848485	8.176799835	-51.27594162
Epochs 120	0.201834857	5.660377358	9.210526316	86.11111111	49.05660377	48	72.22222222	398.7430553	-2.642012201	0.223744288	7.547169811	8	92.10526316	42.85714286	52	86.84210526	-14.45527626	-51.27594162
Epochs 140	0.311926603	5.952380952	10	87.5	47.61904762	49.27536232	78.125	582.0184424	-2.642012201	0.347031951	9.090909091	9.230769231	93.93939394	43.67816092	50.76923077	86.36363636	-49.81486094	-51.27594162
Epochs 160	0.454128444	6.666666667	10.16949153	89.8989899	48.33333333	50	78.78787879	789.3723406	-2.642012201	0.484018266	9.375	11.11111111	93.06930693	46.03174603	50	83.16831683	-46.88991769	-51.27594162

Epochs 180	0.536697268	4.081632653	9.090909091	88.8	48.97959184	53.48837209	78.4	708.4828591	-2.642012201	0.589041114	11.53846154	10.52631579	92.24806202	46.15384615	50	83.59375	-28.48139633	-51.27594162
Epochs 200	0.69266057	4	12.5	90.68322981	48	58.06451613	80.74534161	-62.9787953	-2.642012201	0.712328792	7.692307692	13.79310345	91.46341463	38.46153846	48.27586207	84.04907975	-32.93622553	-51.27594162
Jet blue Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.165137619	6.930693069	4.395604396	96.15384615	45.54455446	47.77777778	84.61538462	174.3613919	19.48199225	0.127853885	7.608695652	6.25	93.33333333	47.82608696	45.53571429	85.71428571	200.6776774	-44.84408332
Epochs 40	0.064220183	7.936507937	4.347826087	0	46.03174603	50.54945055	0	-16.51145281	19.48199225	0.063926943	5.982905983	6.862745098	0	49.13793103	48.03921569	0	75.79223511	-44.84408332
Epochs 60	0.064220183	7.142857143	5.128205128	0	44.28571429	50.64935065	0	29.31844342	19.48199225	0.073059358	7.258064516	7.368421053	0	47.96747967	48.42105263	0	12.45382077	-44.84408332
Epochs 80	0.100917429	8	4.761904762	88.88888889	46.4	50.60240964	88.88888889	27.74597731	19.48199225	0.086757988	6.306306306	6.930693069	71.42857143	46.36363636	47.52475248	71.42857143	-43.61476435	-44.84408332
Epochs 100	0.146788985	7.575757576	4.615384615	90.47619048	46.21212121	51.5625	71.42857143	-3.965136271	19.48199225	0.178082198	6.837606838	9.090909091	96	45.68965517	57.14285714	92	10.53115823	-44.84408332
Epochs 120	0.183486238	7.75862069	6.756756757	92.85714286	47.4137931	50.68493151	89.28571429	9.435544855	19.48199225	0.196347028	7.692307692	8.045977011	100	42.7184466	52.87356322	92.85714286	-24.7703972	-44.84408332
Epochs 140	0.288990825	7.368421053	6.060606061	91.22807018	51.57894737	50.76923077	85.96491228	-19.70174568	19.48199225	0.287671238	8.791208791	7.792207792	96.07843137	42.22222222	55.84415584	92.15686275	-6.370249772	-44.84408332
Epochs 160	0.412844032	7.8125	3.333333333	88.29787234	54.6875	49.15254237	77.65957447	-7.48292896	19.48199225	0.456620991	11.29032258	7.936507937	93.61702128	43.5483871	60.31746032	88.17204301	32.84573996	-44.84408332
Epochs 180	0.513761461	3.278688525	3.03030303	87.90322581	52.45901639	50	79.03225806	-70.82754624	19.48199225	0.566210032	9.259259259	9.756097561	92.74193548	40.74074074	60.97560976	86.17886179	-9.294986598	-44.84408332
Epochs 200	0.674311936	3.333333333	3.703703704	90.0621118	46.66666667	46.15384615	80.74534161	-59.77559205	19.48199225	0.694063902	7.692307692	12.12121212	91.25	42.30769231	63.63636364	85.53459119	92.92295137	-44.84408332
American Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.142201841	5.769230769	4.347826087	95.45454545	44.23076923	41.75824176	90.90909091	-30.6405651	-69.69637123	0.150684938	6.741573034	7.272727273	95	47.72727273	46.36363636	85	857.8794025	-63.19650348
Epochs 40	0.059633028	6.015037594	5.882352941	0	42.10526316	46.42857143	0	208.0533969	-69.69637123	0.077625573	6.557377049	9.278350515	0	46.28099174	48.45360825	0	799.3488421	-63.19650348
Epochs 60	0.055045873	5.673758865	5.194805195	0	41.13475177	46.05263158	0	157.9589461	-69.69637123	0.077625573	5.839416058	10.97560976	0	48.52941176	54.87804878	0	2129.306375	-63.19650348
Epochs 80	0.096330278	6.451612903	5.813953488	100	42.74193548	45.88235294	100	154.9560518	-69.69637123	0.12328767	5.93220339	10.11235955	91.66666667	48.71794872	52.80898876	83.33333333	1609.669963	-63.19650348
Epochs 100	0.16055046	6.25	6.060606061	95.83333333	41.40625	52.30769231	91.66666667	111.9414964	-69.69637123	0.168949768	5.785123967	9.85915493	85.18518519	48.33333333	59.15492958	70.37037037	1478.551654	-63.19650348
Epochs 120	0.201834857	6.363636364	6.849315068	91.42857143	44.54545455	48.61111111	77.14285714	27.15320344	-69.69637123	0.223744288	6.542056075	10.66666667	91.89189189	49.05660377	58.66666667	81.08108108	2252.249827	-63.19650348
Epochs 140	0.284403682	6.18556701	7.575757576	92.72727273	42.26804124	53.84615385	83.63636364	19.02828852	-69.69637123	0.333333343	7.865168539	9.230769231	92.30769231	48.86363636	58.46153846	81.53846154	575.9160105	-63.19650348
Epochs 160	0.426605493	4.47761194	7.01754386	91.4893617	38.80597015	55.35714286	81.91489362	-87.00704669	-69.69637123	0.442922384	8.450704225	10.52631579	93.40659341	47.14285714	61.40350877	82.41758242	81.65787798	-63.19650348
Epochs 180	0.555045843	5.660377358	7.317073171	92.74193548	41.50943396	57.5	85.48387097	-90.44996408	-69.69637123	0.515981734	7.692307692	10	91.22807018	50	60	81.57894737	-48.77932408	-63.19650348
Epochs 200	0.733944952	10	9.090909091	93.93939394	60	59.375	86.06060606	-87.17634866	-69.69637123	0.684931517	9.677419355	7.142857143	90.625	60	57.14285714	80.625	-83.80462587	-63.19650348

Table 17-1 CNN Models Results for Variation 6

Sichuan Swellfun Co.,Ltd CNN Model

Sichuan SwellfunTest Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.062801935	5	8.955223881	0	43.88489209	41.79104478	0	3021.46581	2068.314051	0.0625	6.25	6.25	0	46.09375	51.89873418	0	281.7771543	400.9406907
Epochs 40	0.072463766	5.109489051	11.42857143	0	43.38235294	38.57142857	0	1472.931524	2068.314051	0.067307696	5.64516129	8.333333333	0	44.71544715	46.42857143	0	62.74823059	400.9406907
Epochs 60	0.111111112	6	9.090909091	100	46.46464646	41.41414141	87.5	404.1811307	2068.314051	0.115384616	7.446808511	6.730769231	100	41.93548387	44.23076923	90	-54.82841278	400.9406907
Epochs 80	0.202898547	5.102040816	8.219178082	86.11111111	45.36082474	39.7260274	86.11111111	1660.538148	2068.314051	0.192307696	7.446808511	7.058823529	93.10344828	45.16129032	45.88235294	86.20689655	-38.02594964	400.9406907
Epochs 100	0.231884062	5.333333333	6.818181818	86.36363636	50	39.77272727	75	53.17566923	2068.314051	0.269230783	9.722222222	7.52688172	97.6744186	47.88732394	46.23655914	83.72093023	-17.95765096	400.9406907
Epochs 120	0.376811594	4.6875	8.955223881	90.78947368	47.61904762	40.29850746	81.57894737	31.43057872	2068.314051	0.350961536	11.29032258	5	93.93939394	50.81967213	43.75	83.33333333	10.59908172	400.9406907
Epochs 140	0.444444448	5.555555556	6.666666667	91.39784946	47.16981132	36.66666667	81.72043011	16.09642068	2068.314051	0.389423072	8.163265306	5.063291139	91.25	47.91666667	44.30379747	83.75	39.48802875	400.9406907
Epochs 160	0.599033833	5.882352941	5	90.22556391	41.17647059	42.5	81.06060606	150.0610811	2068.314051	0.552884638	7.407407407	5	90.90909091	46.15384615	48.33333333	83.47107438	-4.951204098	400.9406907
Epochs 180	0.69082123	7.692307692	6.896551724	91.44736842	42.30769231	34.48275862	82.78145695	95.47429152	2068.314051	0.610576928	8	2.173913043	90.51094891	50	54.34782609	83.94160584	0.443873596	400.9406907
Epochs 200	0.763285041	13.33333333	8	92.21556886	40	40	83.13253012	130.2977345	2068.314051	0.692307711	9.523809524	0	91.02564103	60	51.61290323	85.25641026	21.98808533	400.9406907

Wuliangye Yibin Co.,Ltd	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.053140096	5.194805195	5.660377358	0	44.15584416	46.15384615	0	4830.515309	2331.201715	0.067307696	7.692307692	5.128205128	0	42.30769231	44.15584416	0	301.9685415	604.1107527
Epochs 40	0.062801935	5.633802817	7.692307692	0	45.77464789	48.4375	0	3624.366088	2331.201715	0.072115384	8.695652174	5.376344086	0	43.47826087	47.82608696	0	155.2559918	604.1107527
Epochs 60	0.115942031	7.407407407	6.741573034	100	50	46.59090909	90	2244.056745	2331.201715	0.086538464	8.641975309	5.737704918	80	50.61728395	47.10743802	80	111.4471452	604.1107527
Epochs 80	0.227053136	6.930693069	7.246376812	94.59459459	51.48514851	48.52941176	83.78378378	2880.532299	2331.201715	0.201923072	9.459459459	4.081632653	86.11111111	52.7027027	46.39175258	83.33333333	78.98586861	604.1107527
Epochs 100	0.227053136	8.536585366	5.882352941	87.5	54.87804878	47.61904762	82.5	1126.412713	2331.201715	0.230769232	11.66666667	5.454545455	92.10526316	56.66666667	47.70642202	89.47368421	96.75423089	604.1107527
Epochs 120	0.36714977	10	7.352941176	92.75362319	50	49.25373134	86.95652174	1843.46039	2331.201715	0.375	12.5	5.747126437	91.78082192	56.25	50	89.04109589	163.0604202	604.1107527
Epochs 140	0.449275374	8	7.692307692	91.30434783	52	50.76923077	85.71428571	1185.299695	2331.201715	0.475961536	15.625	6.25	92.70833333	59.375	50.63291139	89.58333333	412.0861144	604.1107527
Epochs 160	0.603864729	10.81081081	11.11111111	92.8	51.35135135	57.77777778	85.48387097	10995.17521	2331.201715	0.596153855	14.28571429	6.779661017	91.40625	52.38095238	51.72413793	88.28125	460.3963843	604.1107527
Epochs 180	0.695652187	13.04347826	11.11111111	92.56756757	47.82608696	61.11111111	85.03401361	2323.600073	2331.201715	0.644230783	10.52631579	8.163265306	91.42857143	52.63157895	50	87.14285714	676.985087	604.1107527
Epochs 200	0.724637687	6.25	9.375	91.82389937	43.75	56.25	84.17721519	1518.018695	2331.201715	0.706730783	0	10.52631579	91.08280255	53.84615385	45.94594595	85.98726115	470.9903285	604.1107527

Kweichow Moutai Co., Ltd	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.077294685	7.971014493	7.246376812	0	47.82608696	47.05882353	0	12320.28037	1666.892281	0.067307696	6.818181818	6.578947368	0	39.69465649	42.10526316	0	62.88241037	678.7940879
Epochs 40	0.086956523	8.270676692	9.459459459	0	50.37593985	52.05479452	0	1933.598173	1666.892281	0.072115384	6.779661017	7.777777778	0	45.2991453	50	0	118.6717218	678.7940879
Epochs 60	0.149758458	11.45833333	9.090909091	91.66666667	53.125	48.97959184	91.66666667	1949.402389	1666.892281	0.120192304	8.641975309	6.086956522	91.66666667	51.85185185	49.56521739	81.81818182	74.87497155	678.7940879

Epochs 80	0.289855063	11.95652174	12	100	52.17391304	53.33333333	97.43589744	641.9334828	1666.892281	0.211538464	9.090909091	6.25	88.57142857	51.31578947	52.08333333	80	137.0295324	678.7940879
Epochs 100	0.314009666	14.08450704	10.22727273	95.83333333	54.92957746	53.40909091	91.4893617	2359.041223	1666.892281	0.230769232	10	7.207207207	91.89189189	55.93220339	49.54954955	81.08108108	206.0071407	678.7940879
Epochs 120	0.425120771	15	10	93.50649351	55	51.42857143	89.47368421	1214.188496	1666.892281	0.322115391	9.803921569	7.291666667	90.16393443	56	51.04166667	80.32786885	212.5109624	678.7940879
Epochs 140	0.492753625	18.36734694	10.44776119	94.50549451	61.2244898	49.25373134	91.11111111	4033.249135	1666.892281	0.384615391	9.756097561	6.741573034	89.74358974	58.53658537	49.43820225	83.11688312	283.1296332	678.7940879
Epochs 160	0.652173936	23.33333333	12.76595745	93.84615385	63.33333333	48.93617021	90.69767442	659.4311829	1666.892281	0.538461566	10	7.042253521	89.74358974	45	54.92957746	83.62068966	1503.832214	678.7940879
Epochs 180	0.671497583	16	12.5	91.54929577	56	47.5	88.65248227	503.066414	1666.892281	0.605769217	7.692307692	5.172413793	89.05109489	46.15384615	53.44827586	83.08823529	1211.790395	678.7940879
Epochs 200	0.739130437	13.33333333	15.625	91.25	60	46.875	88.05031447	474.1275255	1666.892281	0.673076928	10	4.444444444	89.54248366	50	51.11111111	82.89473684	2467.281054	678.7940879

Wuliangye Yibin Co.,Ltd CNN Model

Sichuan SwellfunTest Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.15458937	4.794520548	5.714285714	88.46153846	46.20689655	31.42857143	76.92307692	2918.362814	2068.314051	0.192307696	6.015037594	10.41666667	100	43.60902256	51.06382979	88.88888889	23.74313349	400.9406907
Epochs 40	0.12560387	4.597701149	9.259259259	100	47.6744186	44.44444444	91.66666667	797.1729466	2068.314051	0.129807696	7.317073171	7.079646018	100	43.90243902	42.85714286	92.30769231	-67.07950476	400.9406907
Epochs 60	0.164251208	3.96039604	10.97560976	87.5	47	45.12195122	79.16666667	1650.534379	2068.314051	0.149038464	6.666666667	7.142857143	90	47.77777778	46.39175258	80	-44.8784441	400.9406907
Epochs 80	0.159420297	4.255319149	9.090909091	84	50.53763441	45.45454545	80	1620.575422	2068.314051	0.211538464	8	7.843137255	96.77419355	50.66666667	46.53465347	90.32258065	-62.88545021	400.9406907
Epochs 100	0.198067635	4.301075269	5.479452055	80.48780488	48.91304348	45.20547945	75.6097561	1027.914092	2068.314051	0.25	9.459459459	7.368421053	97.43589744	50	46.80851064	89.74358974	-43.05991833	400.9406907
Epochs 120	0.246376812	4.054054054	6.976744186	89.36170213	49.31506849	45.34883721	78.72340426	5.99064906	2068.314051	0.298076928	11.53846154	5.825242718	94.33962264	53.84615385	47.05882353	88.67924528	-61.8095955	400.9406907
Epochs 140	0.396135271	4.225352113	6	88.37209302	50.70422535	50	77.64705882	55.57464829	2068.314051	0.408653855	12.5	6.578947368	96.05263158	53.57142857	46.66666667	90.78947368	-40.41212207	400.9406907
Epochs 160	0.492753625	4.081632653	6	89.81481481	48.97959184	50	80.37383178	23.59574951	2068.314051	0.490384609	12.19512195	7.142857143	94.84536082	56.09756098	45.71428571	90.625	-22.26281059	400.9406907
Epochs 180	0.61835748	4.444444444	8	90.51094891	55.55555556	60	82.35294118	78.97021986	2068.314051	0.663461566	8.333333333	14.28571429	94.89051095	58.33333333	51.42857143	91.17647059	-61.26218435	400.9406907
Epochs 200	0.681159437	3.333333333	7.692307692	91.39072848	50	50	82.66666667	1.168772024	2068.314051	0.701923072	9.523809524	10.52631579	93.95973154	61.9047619	47.36842105	89.18918919	3.383695691	400.9406907

Wuliangye Yibin Co.,Ltd	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.198067635	5.555555556	6.666666667	93.93939394	44.44444444	43.33333333	90.625	26062.06715	2331.201715	0.211538464	7.352941176	5.263157895	94.11764706	40.74074074	44.73684211	88.23529412	248.259959	604.1107527
Epochs 40	0.101449274	8.333333333	6.730769231	85.71428571	50	47.57281553	85.71428571	1804.947591	2331.201715	0.120192304	11.42857143	4	92.30769231	53.62318841	47.2	92.30769231	26.3745882	604.1107527
Epochs 60	0.159420297	7.547169811	7.407407407	95	50.94339623	50	90	4338.080492	2331.201715	0.139423072	10.12658228	3.636363636	89.47368421	51.28205128	48.18181818	84.21052632	44.13377974	604.1107527
Epochs 80	0.188405797	8.333333333	7.142857143	92.59259259	53.125	49.39759036	85.18518519	4747.776173	2331.201715	0.173076928	11.76470588	3.539823009	88.88888889	53.73134328	49.55752212	81.48148148	46.42721423	604.1107527
Epochs 100	0.246376812	8.695652174	6.756756757	92.68292683	53.26086957	47.94520548	85.36585366	3066.979484	2331.201715	0.278846145	12.5	4.210526316	93.87755102	56.25	46.31578947	87.5	22.98941144	604.1107527
Epochs 120	0.280193239	9.589041096	5.952380952	92	52.05479452	48.19277108	80	1868.769155	2331.201715	0.283653855	11.53846154	3.921568627	90.74074074	55.76923077	49.01960784	83.01886792	15.36910128	604.1107527
Epochs 140	0.444444448	10.76923077	8.620689655	95.23809524	53.84615385	43.85964912	85.71428571	1804.14729	2331.201715	0.466346145	12	4.6875	93.61702128	56	48.4375	87.09677419	54.36639283	604.1107527
Epochs 160	0.497584552	6.12244898	9.090909091	92.23300971	55.10204082	44.44444444	85.4368932	2278.060871	2331.201715	0.548076928	16.21621622	3.50877193	92.98245614	64.86486486	47.36842105	87.61061947	49.4108914	604.1107527

Epochs 180	0.628019333	7.142857143	3.703703704	91.30434783	52.38095238	40.74074074	83.94160584	1992.464266	2331.201715	0.649038434	11.76470588	3.125	91.54929577	58.82352941	43.75	87.23404255	83.85997363	604.1107527
Epochs 200	0.66183573	10	6.060606061	91.66666667	53.33333333	39.39393939	84.61538462	1645.585525	2331.201715	0.6875	9.523809524	3.125	90.32258065	57.14285714	40.625	85.71428571	51.28904436	604.1107527
Kweichow Moutai Co., Ltd	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.212560385	7.857142857	5.882352941	93.93939394	45.71428571	44.11764706	87.5	9364.038129	1666.892281	0.192307696	6.52173913	2.777777778	88.23529412	40.1459854	44.44444444	85.29411765	637.9890636	678.7940879
Epochs 40	0.159420297	13.0952381	9.090909091	92.30769231	52.38095238	50.4587156	92.30769231	1523.917393	1666.892281	0.086538464	6.060606061	6.015037594	66.66666667	43.93939394	50	55.55555556	114.0561326	678.7940879
Epochs 60	0.16908212	11.82795699	9.183673469	93.75	51.61290323	50.51546392	87.5	1961.638819	1666.892281	0.139423072	9.210526316	6.896551724	87.5	48.68421053	52.17391304	75	197.0754276	678.7940879
Epochs 80	0.231884062	12.65822785	9.278350515	93.5483871	50.63291139	48.95833333	87.09677419	1949.940812	1666.892281	0.197115391	10.29411765	7.079646018	96.2962963	51.47058824	51.78571429	88.88888889	102.7466439	678.7940879
Epochs 100	0.318840593	13.88888889	9.523809524	94.11764706	50	49.39759036	88.23529412	892.1264116	1666.892281	0.25	10.60606061	7.843137255	92.5	51.51515152	52.47524752	85	93.5504449	678.7940879
Epochs 120	0.333333343	15.25423729	6.896551724	88.52459016	54.23728814	46.51162791	83.60655738	353.5048207	1666.892281	0.25	8.474576271	7.547169811	90.69767442	52.54237288	47.61904762	83.72093023	34.54775998	678.7940879
Epochs 140	0.458937198	16.07142857	6.557377049	91.11111111	51.78571429	49.18032787	86.51685393	396.225318	1666.892281	0.403846145	9.259259259	6.944444444	90.24390244	50	48.61111111	85.18518519	47.40457588	678.7940879
Epochs 160	0.487922698	16.27906977	6.349206349	89.10891089	55.81395349	46.03174603	85	37.45692757	1666.892281	0.514423072	10.52631579	9.230769231	92.38095238	52.63157895	50.76923077	87.5	53.49717231	678.7940879
Epochs 180	0.63285023	14.63414634	9.375	91.04477612	48.7804878	50	86.46616541	120.0361478	1666.892281	0.639423072	11.76470588	5.714285714	91.36690647	58.82352941	48.57142857	86.23188406	144.9502795	678.7940879
Epochs 200	0.657004833	17.39130435	7.5	89.58333333	69.56521739	40	85.31468531	509.9282082	1666.892281	0.639423072	12	4.761904762	90.78014184	64	45.23809524	85	172.6802007	678.7940879

Kweichow Moutai Co., Ltd CNN Model

Sichuan SwellfunTest Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.043478262	3.910614525	7.142857143	0	43.25842697	39.28571429	0	5204.518701	2068.314051	0.057692308	4.705882353	10.52631579	0	40	51.35135135	0	200.9351454	400.9406907
Epochs 40	0.067632847	3.603603604	10.41666667	0	42.72727273	39.58333333	0	155.3974401	2068.314051	0.072115384	8.510638298	6.140350877	0	44.68085106	46.01769912	0	-45.30838113	400.9406907
Epochs 60	0.067632847	3.773584906	9.900990099	0	45.71428571	40.59405941	0	295.3925063	2068.314051	0.072115384	8.045977011	6.611570248	0	44.82758621	44.16666667	0	-71.99626413	400.9406907
Epochs 80	0.178743958	4.761904762	10.1010101	95.83333333	51.80722892	44.44444444	87.5	97.47406737	2068.314051	0.11057692	6.944444444	6.504065041	76.92307692	47.22222222	45.08196721	69.23076923	-60.38114172	400.9406907
Epochs 100	0.246376812	6.024096386	10.46511628	97.36842105	48.7804878	44.18604651	84.21052632	93.18176717	2068.314051	0.254807681	6.896551724	6.796116505	89.36170213	50	49.01960784	85.10638298	-37.66130063	400.9406907
Epochs 120	0.314009666	4.285714286	10.12658228	93.10344828	50.72463768	45.56962025	81.03448276	121.0218162	2068.314051	0.355769217	7.142857143	7.291666667	91.42857143	50	50	85.50724638	-36.14488795	400.9406907
Epochs 140	0.386473417	1.785714286	8.571428571	90.12345679	48.21428571	44.28571429	77.5	22.96653375	2068.314051	0.423076928	7.894736842	7.142857143	91.86046512	50	51.19047619	84.70588235	-22.23465676	400.9406907
Epochs 160	0.434782594	3.921568627	8.955223881	92.13483146	45.09803922	44.7761194	81.81818182	23.70822236	2068.314051	0.5	6.666666667	8.108108108	92.30769231	50	50	84.46601942	-8.949436951	400.9406907
Epochs 180	0.531400979	3.846153846	7.5	91.30434783	44.23076923	47.5	81.57894737	-2.294997326	2068.314051	0.576923072	6.451612903	7.547169811	91.93548387	51.61290323	54.71698113	83.7398374	-37.57680001	400.9406907
Epochs 200	0.574879229	2.272727273	8.333333333	90.5511811	38.63636364	47.22222222	80.15873016	-16.79079111	2068.314051	0.625	8	4.444444444	91.30434783	52	53.33333333	83.94160584	-25.46391495	400.9406907
Wuliangye Yibin Co.,Ltd	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.043478262	4.210526316	5.882352941	0	42.10526316	50	0	2505.10452	2331.201715	0.057692308	5.524861878	7.407407407	0	40.55555556	44.44444444	0	237.2892881	604.1107527

Epochs 40	0.062801935	5.982905983	6.666666667	0	45.2991453	44.94382022	0	7322.182625	2331.201715	0.057692308	10.38961039	3.053435115	0	46.75324675	44.61538462	0	43.66051982	604.1107527
Epochs 60	0.062801935	6.481481481	6.060606061	0	50	47.95918367	0	3810.799593	2331.201715	0.057692308	10.29411765	3.571428571	0	48.52941176	44.60431655	0	56.65782403	604.1107527
Epochs 80	0.144927531	6.741573034	7	94.44444444	52.80898876	47.47474747	83.33333333	3003.263319	2331.201715	0.100961536	10.16949153	5	88.88888889	52.54237288	46.04316547	88.88888889	62.48804283	604.1107527
Epochs 100	0.265700489	7.792207792	6.25	88	54.54545455	48.10126582	74	244.8485469	2331.201715	0.192307696	8.888888889	3.968253968	83.78378378	55.55555556	45.6	78.37837838	31.25854842	604.1107527
Epochs 120	0.342995167	7.936507937	8.75	92.1875	55.55555556	48.10126582	79.6875	442.2438344	2331.201715	0.278846145	7.692307692	4.504504505	86.20689655	58.97435897	48.18181818	82.75862069	11.69482026	604.1107527
Epochs 140	0.454106271	8.510638298	6.060606061	91.4893617	55.31914894	52.30769231	81.91489362	383.6624897	2331.201715	0.379807681	9.375	3.225806452	87.95180723	62.5	47.82608696	81.92771084	38.96082325	604.1107527
Epochs 160	0.463768125	6.976744186	3.225806452	89.21568627	58.13953488	47.54098361	80.39215686	554.0593679	2331.201715	0.423076928	10.34482759	3.409090909	90.10989011	62.06896552	45.97701149	83.51648352	30.99698478	604.1107527
Epochs 180	0.560386479	6.976744186	2.5	90.32258065	55.81395349	56.41025641	82.25806452	413.9748401	2331.201715	0.528846145	10.34482759	4.545454545	92.03539823	62.06896552	47.69230769	85.84070796	40.42378605	604.1107527
Epochs 200	0.603864729	5.714285714	2.702702703	90.37037037	60	55.55555556	82.22222222	164.6820529	2331.201715	0.567307711	10.71428571	5.084745763	92.56198347	64.28571429	50	85.95041322	30.44311339	604.1107527
Kweichow Moutai Co., Ltd	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.053140096	6.010928962	0	0	42.85714286	41.66666667	0	1402.514214	1666.892281	0.043269232	4.864864865	0	0	39.67391304	43.47826087	0	662.8925474	678.7940879
Epochs 40	0.082125604	10.1010101	6.481481481	0	50.50505051	47.6635514	0	3000.190816	1666.892281	0.07692308	9.090909091	6.666666667	0	44.31818182	48.7394958	0	326.2686522	678.7940879
Epochs 60	0.091787443	12.04819277	7.317073171	0	55.42168675	47.54098361	0	1074.079955	1666.892281	0.072115384	9.210526316	5.34351145	100	46.05263158	47.69230769	100	219.7695204	678.7940879
Epochs 80	0.135265693	12.98701299	7.56302521	81.81818182	54.54545455	47.45762712	72.72727273	1298.367556	1666.892281	0.125	11.11111111	5.34351145	85.71428571	50.79365079	50	71.42857143	299.072571	678.7940879
Epochs 100	0.275362313	13.43283582	8.24742268	93.02325581	53.73134328	51.04166667	90.69767442	1055.908602	1666.892281	0.274038464	11.32075472	6.481481481	93.61702128	52.83018868	49.53271028	85.10638298	433.4867109	678.7940879
Epochs 120	0.280193239	12.6984127	8.163265306	91.30434783	53.96825397	48.45360825	84.7826087	750.386579	1666.892281	0.341346145	12.76595745	7	95.08196721	55.31914894	50	90	511.9310351	678.7940879
Epochs 140	0.391304344	13.46153846	8.641975309	90.54054054	57.69230769	49.38271605	86.30136986	1121.335785	1666.892281	0.4375	11.62790698	8.536585366	95.18072289	53.48837209	52.43902439	91.46341463	401.4564672	678.7940879
Epochs 160	0.439613521	14.89361702	9.210526316	91.66666667	55.31914894	46.05263158	87.95180723	1375.959	1666.892281	0.475961536	10.52631579	10.12658228	95.6043956	55.26315789	55.69620253	91.11111111	436.1235992	678.7940879
Epochs 180	0.521739125	14.58333333	12.06896552	93.06930693	56.25	46.55172414	89	1305.266462	1666.892281	0.552884638	10.52631579	7.547169811	91.45299145	55.26315789	64.1509434	84.48275862	524.0680385	678.7940879
Epochs 200	0.608695626	17.5	11.62790698	91.93548387	57.5	39.53488372	86.99186992	915.3392231	1666.892281	0.625	11.11111111	8.510638298	91.79104478	66.66666667	63.82978723	85.71428571	410.0916878	678.7940879

Table 17-2 CNN Models Results for Variation 6

First BanCorp CNN Model																		
First BanCorp	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.04587156	2.803738318	6.306306306	0	45.79439252	40	0	-94.93714824	-15.16491294	0.06849315	5.607476636	6.363636364	100	44.85981308	44.95412844	100	228.4376394	-8.209536376
Epochs 40	0.128440365	3.773584906	7.52688172	89.47368421	46.22641509	39.13043478	84.21052632	-92.24341955	-15.16491294	0.118721463	5.555555556	7.216494845	92.85714286	49.07407407	48.95833333	92.85714286	269.4055379	-8.209536376
Epochs 60	0.110091746	3.603603604	7.608695652	86.66666667	45.04504505	37.36263736	80	-98.91703682	-15.16491294	0.12328767	6.363636364	8.421052632	85.71428571	50	52.12765957	85.71428571	650.8325926	-8.209536376
Epochs 80	0.220183492	4.807692308	8.108108108	92.5	48.07692308	41.09589041	87.5	-93.68194681	-15.16491294	0.214611873	7.766990291	8.641975309	91.42857143	50.48543689	52.5	85.71428571	749.1962423	-8.209536376

Epochs 100	0.334862381	5.555555556	8.974358974	91.17647059	54.16666667	45.45454545	83.82352941	-27.3667197	-15.16491294	0.292237431	7.228915663	8.75	91.07142857	51.80722892	51.89873418	83.92857143	550.1200107	-8.209536376
Epochs 120	0.444954127	4.411764706	9.615384615	90.81632653	52.94117647	45.09803922	84.69387755	-96.87273005	-15.16491294	0.433789968	6.756756757	8.163265306	89.58333333	48.64864865	54.16666667	84.375	18.87618908	-8.209536376
Epochs 140	0.610091746	5.882352941	8.888888889	91.36690647	67.64705882	46.66666667	84.05797101	-92.58104315	-15.16491294	0.602739751	9.090909091	8.333333333	89.92805755	54.54545455	54.28571429	83.45323741	13.73301546	-8.209536376
Epochs 160	0.69266057	3.333333333	11.11111111	91.30434783	66.66666667	48.14814815	83.75	-95.56422078	-15.16491294	0.703196347	11.11111111	10	90.79754601	58.33333333	55	84.56790123	72.14224682	-8.209536376
Epochs 180	0.715596318	3.846153846	12	91.01796407	65.38461538	52	84.3373494	-95.28908394	-15.16491294	0.730593622	3.846153846	11.11111111	89.71428571	46.15384615	55.55555556	83.90804598	-10.32050785	-8.209536376
Epochs 200	0.793577969	5	18.18181818	90.90909091	70	54.54545455	83.33333333	-64.57322915	-15.16491294	0.79908675	0	20	90.10416667	47.05882353	70	83.76963351	358.8698891	-8.209536376
American Financial Group, Inc	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.064220183	5.813953488	5.384615385	100	45.34883721	41.86046512	100	-51.86790884	566.6403159	0.059360731	4.761904762	7.01754386	0	40.38461538	46.49122807	0	-1.729852998	-42.76165206
Epochs 40	0.100917429	5.747126437	5.042016807	91.66666667	47.12643678	41.52542373	91.66666667	105.4021124	566.6403159	0.146118715	4.95049505	8.24742268	90.47619048	45	50.51546392	80.95238095	42.71394426	-42.76165206
Epochs 60	0.096330278	6.382978723	5.309734513	81.81818182	47.87234043	40.17857143	81.81818182	185.3377346	566.6403159	0.114155248	4.504504505	8.510638298	85.71428571	45.45454545	50	78.57142857	4.712043898	-42.76165206
Epochs 80	0.142201841	5.882352941	3.773584906	81.48148148	49.41176471	41.9047619	77.77777778	346.0758083	566.6403159	0.187214613	4.854368932	9.638554217	84.84848485	46.07843137	54.21686747	78.78787879	-16.0118635	-42.76165206
Epochs 100	0.206422016	5.970149254	3.738317757	84.09090909	53.73134328	41.50943396	79.54545455	271.4033913	566.6403159	0.315068483	5.479452055	9.638554217	90.47619048	43.83561644	56.62650602	88.70967742	70.73881926	-42.76165206
Epochs 120	0.389908254	6.451612903	5.555555556	91.66666667	53.22580645	40.27777778	85.54216867	276.2780199	566.6403159	0.438356161	4.615384615	10.52631579	89.69072165	43.07692308	59.64912281	84.375	38.40407736	-42.76165206
Epochs 140	0.532110095	7.142857143	7.272727273	90.08264463	59.52380952	36.36363636	83.33333333	-34.50964534	566.6403159	0.639269412	6.666666667	11.62790698	91.09589041	43.33333333	58.13953488	84.13793103	2478.896813	-42.76165206
Epochs 160	0.605504572	2.702702703	8.333333333	88.27586207	56.75675676	41.66666667	81.94444444	2.067736437	566.6403159	0.739726007	9.090909091	13.04347826	90.22988506	40.90909091	65.2173913	83.23699422	2060.248584	-42.76165206
Epochs 180	0.683486223	3.703703704	7.407407407	89.02439024	51.85185185	40.74074074	82.82208589	-12.62000851	566.6403159	0.721461177	0	12.5	89.08045977	33.33333333	70.83333333	82.08092486	446.2996195	-42.76165206
Epochs 200	0.75688076	5	6.25	89.56043956	50	31.25	82.87292818	17.53362958	566.6403159	0.803652942	0	21.42857143	90.10416667	46.15384615	71.42857143	82.72251309	-14.08826644	-42.76165206
JPMorgan Chase & Co	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.059633028	9.302325581	3.787878788	0	43.52941176	44.6969697	0	8782.101095	1576.179166	0.077625573	6.730769231	8.771929825	0	41.74757282	47.36842105	0	341.8482103	-31.90034799
Epochs 40	0.087155961	9.574468085	4.237288136	83.33333333	44.68085106	44.44444444	50	4671.484523	1576.179166	0.12328767	7.692307692	8.737864078	83.33333333	46.60194175	48.54368932	66.66666667	390.6414356	-31.90034799
Epochs 60	0.082568809	9.090909091	4.385964912	80	44.44444444	44.24778761	60	2346.766125	1576.179166	0.150684938	7.894736842	10.98901099	100	44.24778761	47.25274725	78.57142857	715.0627222	-31.90034799
Epochs 80	0.16055046	10.11235955	4.761904762	87.5	47.19101124	45.19230769	75	4143.462999	1576.179166	0.214611873	8.181818182	12.5	96.55172414	43.11926606	51.25	86.20689655	679.9149767	-31.90034799
Epochs 100	0.24311927	13.23529412	5.454545455	95	50	45.87155963	87.5	5951.799726	1576.179166	0.324200898	6.329113924	12.82051282	90.32258065	46.15384615	50	80.64516129	153.3029546	-31.90034799
Epochs 120	0.357798159	11.29032258	4.819277108	91.78082192	50	46.34146341	83.56164384	5606.241948	1576.179166	0.429223746	5.970149254	7.692307692	86	46.96969697	50	78	-55.21832917	-31.90034799
Epochs 140	0.481651366	6.666666667	4.761904762	90	55.55555556	46.77419355	82.72727273	4240.778522	1576.179166	0.652968049	11.76470588	11.11111111	90.60402685	52.94117647	50	82.43243243	-55.63098149	-31.90034799
Epochs 160	0.605504572	5.882352941	4.651162791	90.78014184	55.88235294	44.18604651	84.28571429	377.9799444	1576.179166	0.744292259	16	13.04347826	91.22807018	52	56.52173913	83.52941176	120.5909817	-31.90034799
Epochs 180	0.674311936	4.545454545	5.263157895	91.13924051	54.54545455	44.73684211	84.7133758	379.0871452	1576.179166	0.757990897	15.38461538	15.78947368	91.37931034	46.15384615	57.89473684	83.23699422	80.77833425	-31.90034799
Epochs 200	0.747706413	5.882352941	7.407407407	91.95402299	52.94117647	48.14814815	85.54913295	270.1185808	1576.179166	0.812785387	11.76470588	20	90.625	47.05882353	60	82.72251309	-32.08390608	-31.90034799

American Financial Group, Inc CNN Model

First BanCorp	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.426605493	3.896103896	8.888888889	89.58333333	53.24675325	46.66666667	81.05263158	-43.51813058	-15.16491294	0.442922384	5.494505495	7.142857143	90	48.35164835	53.57142857	87.87878788	46.81618488	-8.209536376
Epochs 40	0.532110095	7.462686567	11.42857143	92.24137931	49.25373134	42.85714286	85.2173913	-74.08069715	-15.16491294	0.529680371	4.47761194	8	87.4015748	50.74626866	72	84.12698413	-27.06082862	-8.209536376
Epochs 60	0.16055046	5.172413793	7.792207792	92	45.68965517	43.42105263	80	-99.10626164	-15.16491294	0.146118715	6.837606838	8.536585366	85	49.57264957	53.65853659	78.94736842	902.9172707	-8.209536376
Epochs 80	0.293577969	7.058823529	7.894736842	91.22807018	52.94117647	44	85.96491228	-98.42890053	-15.16491294	0.273972601	7.5	8.235294118	87.03703704	51.25	55.29411765	81.13207547	577.1796072	-8.209536376
Epochs 100	0.334862381	6.172839506	8.571428571	92.53731343	53.08641975	46.37681159	83.58208955	-97.55837317	-15.16491294	0.342465758	7.594936709	10.95890411	91.04477612	50.63291139	56.16438356	86.36363636	982.0721345	-8.209536376
Epochs 120	0.472477078	5.333333333	8.108108108	90.56603774	53.33333333	51.35135135	83.80952381	-97.27398729	-15.16491294	0.465753436	6.849315068	13.33333333	90.0990099	47.94520548	57.77777778	82	308.6140043	-8.209536376
Epochs 140	0.619266033	6.557377049	11.11111111	92.8057554	54.09836066	38.88888889	83.33333333	-88.33471749	-15.16491294	0.598173499	7.01754386	16	89.7810219	54.38596491	64	83.08823529	120.0296674	-8.209536376
Epochs 160	0.701834857	9.523809524	11.11111111	93.03797468	61.9047619	44.44444444	83.43949045	-84.28582964	-15.16491294	0.671232879	4.87804878	19.04761905	89.8089172	53.65853659	61.9047619	83.33333333	77.38615363	-8.209536376
Epochs 180	0.770642221	10	10	92.13483146	73.33333333	30	83.61581921	-87.08173722	-15.16491294	0.748858452	3.846153846	20	89.88764045	53.84615385	60	83.05084746	59.19519967	-8.209536376
Epochs 200	0.793577969	11.11111111	14.28571429	91.84782609	70.37037037	28.57142857	83.60655738	-85.02319275	-15.16491294	0.789954364	5.263157895	11.11111111	89.52879581	57.89473684	55.55555556	82.63157895	64.71792918	-8.209536376

American Financial Group, Inc	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.389908254	6.756756757	7.692307692	94.93670886	44.59459459	32.8125	89.87341772	59.14416852	566.6403159	0.406392694	4.597701149	11.36363636	90.90909091	44.18604651	56.81818182	85.22727273	32.36888621	-42.76165206
Epochs 40	0.440366983	8.064516129	6.779661017	89.69072165	54.83870968	47.45762712	81.25	-54.64252624	566.6403159	0.511415541	6.25	5.714285714	88.33333333	49.20634921	51.42857143	82.5	-45.79170267	-42.76165206
Epochs 60	0.133027524	5.940594059	6.18556701	85	48.51485149	42.70833333	85	145.9114216	566.6403159	0.146118715	5.454545455	7.317073171	74.07407407	46.78899083	50	66.66666667	64.71387516	-42.76165206
Epochs 80	0.24311927	5.714285714	6.060606061	87.75510204	52.85714286	43.87755102	81.63265306	221.1787733	566.6403159	0.260273963	4.87804878	7.5	82.45614035	48.14814815	50	77.19298246	-1.742860771	-42.76165206
Epochs 100	0.266055048	6.060606061	6.25	85.71428571	56.06060606	43.15789474	82.14285714	328.6178641	566.6403159	0.310502291	5.063291139	6.060606061	81.08108108	48.71794872	51.51515152	75.67567568	8.167550444	-42.76165206
Epochs 120	0.458715588	4.838709677	9.433962264	89.32038835	56.4516129	42.30769231	83.49514563	174.684729	566.6403159	0.429223746	5.063291139	7.894736842	85.29411765	51.28205128	55.26315789	79.41176471	-41.32282882	-42.76165206
Epochs 140	0.623853207	6.666666667	7.692307692	89.11564626	60	34.61538462	82.87671233	291.8962144	566.6403159	0.584474862	5	10.52631579	87.85714286	52.54237288	52.63157895	81.42857143	-21.30951379	-42.76165206
Epochs 160	0.697247684	8.571428571	10	90.18404908	62.85714286	40	84.56790123	-30.89200621	566.6403159	0.675799072	4.87804878	12.5	88.88888889	48.7804878	50	83.22981366	2.694569042	-42.76165206
Epochs 180	0.784403682	10.52631579	13.33333333	90.76086957	63.15789474	46.66666667	84.15300546	11.95911522	566.6403159	0.735159814	5.882352941	12.5	89.26553672	50	50	82.95454545	-44.5591093	-42.76165206
Epochs 200	0.811926603	10.52631579	14.28571429	90.625	57.89473684	14.28571429	83.2460733	28.09558311	566.6403159	0.767123282	6.896551724	16.66666667	89.67391304	48.27586207	50	82.5136612	-33.45549202	-42.76165206

JPMorgan Chase & Co	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.444954127	8.641975309	0	91.83673469	43.20987654	38.46153846	85.56701031	15591.32164	1576.179166	0.433789968	9.302325581	6.666666667	95.45454545	46.51162791	46.66666667	85.05747126	71.12875006	-31.90034799
Epochs 40	0.472477078	12.12121212	5.454545455	94.84536082	54.54545455	45.45454545	85.41666667	13541.32372	1576.179166	0.543379009	12.6984127	10	92.24137931	50.79365079	52.5	82.60869565	3265.246953	-31.90034799
Epochs 60	0.137614682	10.75268817	1.923076923	85.71428571	49.46236559	41.74757282	71.42857143	20.10039131	1576.179166	0.19178082	9.090909091	10.58823529	95.83333333	47.27272727	46.42857143	75	68.18981563	-31.90034799

Epochs 80	0.247706428	13.63636364	1.941747573	87.75510204	54.54545455	41.17647059	79.59183673	749.1948295	1576.179166	0.337899536	10.66666667	9.87654321	92.06349206	49.33333333	45	79.36507937	1869.849292	-31.90034799
Epochs 100	0.288990825	13.84615385	3.092783505	91.07142857	55.38461538	44.79166667	83.92857143	159.3408867	1576.179166	0.392694056	10.38961039	13.04347826	94.52054795	48.05194805	42.64705882	82.19178082	2089.248343	-31.90034799
Epochs 120	0.440366983	13.63636364	4.761904762	94.38202247	51.51515152	44.44444444	87.5	89.87785298	1576.179166	0.511415541	10.25641026	14.70588235	92.52336449	51.28205128	45.45454545	84.11214953	229.181902	-31.90034799
Epochs 140	0.614678919	16.32653061	5.263157895	94.65648855	59.18367347	50	88.46153846	530.0582367	1576.179166	0.639269412	11.86440678	19.04761905	92.8057554	52.54237288	55	84.89208633	363.6943607	-31.90034799
Epochs 160	0.711009145	21.21212121	6.451612903	94.80519481	63.63636364	51.61290323	89.54248366	3600.742449	1576.179166	0.707762539	11.11111111	21.42857143	91.875	51.11111111	53.84615385	85	450.8245174	-31.90034799
Epochs 180	0.798165143	22.22222222	5.263157895	93.37016575	66.66666667	47.36842105	87.77777778	6658.186792	1576.179166	0.767123282	10	20	91.06145251	60	44.44444444	83.79888268	341.3750407	-31.90034799
Epochs 200	0.857798159	23.52941176	0	93.36734694	64.70588235	60	86.66666667	677.4369364	1576.179166	0.79908675	12.5	0	90.52631579	54.16666667	20	83.5978836	853.9087903	-31.90034799

JPMorgan Chase & Co CNN Model

First BanCorp	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.362385333	3.614457831	7.407407407	88.88888889	51.80722892	45.28301887	83.95061728	-82.92922692	-15.16491294	0.356164396	4.95049505	9.523809524	90.78947368	46.53465347	54.76190476	86.66666667	42.30501373	-8.209536376
Epochs 40	0.110091746	4.597701149	6.034482759	86.66666667	50.57471264	44.34782609	80	-77.48280161	-15.16491294	0.146118715	6.818181818	7.142857143	94.73684211	49.42528736	49.10714286	89.47368421	295.0063216	-8.209536376
Epochs 60	0.137614682	6.140350877	6.976744186	94.44444444	49.12280702	42.35294118	88.88888889	-96.46169817	-15.16491294	0.146118715	7.339449541	8.510638298	100	49.07407407	48.93617021	87.5	637.8330097	-8.209536376
Epochs 80	0.220183492	4.87804878	7.608695652	84.09090909	52.43902439	43.95604396	81.81818182	-96.30661287	-15.16491294	0.232876718	8.602150538	8.045977011	92.30769231	50	49.42528736	89.74358974	710.0678193	-8.209536376
Epochs 100	0.408256888	3.333333333	10.14492754	89.88764045	58.33333333	39.13043478	86.36363636	-99.4832965	-15.16491294	0.378995448	8.108108108	10.44776119	89.74358974	52.05479452	53.73134328	87.17948718	810.9502619	-8.209536376
Epochs 120	0.541284382	4.347826087	10.41666667	89.51612903	63.04347826	37.5	84.55284553	-98.73108873	-15.16491294	0.557077646	9.090909091	12.19512195	91.05691057	56.36363636	60.97560976	86.06557377	627.0911698	-8.209536376
Epochs 140	0.633027494	6.25	13.63636364	91.54929577	71.875	40.90909091	84.39716312	-98.47351374	-15.16491294	0.621004581	10	12.5	91.36690647	55	57.5	86.23188406	327.5771363	-8.209536376
Epochs 160	0.729357779	8.333333333	14.81481481	91.61676647	75	37.03703704	83.73493976	-78.29851611	-15.16491294	0.767123282	14.28571429	15	91.01123596	61.9047619	70	83.61581921	-41.13290241	-8.209536376
Epochs 180	0.784403682	9.523809524	18.75	91.71270718	76.19047619	43.75	84.44444444	-66.71012584	-15.16491294	0.785388112	14.28571429	8.333333333	90.32258065	66.66666667	66.66666667	83.24324324	-37.65773068	-8.209536376
Epochs 200	0.784403682	9.523809524	18.75	91.71270718	76.19047619	43.75	84.44444444	-66.71012584	-15.16491294	0.780821919	14.28571429	0	89.83957219	61.9047619	54.54545455	83.33333333	-27.61640934	-8.209536376

American Financial Group, Inc	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.344036698	5.263157895	5.797101449	91.78082192	46.05263158	33.82352941	84.93150685	-67.22509431	566.6403159	0.356164396	4.705882353	8.928571429	88.46153846	39.28571429	55.35714286	83.33333333	-49.52890294	-42.76165206
Epochs 40	0.100917429	6.25	5.555555556	83.33333333	51.25	44	75	415.0309962	566.6403159	0.150684938	5.555555556	6.504065041	87.5	42.25352113	47.96747967	83.33333333	-13.20705301	-42.76165206
Epochs 60	0.128440365	6.52173913	7.207207207	93.33333333	51.08695652	47.27272727	80	149.2350451	566.6403159	0.159817353	4.807692308	8.791208791	91.66666667	46.60194175	52.74725275	79.16666667	-20.2226864	-42.76165206
Epochs 80	0.197247714	6.493506494	6.666666667	86.11111111	54.54545455	46.15384615	69.44444444	362.9279083	566.6403159	0.237442926	5.952380952	7.777777778	88.88888889	45.78313253	52.22222222	82.22222222	-29.13076075	-42.76165206
Epochs 100	0.357798159	4.761904762	8.75	90.66666667	57.14285714	43.75	79.72972973	12.22867866	566.6403159	0.388127863	7.692307692	8.333333333	90.24390244	43.75	52.77777778	81.70731707	-28.61109437	-42.76165206
Epochs 120	0.513761461	6.52173913	5.660377358	89.07563025	65.2173913	37.73584906	81.3559322	39.98515849	566.6403159	0.520547926	7.547169811	6.52173913	89.16666667	43.39622642	58.69565217	81.51260504	-22.57116285	-42.76165206
Epochs 140	0.577981651	3.125	6.25	88.4057971	71.875	41.66666667	81.02189781	-86.84423817	566.6403159	0.589041114	8.571428571	4.545454545	88.57142857	34.28571429	56.81818182	81.29496403	-36.37907824	-42.76165206
Epochs 160	0.701834857	0	10	89.28571429	70	50	82.63473054	-1.383495418	566.6403159	0.721461177	13.04347826	4.166666667	89.53488372	34.7826087	54.16666667	82.45614035	-70.86814404	-42.76165206

Epochs 180	0.75688076	0	11.11111111	89.56043956	72.22222222	55.55555556	82.87292818	54.94462789	566.6403159	0.785388112	13.33333333	6.25	89.89361702	40	43.75	82.35294118	-51.56177181	-42.76165206
Epochs 200	0.770642221	0	12.5	89.72972973	76.47058824	56.25	83.15217391	401.1852915	566.6403159	0.803652942	15.38461538	7.142857143	90.10416667	46.15384615	42.85714286	82.72251309	-51.20115818	-42.76165206
JPMorgan Chase & Co	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.403669715	10.71428571	3.773584906	95.0617284	45.23809524	37.73584906	85	17424.90614	1576.179166	0.378995448	9.638554217	8.064516129	94.59459459	50	50	83.78378378	35.71704651	-31.90034799
Epochs 40	0.077981651	8.43373494	3.174603175	66.66666667	47.56097561	44.44444444	66.66666667	1670.312189	1576.179166	0.146118715	10.97560976	9.523809524	100	49.38271605	48.41269841	100	231.0997695	-31.90034799
Epochs 60	0.123853214	10.1010101	2.941176471	82.35294118	44.89795918	44.11764706	76.47058824	1752.559464	1576.179166	0.132420093	9.090909091	8.490566038	78.57142857	50	48.11320755	64.28571429	82.62617785	-31.90034799
Epochs 80	0.233944952	12.19512195	4.12371134	94.87179487	51.2195122	46.39175258	84.21052632	2829.915426	1576.179166	0.260273963	10	9.473684211	90.90909091	46.83544304	49.47368421	86.36363636	144.3526079	-31.90034799
Epochs 100	0.32110092	8.571428571	4.938271605	89.55223881	50	48.14814815	80.3030303	2875.287874	1576.179166	0.397260278	10.60606061	8.571428571	89.15662651	44.61538462	52.85714286	81.92771084	105.9307551	-31.90034799
Epochs 120	0.472477078	8.928571429	1.851851852	89.81481481	48.21428571	46.2962963	83.17757009	3259.645248	1576.179166	0.570776284	6.666666667	9.756097561	88.72180451	42.22222222	58.53658537	81.06060606	157.3779208	-31.90034799
Epochs 140	0.541284382	9.523809524	1.960784314	90.4	50	45.09803922	84.67741935	7089.139297	1576.179166	0.611872137	3.125	9.756097561	88.35616438	34.375	56.09756098	81.37931034	73.11694391	-31.90034799
Epochs 160	0.678899109	11.11111111	0	91.19496855	59.25925926	43.75	84.17721519	8432.275268	1576.179166	0.739726007	5.263157895	15.38461538	90.22988506	36.84210526	61.53846154	82.65895954	12.73734675	-31.90034799
Epochs 180	0.779816508	15.78947368	0	92.26519337	73.68421053	38.88888889	85	63791.77121	1576.179166	0.771689475	5.555555556	12.5	89.72972973	38.88888889	56.25	82.60869565	-40.31141711	-31.90034799
Epochs 200	0.802752316	12.5	0	92.0212766	68.75	35.71428571	84.49197861	54109.48838	1576.179166	0.771689475	5.555555556	7.142857143	89.30481283	38.88888889	57.14285714	82.25806452	-39.95763535	-31.90034799

Table 17-3 CNN Models Results for Variation 6

Vaxart, Inc CNN Model																		
Vaxart, Inc	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.059633028	5.128205128	6.930693069	0	50	59.40594059	0	-89.14982484	-97.40654205	0.063926943	5.660377358	7.079646018	0	46.22641509	41.96428571	0	109.2002077	3138.165411
Epochs 40	0.059633028	5.660377358	6.25	0	50.47619048	58.92857143	0	-94.24301383	-97.40654205	0.063926943	6.593406593	6.25	0	50.54945055	45.66929134	0	89.31187756	3138.165411
Epochs 60	0.096330278	4.6875	7.407407407	100	51.18110236	61.72839506	88.88888889	-96.2768822	-97.40654205	0.100456618	6	7.207207207	100	51	45.45454545	100	203.759061	3138.165411
Epochs 80	0.151376143	6.25	5.940594059	100	53.68421053	60.3960396	90.47619048	-81.75906291	-97.40654205	0.10958904	5	4.285714286	78.94736842	50	46.04316547	68.42105263	257.161592	3138.165411
Epochs 100	0.233944952	7.692307692	5.154639175	93.02325581	55.84415584	60.82474227	76.74418605	-85.85735663	-97.40654205	0.19178082	3.773584906	4	85.36585366	52.83018868	45.16129032	78.04878049	306.5662485	3138.165411
Epochs 120	0.362385333	7.594936709	7.246376812	97.14285714	53.84615385	62.31884058	82.85714286	-89.10120188	-97.40654205	0.310502291	7.01754386	3.157894737	91.04477612	54.38596491	47.87234043	83.58208955	132.1081531	3138.165411
Epochs 140	0.522935808	9.375	6.818181818	95.45454545	56.25	65.90909091	76.14678899	-87.08443446	-97.40654205	0.465753436	5.555555556	3.389830508	91.50943396	57.40740741	46.55172414	83.01886792	-61.18965137	3138.165411
Epochs 160	0.614678919	11.11111111	8.823529412	96.15384615	55.55555556	73.52941176	75.19379845	-84.95756353	-97.40654205	0.561643839	5.128205128	2.083333333	90.90909091	61.53846154	46.80851064	81.81818182	34.80718348	3138.165411
Epochs 180	0.738532126	6.25	15	93.97590361	46.875	60	74.54545455	-84.86587318	-97.40654205	0.712328792	0	3.846153846	91.17647059	52.17391304	56	81.76470588	99.86849337	3138.165411
Epochs 200	0.802752316	9.523809524	14.28571429	93.44262295	52.38095238	64.28571429	74.72527473	-64.57300308	-97.40654205	0.789954364	0	4.545454545	91.97860963	50	57.14285714	82.88770053	107.8680662	3138.165411
Inovio Pharmaceuticals, Inc.	Non-Recession									Recession								

	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.055045873	5.925925926	4.819277108	0	47.40740741	60.97560976	0	-74.58579667	-73.87057277	0.06849315	5	9.090909091	0	47.89915966	42.42424242	0	594.0010846	2086.781994
Epochs 40	0.064220183	6.451612903	6.382978723	0	45.96774194	55.91397849	0	-75.84623243	-73.87057277	0.063926943	5	7.56302521	0	47.47474747	42.01680672	0	100.2913759	2086.781994
Epochs 60	0.105504587	6.666666667	6.756756757	100	47.40740741	58.90410959	77.77777778	-78.19555381	-73.87057277	0.073059358	5.555555556	5.714285714	66.66666667	48.59813084	44.76190476	66.66666667	269.7182328	2086.781994
Epochs 80	0.123853214	8.510638298	5.504587156	86.66666667	51.06382979	56.48148148	73.33333333	2.103552667	-73.87057277	0.10958904	6.172839506	6.4	84.61538462	45.67901235	40.8	66.66666667	109.5114818	2086.781994
Epochs 100	0.279816508	10.81081081	5.434782609	92.30769231	56.75675676	56.04395604	80.76923077	80.47487683	-73.87057277	0.210045666	7.246376812	6.956521739	94.28571429	46.37681159	41.73913043	88.23529412	84.52965256	2086.781994
Epochs 120	0.380733937	10.52631579	7.352941176	94.59459459	57.89473684	59.70149254	89.18918919	-25.63791348	-73.87057277	0.278538823	6.756756757	5.617977528	91.07142857	52.05479452	42.69662921	87.5	53.32466406	2086.781994
Epochs 140	0.522935808	11.5942029	7.5	94.49541284	53.62318841	61.53846154	86.23853211	-65.67271625	-73.87057277	0.438356161	6.25	3.703703704	89.10891089	53.125	48.14814815	85	203.0220101	2086.781994
Epochs 160	0.605504572	10.52631579	7.692307692	91.85185185	54.38596491	68	82.96296296	-75.68328023	-73.87057277	0.493150681	5.454545455	4.166666667	88.79310345	47.27272727	43.75	85.2173913	587.4985244	2086.781994
Epochs 180	0.688073397	12.76595745	11.11111111	92.81045752	51.06382979	72.22222222	80.92105263	-82.20084632	-73.87057277	0.639269412	8.571428571	5.714285714	90.60402685	42.85714286	57.14285714	85.81081081	41.20091733	2086.781994
Epochs 200	0.779816508	19.23076923	11.76470588	93.14285714	65.38461538	70.58823529	81.6091954	-49.07523904	-73.87057277	0.753424644	8.333333333	3.703703704	90.55555556	25	55.55555556	86.03351955	-39.07778544	2086.781994
Novavax, Inc	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.059633028	5.298013245	7.462686567	0	42	55.2238806	0	-65.14928407	-97.62028238	0.059360731	5.714285714	6.140350877	0	49.52380952	47.78761062	0	246.6550872	5802.379195
Epochs 40	0.064220183	5.035971223	8.860759494	0	44.20289855	53.16455696	0	-16.16576549	-97.62028238	0.05479452	5.747126437	5.303030303	0	48.8372093	43.18181818	0	222.770516	5802.379195
Epochs 60	0.073394492	5.22875817	9.677419355	66.66666667	45.39473684	58.06451613	66.66666667	-58.12465935	-97.62028238	0.08219178	5.825242718	5.504587156	85.71428571	49.01960784	47.70642202	85.71428571	201.8851861	5802.379195
Epochs 80	0.114678897	5.833333333	8.139534884	91.66666667	44.53781513	50	91.66666667	-14.39236861	-97.62028238	0.141552508	6.666666667	5.109489051	90.90909091	46.66666667	41.91176471	86.36363636	338.4052087	5802.379195
Epochs 100	0.275229365	6.315789474	9.459459459	95.91836735	40.42553191	51.35135135	89.79591837	-20.46338169	-97.62028238	0.223744288	6.12244898	4.761904762	90.90909091	44.89795918	40.8	81.81818182	7.739536715	5802.379195
Epochs 120	0.344036698	5.434782609	10.34482759	94.11764706	41.75824176	53.44827586	82.35294118	-58.84654788	-97.62028238	0.347031951	8.163265306	6	94.28571429	44.89795918	42	81.15942029	543.3734982	5802.379195
Epochs 140	0.509174287	5.263157895	14.70588235	94.44444444	37.33333333	64.70588235	84.25925926	-75.86031938	-97.62028238	0.534246564	6.382978723	8.928571429	93.96551724	44.68085106	50	84.34782609	105.9819157	5802.379195
Epochs 160	0.559633017	4.615384615	15.625	94.21487603	35.9375	59.375	83.47107438	-75.70285502	-97.62028238	0.575342476	4.761904762	10	93.7007874	40.47619048	54	84.12698413	63.28894917	5802.379195
Epochs 180	0.706422031	5.128205128	15	93.71069182	36.84210526	55	83.64779874	-87.76445792	-97.62028238	0.671232879	6.451612903	12.82051282	93.95973154	32.25806452	66.66666667	85.13513514	450.5031014	5802.379195
Epochs 200	0.798165143	4.166666667	23.07692308	93.92265193	37.5	69.23076923	85	-91.55776597	-97.62028238	0.789954364	8.333333333	15.38461538	92.81767956	41.66666667	61.53846154	85.55555556	340.3051347	5802.379195
Inovio Pharmaceuticals, Inc. CNN Model																		
Vaxart, Inc	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.114678897	4.87804878	6.172839506	100	47.54098361	59.25925926	71.42857143	-91.13197964	-97.40654205	0.159817353	5.714285714	7.608695652	100	48.07692308	44.56521739	95.45454545	1154.364844	3138.165411
Epochs 40	0.472477078	4.672897196	0	90.74074074	49.05660377	66.66666667	63.88888889	-96.93785084	-97.40654205	0.547945201	6.52173913	0	92.68292683	47.82608696	75	83.60655738	5028.214373	3138.165411
Epochs 60	0.24311927	4.807692308	7.246376812	95.55555556	50.48543689	65.2173913	73.33333333	-92.31640705	-97.40654205	0.219178081	5.128205128	6.796116505	97.36842105	46.15384615	46.07843137	86.84210526	618.4254755	3138.165411
Epochs 80	0.224770635	4.901960784	6.666666667	95.12195122	46.53465347	60	70.73170732	-94.32554844	-97.40654205	0.187214613	5.194805195	6.306306306	96.77419355	46.75324675	45.45454545	90.32258065	756.228237	3138.165411

Epochs 100	0.362385333	4.444444444	7.692307692	93.42105263	43.82022472	67.30769231	73.68421053	-94.02295857	-97.40654205	0.388127863	4.761904762	6.756756757	93.90243902	44.44444444	41.09589041	85.36585366	365.0058064	3138.165411
Epochs 120	0.467889905	1.298701299	8.823529412	91.58878505	40.78947368	58.82352941	75.70093458	-95.23535121	-97.40654205	0.543379009	4.166666667	6.25	92.68292683	41.66666667	35.41666667	83.60655738	344.0069741	3138.165411
Epochs 140	0.550458729	1.492537313	4.545454545	91.47286822	40.90909091	50	73.64341085	-96.7160135	-97.40654205	0.639269412	0	4.166666667	90.8496732	35.71428571	37.5	82.89473684	118.1883232	3138.165411
Epochs 160	0.600917459	1.694915254	5.555555556	91.4893617	43.10344828	44.44444444	72.34042553	-95.73726092	-97.40654205	0.639269412	0	4	90.8496732	36.58536585	36	82.23684211	145.489018	3138.165411
Epochs 180	0.678899109	2.127659574	9.090909091	91.25	41.30434783	45.45454545	72.5	-95.19798281	-97.40654205	0.712328792	0	4.761904762	91.71597633	31.03448276	47.61904762	82.73809524	495.8183682	3138.165411
Epochs 200	0.752293587	2.777777778	16.66666667	92.04545455	40	50	72.72727273	-95.57252034	-97.40654205	0.762557089	0	5.555555556	92.22222222	33.33333333	44.44444444	83.24022346	487.5627487	3138.165411
Inovio Pharmaceuticals, Inc.	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.096330278	4.273504274	5.747126437	78.57142857	41.88034188	53.48837209	78.57142857	-69.01190985	-73.87057277	0.1369863	3.773584906	9.574468085	89.47368421	46.66666667	44.68085106	78.94736842	296.8509388	2086.781994
Epochs 40	0.504587173	6	0	91.22807018	45	75	78.76106195	-68.17073506	-73.87057277	0.525114179	5.434782609	0	90.16393443	48.35164835	60	85.24590164	1709.919201	2086.781994
Epochs 60	0.197247714	6.060606061	5.882352941	94.11764706	45.91836735	52.94117647	85.29411765	-14.56723496	-73.87057277	0.196347028	4.938271605	7.843137255	86.11111111	45	43.1372549	80.55555556	-25.21137966	2086.781994
Epochs 80	0.188073397	6.12244898	5.681818182	93.75	44.32989691	53.40909091	81.25	-43.649403	-73.87057277	0.19178082	5.194805195	7.476635514	85.71428571	46.05263158	42.05607477	85.71428571	205.2774448	2086.781994
Epochs 100	0.412844032	7.407407407	9.090909091	96.34146341	50	58.18181818	84.14634146	-4.340318514	-73.87057277	0.420091331	5.172413793	10	90.10989011	43.85964912	52.85714286	84.61538462	-3.551806033	2086.781994
Epochs 120	0.545871556	8.196721311	9.756097561	94.82758621	44.26229508	60.97560976	81.73913043	-25.7271885	-73.87057277	0.616438329	6.25	10.63829787	91.42857143	40.625	51.06382979	85.61151079	3.208208295	2086.781994
Epochs 140	0.660550475	10.41666667	11.53846154	94.44444444	47.91666667	69.23076923	83.21678322	-48.61603462	-73.87057277	0.721461177	7.407407407	8.695652174	91.12426036	40.74074074	52.17391304	85.71428571	134.357697	2086.781994
Epochs 160	0.69266057	11.36363636	16	95.30201342	52.27272727	72	81.75675676	-54.01528638	-73.87057277	0.726027369	7.407407407	15.38461538	92.1686747	40.74074074	57.69230769	86.66666667	120.6133214	2086.781994
Epochs 180	0.724770665	6.451612903	16	93.82716049	48.38709677	68	81.36645963	5.839242798	-73.87057277	0.808219194	13.33333333	20	92.93478261	53.33333333	50	87.43169399	2.173433438	2086.781994
Epochs 200	0.784403682	0	20	93.29608939	47.36842105	65	80.8988764	-44.80410217	-73.87057277	0.81735158	10	11.76470588	91.66666667	60	41.17647059	86.38743455	30.08877381	2086.781994
Novavax, Inc	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.087155961	4.316546763	5.882352941	81.81818182	41.30434783	47.05882353	72.72727273	-38.78623518	-97.62028238	0.10958904	5.263157895	6.306306306	92.30769231	50	45.04504505	76.92307692	477.4422883	5802.379195
Epochs 40	0.43577981	6.451612903	0	93.5483871	43.08943089	100	87.09677419	-98.055158	-97.62028238	0.648401797	7.142857143	25	93.79310345	51.42857143	100	88.19444444	12692.56783	5802.379195
Epochs 60	0.211009175	6.722689076	7.575757576	100	43.22033898	53.03030303	87.87878788	-10.37794007	-97.62028238	0.242009133	7.575757576	6.422018349	93.18181818	51.51515152	46.78899083	83.72093023	213.0078142	5802.379195
Epochs 80	0.206422016	5.93220339	7.575757576	97.05882353	43.58974359	53.03030303	82.35294118	-5.067291143	-97.62028238	0.242009133	11.11111111	6.034482759	97.5	55.55555556	46.55172414	84.61538462	1228.874062	5802.379195
Epochs 100	0.43577981	7.446808511	9.090909091	93.40659341	43.61702128	60.60606061	84.44444444	-30.61295436	-97.62028238	0.442922384	13.20754717	8.641975309	97.64705882	54.71698113	54.32098765	90.47619048	897.4333785	5802.379195
Epochs 120	0.550458729	6.944444444	8.333333333	92.62295082	43.05555556	62.5	84.29752066	-47.14196005	-97.62028238	0.547945201	8.571428571	10.44776119	94.01709402	54.28571429	53.73134328	85.34482759	226.6537828	5802.379195
Epochs 140	0.655963302	8.474576271	14.28571429	93.79310345	44.06779661	64.28571429	85.41666667	33.23920192	-97.62028238	0.639269412	6.060606061	10	91.78082192	57.57575758	57.5	84.82758621	863.232498	5802.379195
Epochs 160	0.69266057	9.615384615	15.38461538	94.11764706	40.38461538	61.53846154	85.52631579	-17.10770567	-97.62028238	0.662100434	6.666666667	8.333333333	91.50326797	56.66666667	58.33333333	84.21052632	1958.976579	5802.379195
Epochs 180	0.720183492	6.976744186	16.66666667	93.25153374	34.88372093	66.66666667	84.56790123	41.22719314	-97.62028238	0.753424644	11.11111111	13.33333333	92.98245614	66.66666667	50	86.47058824	1576.16841	5802.379195

Epochs 200	0.75688076	5.714285714	12.5	92.57142857	37.14285714	62.5	84.48275862	-3.418907597	-97.62028238	0.794520557	15.38461538	9.090909091	92.39130435	76.92307692	45.45454545	86.33879781	2278.371954	5802.379195
Novavax, Inc CNN Model																		
Vaxart, Inc	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.683486223	6.557377049	0	92.94871795	48.33333333	0	69.23076923	-97.71715254	-97.40654205	0.694063902	8.620689655	0	93.03797468	49.12280702	33.33333333	84.81012658	805.3408689	3138.165411
Epochs 40	0.128440365	4.444444444	4.838709677	90.47619048	49.25373134	61.29032258	71.42857143	-92.37468757	-97.40654205	0.173515975	5.833333333	8.219178082	96.15384615	45.37815126	47.94520548	76.92307692	44.3585828	3138.165411
Epochs 60	0.201834857	5.319148936	4.597701149	94.59459459	49.46236559	57.47126437	78.37837838	-94.33493206	-97.40654205	0.168949768	5.813953488	7.407407407	96	51.76470588	47.22222222	84	-15.4293662	3138.165411
Epochs 80	0.325688064	4.347826087	5.172413793	94.11764706	48.35164835	63.79310345	73.52941176	-93.74144406	-97.40654205	0.278538823	6.172839506	9.090909091	96	51.25	50	76	-3.381271213	3138.165411
Epochs 100	0.353211015	6	6.25	97.14285714	52.52525253	64.58333333	75.71428571	-91.56348258	-97.40654205	0.292237431	8.235294118	6.329113924	94.54545455	52.38095238	49.36708861	78.18181818	14.43903057	3138.165411
Epochs 120	0.518348634	3.846153846	4.255319149	91.59663866	56.8627451	61.70212766	73.1092437	-85.19684358	-97.40654205	0.552511394	11.11111111	6.349206349	94.16666667	57.14285714	47.61904762	79.16666667	167.5442667	3138.165411
Epochs 140	0.623853207	4.444444444	3.448275862	92.36111111	61.36363636	72.4137931	71.52777778	-88.57698608	-97.40654205	0.712328792	6.25	7.692307692	92.68292683	50	46.15384615	81.59509202	-53.61813144	3138.165411
Epochs 160	0.697247684	5.405405405	5	92.54658385	58.33333333	75	72.04968944	-86.41694246	-97.40654205	0.753424644	6.666666667	6.896551724	92.57142857	46.66666667	41.37931034	82.18390805	-57.54306857	3138.165411
Epochs 180	0.724770665	6.25	5.555555556	92.26190476	58.06451613	66.66666667	72.61904762	-59.33248527	-97.40654205	0.762557089	6.25	7.692307692	92.65536723	43.75	46.15384615	82.38636364	-41.13683621	3138.165411
Epochs 200	0.74311924	6.896551724	5.882352941	92.44186047	57.14285714	64.70588235	72.09302326	-41.34651303	-97.40654205	0.780821919	0	0	91.44385027	45.45454545	42.85714286	81.72043011	-11.14874437	3138.165411
Inovio Pharmaceuticals, Inc.	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.62844038	5.714285714	0	90.47619048	47.14285714	100	79.45205479	-69.7556658	-73.87057277	0.625570774	2.985074627	50	89.33333333	46.96969697	100	85.33333333	4502.923583	2086.781994
Epochs 40	0.169724777	7.299270073	7.01754386	95.83333333	47.44525547	64.28571429	83.33333333	22.24634989	-73.87057277	0.168949768	5	9.722222222	88.88888889	46.21848739	48.61111111	85.18518519	349.6698789	2086.781994
Epochs 60	0.215596333	6.451612903	5.952380952	87.80487805	48.38709677	59.03614458	73.17073171	184.1309066	-73.87057277	0.237442926	5.882352941	10.63829787	92.5	48.80952381	43.61702128	90	408.7534849	2086.781994
Epochs 80	0.284403682	8.421052632	3.03030303	91.22807018	51.57894737	60	77.19298246	36.35087703	-73.87057277	0.324200898	5.952380952	12.16216216	93.44262295	49.39759036	51.35135135	91.80327869	872.730302	2086.781994
Epochs 100	0.302752286	7.920792079	3.571428571	91.80327869	51.48514851	60	78.68852459	43.03054253	-73.87057277	0.347031951	6.097560976	9.375	89.04109589	48.14814815	48.4375	84.93150685	519.2611112	2086.781994
Epochs 120	0.504587173	4.347826087	3.846153846	88.33333333	56.52173913	62.74509804	79.16666667	234.6737792	-73.87057277	0.525114179	6.666666667	7.272727273	90.75630252	54.54545455	49.09090909	82.35294118	713.9858859	2086.781994
Epochs 140	0.637614667	6.25	2.941176471	89.47368421	68.75	57.57575758	78.94736842	243.9148654	-73.87057277	0.652968049	3.846153846	7.692307692	90.25974026	56	46.15384615	83.76623377	98.77713035	2086.781994
Epochs 160	0.724770665	9.090909091	4	90.64327485	63.63636364	58.33333333	78.94736842	104.7963707	-73.87057277	0.712328792	4.761904762	6.896551724	90.53254438	60	44.82758621	84.02366864	64.5011898	2086.781994
Epochs 180	0.738532126	9.523809524	4.347826087	90.8045977	61.9047619	54.54545455	79.31034483	12.26221246	-73.87057277	0.757990897	5.882352941	8.695652174	91.06145251	75	39.13043478	84.3575419	71.19882339	2086.781994
Epochs 200	0.747706413	9.090909091	0	90.96045198	59.09090909	55.55555556	79.66101695	284.6518459	-73.87057277	0.776255727	7.142857143	9.090909091	91.2568306	69.23076923	36.36363636	84.69945355	67.45025183	2086.781994
Novavax, Inc	Test accuracy									Correct buys								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.591743112	6.097560976	0	91.85185185	48.14814815	0	85.18518519	-96.56747421	-97.62028238	0.739726007	6.52173913	33.33333333	92.94117647	41.30434783	66.66666667	86.98224852	8972.994504	5802.379195

Epochs 40	0.142201841	5.921052632	6.52173913	95	43.04635762	56.52173913	85	-82.329714	-97.62028238	0.146118715	5.042016807	7.792207792	86.95652174	45.37815126	51.31578947	82.60869565	1503.303171	5802.379195
Epochs 60	0.220183492	6.896551724	10.44776119	94.28571429	47.82608696	53.73134328	85.71428571	-42.99320145	-97.62028238	0.214611873	8.219178082	7.142857143	97.05882353	49.31506849	45.94594595	97.05882353	756.0193611	5802.379195
Epochs 80	0.32110092	8.181818182	11.76470588	96.49122807	48.62385321	60.78431373	89.47368421	-51.91636613	-97.62028238	0.342465758	7.246376812	9.302325581	96.875	49.27536232	51.76470588	92.1875	796.5844951	5802.379195
Epochs 100	0.330275238	7.894736842	11.62790698	95.08196721	46.01769912	55.81395349	85.24590164	-63.58108351	-97.62028238	0.360730588	8.219178082	8.974358974	97.05882353	50.68493151	51.94805195	91.17647059	624.6137492	5802.379195
Epochs 120	0.522935808	7.462686567	8.333333333	92.17391304	44.7761194	44.44444444	83.33333333	-87.12112958	-97.62028238	0.520547926	5.714285714	9.589041096	94.59459459	37.14285714	52.77777778	87.38738739	2.254139643	5802.379195
Epochs 140	0.697247684	7.692307692	13.63636364	92.99363057	51.28205128	50	83.97435897	-91.44066436	-97.62028238	0.648401797	3.846153846	8.888888889	92.56756757	38.46153846	50	85.81081081	268.6507323	5802.379195
Epochs 160	0.775229335	12.5	21.42857143	94.18604651	59.375	50	84.79532164	-74.06095056	-97.62028238	0.716894984	5	8.823529412	92.72727273	35	54.54545455	86.66666667	653.1042987	5802.379195
Epochs 180	0.766055048	9.677419355	9.090909091	92.61363636	54.83870968	45.45454545	84	-92.2566736	-97.62028238	0.744292259	4.761904762	11.11111111	92.98245614	38.0952381	53.84615385	87.13450292	617.4684033	5802.379195
Epochs 200	0.775229335	10.34482759	9.090909091	92.69662921	58.62068966	45.45454545	83.61581921	-92.21358483	-97.62028238	0.762557089	6.25	8	92.13483146	37.5	54.16666667	86.51685393	405.4154206	5802.379195

Table 17-4 CNN Models Results for Variation 6

Hawaiian Airlines LSTM Model																		
Hawaiian Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.330275238	3.738317757	10.81081081	86.48648649	43.39622642	59.45945946	75.67567568	454.775334	-2.642012201	0.415525109	7.476635514	17.24137931	93.97590361	42.05607477	58.62068966	85.36585366	60.41391136	-51.27594162
Epochs 40	0.481651366	7.692307692	12.72727273	94.89795918	52.30769231	52.72727273	82.4742268	959.9700836	-2.642012201	0.484018266	7.8125	10.20408163	90.56603774	46.03174603	51.02040816	82.0754717	-47.74861188	-51.27594162
Epochs 60	0.577981651	6.818181818	15.68627451	93.49593496	54.54545455	52.94117647	81.96721311	1312.00761	-2.642012201	0.557077646	7.272727273	14.28571429	91.80327869	49.09090909	47.61904762	82.6446281	-70.91871369	-51.27594162
Epochs 80	0.642201841	8.823529412	17.0212766	94.16058394	50	57.44680851	83.82352941	873.6022852	-2.642012201	0.589041114	8.888888889	9.756097561	90.97744361	53.33333333	46.34146341	81.81818182	-64.54531233	-51.27594162
Epochs 100	0.678899109	10.34482759	13.88888889	91.50326797	51.72413793	55.55555556	81.57894737	880.2390515	-2.642012201	0.616438329	9.090909091	11.11111111	91.36690647	51.1627907	41.66666667	82.73381295	-85.02682964	-51.27594162
Epochs 120	0.724770665	4.545454545	17.24137931	91.01796407	50	55.17241379	81.92771084	1290.249243	-2.642012201	0.694063902	11.42857143	14.28571429	92.30769231	54.28571429	50	83.87096774	-28.71182906	-51.27594162
Epochs 140	0.798165143	7.692307692	22.72727273	91.80327869	53.84615385	59.09090909	82.96703297	279.5480804	-2.642012201	0.726027369	6.896551724	14.28571429	91.12426036	48.27586207	57.14285714	83.33333333	-57.13694768	-51.27594162
Epochs 160	0.802752316	0	24	91.84782609	55.55555556	52	83.06010929	113.7006424	-2.642012201	0.739726007	7.692307692	14.28571429	91.27906977	46.15384615	57.14285714	83.04093567	-84.54195616	-51.27594162
Epochs 180	0.802752316	0	18.18181818	90.95744681	62.5	45.45454545	81.81818182	55.13740759	-2.642012201	0.762557089	9.090909091	15	91.52542373	45.45454545	55	83.52272727	-82.08740989	-51.27594162
Epochs 200	0.798165143	0	15	90.47619048	44.44444444	45	81.38297872	52.15997086	-2.642012201	0.776255727	5.882352941	11.11111111	90.76086957	41.17647059	50	83.06010929	-85.65573391	-51.27594162
Jet blue Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.449541271	7.865168539	8.823529412	92.63157895	55.68181818	50	84.21052632	-61.73558028	19.48199225	0.452054799	7.608695652	10	91.75257732	47.82608696	63.33333333	84.375	10.88821533	-44.84408332
Epochs 40	0.399082571	5.714285714	5.084745763	89.88764045	50	52.54237288	80.68181818	376.0076219	19.48199225	0.493150681	14.0625	9.259259259	93.06930693	52.38095238	64.81481481	87.12871287	2671.770928	-44.84408332
Epochs 60	0.495412856	5.084745763	6.382978723	91.07142857	50.84745763	51.06382979	80.18018018	130.8245571	19.48199225	0.566210032	17.30769231	11.76470588	93.96551724	50.98039216	60.78431373	87.06896552	390.92573	-44.84408332
Epochs 80	0.536697268	4.166666667	4.444444444	90.4	54.16666667	51.11111111	81.4516129	572.582794	19.48199225	0.557077646	13.04347826	11.11111111	92.43697479	51.11111111	53.7037037	86.55462185	938.8001845	-44.84408332

Epochs 100	0.619266033	2.702702703	5.555555556	91.03448276	48.64864865	55.55555556	82.63888889	-83.28224707	19.48199225	0.602739751	13.63636364	11.62790698	91.66666667	53.48837209	53.48837209	87.12121212	233.9994269	-44.84408332
Epochs 120	0.678899109	0	6.896551724	91.25	44.82758621	51.72413793	83.01886792	-78.50717663	19.48199225	0.684931517	14.70588235	10.34482759	91.02564103	57.57575758	55.17241379	85.25641026	413.8989626	-44.84408332
Epochs 140	0.724770665	0	0	90.8045977	35	50	82.65895954	-29.35735679	19.48199225	0.744292259	16.66666667	9.090909091	90.75144509	56.52173913	59.09090909	84.97109827	8223.940159	-44.84408332
Epochs 160	0.74311924	0	3.846153846	90.96045198	40	50	82.95454545	6.723936285	19.48199225	0.785388112	21.42857143	9.523809524	90.76086957	57.14285714	57.14285714	85.24590164	5212.885288	-44.84408332
Epochs 180	0.75688076	0	0	90.65934066	46.15384615	47.82608696	82.32044199	-17.8053509	19.48199225	0.776255727	23.07692308	8.333333333	90.65934066	46.15384615	50	85.08287293	1943.435268	-44.84408332
Epochs 200	0.775229335	0	0	90.86021505	45.45454545	42.85714286	82.7027027	-0.08264435	19.48199225	0.803652942	10	11.76470588	90.10416667	50	47.05882353	85.34031414	-54.84555008	-44.84408332
American Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.467889905	6.593406593	13.33333333	94.84536082	39.56043956	50	85.41666667	-56.46242015	-69.69637123	0.442922384	4.444444444	11.76470588	93.68421053	44.94382022	52.94117647	84.21052632	-95.06033816	-63.19650348
Epochs 40	0.417431206	7.228915663	9.803921569	95.23809524	44.57831325	52	88.0952381	521.8267982	-69.69637123	0.506849289	11.26760563	13.04347826	95.09803922	54.28571429	58.69565217	87.25490196	2339.49589	-63.19650348
Epochs 60	0.504587173	7.462686567	9.090909091	94.39252336	44.7761194	51.1627907	86.91588785	-48.40076745	-69.69637123	0.557077646	12.6984127	13.95348837	95.57522124	50	53.48837209	84.95575221	534.0009073	-63.19650348
Epochs 80	0.56422019	8.771929825	9.756097561	95	47.36842105	47.5	90	-46.93078391	-69.69637123	0.575342476	13.79310345	15.2173913	96.52173913	52.63157895	58.69565217	85.2173913	2541.297246	-63.19650348
Epochs 100	0.582568824	8.474576271	9.090909091	94.44444444	47.45762712	53.125	88.0952381	-7.293018818	-69.69637123	0.634703219	12.96296296	18.18181818	95.45454545	50.94339623	60.60606061	86.36363636	1220.581811	-63.19650348
Epochs 120	0.655963302	4.761904762	7.407407407	93.2885906	40.47619048	51.85185185	87.16216216	-59.39813104	-69.69637123	0.712328792	13.88888889	20	94.77124183	48.57142857	60	85.62091503	448.3066028	-63.19650348
Epochs 140	0.701834857	0	8.333333333	92.63803681	41.93548387	58.33333333	86.41975309	-57.70931605	-69.69637123	0.712328792	14.28571429	14.81481481	93.63057325	52.94117647	59.25925926	85.35031847	300.4240481	-63.19650348
Epochs 160	0.724770665	10.71428571	7.407407407	93.86503067	53.57142857	57.69230769	87.11656442	-53.51511282	-69.69637123	0.753424644	15.38461538	16.66666667	92.89940828	57.69230769	58.33333333	84.52380952	616.5034813	-63.19650348
Epochs 180	0.766055048	4.761904762	9.523809524	93.18181818	47.61904762	57.14285714	86.85714286	-50.78293865	-69.69637123	0.780821919	18.18181818	18.18181818	93.14285714	50	59.09090909	84.48275862	1035.02209	-63.19650348
Epochs 200	0.770642221	5.263157895	9.090909091	93.22033898	47.36842105	54.54545455	86.93181818	-50.78293865	-69.69637123	0.794520557	20	19.04761905	93.25842697	55	66.66666667	85.31073446	964.1711852	-63.19650348
Jet Blue Airlines LSTM Model																		
Hawaiian Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.339449555	5	6.097560976	86.84210526	43.33333333	46.91358025	78.94736842	-6.216006678	-2.642012201	0.374429226	6.896551724	7.407407407	90	36.20689655	49.38271605	86.07594937	-78.17358379	-51.27594162
Epochs 40	0.399082571	7.272727273	7.594936709	91.66666667	60	48.71794872	80.95238095	1086.691539	-2.642012201	0.589041114	11.32075472	8.333333333	92.30769231	45.28301887	50	83.72093023	-55.27891608	-51.27594162
Epochs 60	0.504587173	7.142857143	7.936507937	90.26548673	64.28571429	44.44444444	79.46428571	5665.793108	-2.642012201	0.630136967	7.142857143	9.375	91.03448276	40.47619048	43.75	82.63888889	-90.5314707	-51.27594162
Epochs 80	0.573394477	7.5	10.20408163	90.69767442	67.5	51.02040816	81.25	11225.88417	-2.642012201	0.671232879	9.090909091	9.375	91.55844156	39.39393939	37.5	83.66013072	-95.23930078	-51.27594162
Epochs 100	0.610091746	6.25	10.63829787	90.64748201	71.875	55.31914894	79.71014493	14659.59284	-2.642012201	0.726027369	12.5	10.34482759	92.1686747	37.5	44.82758621	83.63636364	-91.74114573	-51.27594162
Epochs 120	0.674311936	7.692307692	10.81081081	90.96774194	65.38461538	51.35135135	80.51948052	2257.86519	-2.642012201	0.771689475	10.52631579	10.52631579	91.16022099	36.84210526	47.36842105	83.33333333	-84.08115211	-51.27594162
Epochs 140	0.697247684	4.347826087	9.677419355	90.24390244	56.52173913	51.61290323	80.36809816	2992.276725	-2.642012201	0.794520557	6.25	13.33333333	90.95744681	31.25	53.33333333	83.42245989	-89.11402955	-51.27594162
Epochs 160	0.733944952	5.555555556	7.692307692	90.22988506	55.55555556	50	80.34682081	2321.522194	-2.642012201	0.812785387	7.692307692	14.28571429	91.14583333	23.07692308	50	83.76963351	-74.26532096	-51.27594162
Epochs 180	0.75688076	5.882352941	9.090909091	90.5027933	58.82352941	45.45454545	80.8988764	247.198057	-2.642012201	0.826484025	10	14.28571429	91.28205128	30	50	84.02061856	-82.84388923	-51.27594162

Epochs 200	0.775229335	7.692307692	9.523809524	90.2173913	61.53846154	47.61904762	80.32786885	347.2076665	-2.642012201	0.858447492	20	10	91.17647059	20	60	84.2364532	-20.16739741	-51.27594162
Jet blue Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.399082571	8.955223881	7.142857143	93.82716049	54.54545455	51.42857143	85.18518519	20.52080036	19.48199225	0.374429226	9.615384615	9.782608696	90.66666667	50	53.26086957	83.78378378	225.6762311	-44.84408332
Epochs 40	0.394495428	10.38961039	4.918032787	93.75	51.94805195	61.66666667	86.25	88.71641531	19.48199225	0.570776284	12.82051282	13.33333333	93.33333333	48.71794872	55	86.55462185	199.9241189	-44.84408332
Epochs 60	0.467889905	6.666666667	5.660377358	90.47619048	46.66666667	63.46153846	82.85714286	147.1721993	19.48199225	0.634703219	8.571428571	12.5	90.97222222	48.57142857	55	85.31468531	67.56127313	-44.84408332
Epochs 80	0.5	8.064516129	6.666666667	90.99099099	48.38709677	68.18181818	81.08108108	163.5466757	19.48199225	0.680365324	7.142857143	12.12121212	90.50632911	50	57.57575758	85.35031847	-25.78914008	-44.84408332
Epochs 100	0.536697268	7.01754386	7.5	90.90909091	49.12280702	62.5	81.66666667	85.98125353	19.48199225	0.726027369	8.333333333	14.81481481	91.07142857	54.16666667	59.25925926	86.22754491	-23.93256553	-44.84408332
Epochs 120	0.56422019	7.843137255	2.777777778	90.07633588	45.09803922	63.88888889	81.53846154	285.8680943	19.48199225	0.739726007	4.761904762	16	90.75144509	57.14285714	60	86.04651163	-22.83936171	-44.84408332
Epochs 140	0.587155938	8.510638298	2.857142857	90.44117647	48.93617021	64.70588235	81.61764706	-18.01583826	19.48199225	0.767123282	0	20	90.10989011	58.82352941	65	85.63535912	16.22000699	-44.84408332
Epochs 160	0.669724762	8.571428571	3.703703704	91.02564103	54.28571429	62.96296296	82.58064516	321.0493498	19.48199225	0.785388112	0	11.76470588	89.47368421	58.33333333	58.82352941	84.65608466	8.912121777	-44.84408332
Epochs 180	0.665137589	6.451612903	3.333333333	90.44585987	51.61290323	66.66666667	82.05128205	258.6684263	19.48199225	0.812785387	0	26.66666667	90.625	58.33333333	73.33333333	85.86387435	171.7722878	-44.84408332
Epochs 200	0.715596318	7.692307692	4.166666667	91.07142857	42.30769231	70.83333333	83.23353293	73.03282381	19.48199225	0.83561641	0	30.76923077	90.86294416	55.55555556	76.92307692	86.2244898	227.0141436	-44.84408332
American Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.32110092	7.228915663	3.03030303	89.85507246	40.96385542	43.07692308	82.60869565	-76.31330037	-69.69637123	0.315068483	9.210526316	3.896103896	89.39393939	53.94736842	49.35064935	80	435.9935906	-63.19650348
Epochs 40	0.417431206	6.557377049	5.882352941	93.25842697	49.18032787	47.76119403	87.64044944	-82.87842987	-69.69637123	0.502283096	12.96296296	8.474576271	92.45283019	53.7037037	47.45762712	82.85714286	1114.549373	-63.19650348
Epochs 60	0.513761461	9.615384615	6.896551724	95.37037037	53.84615385	47.36842105	88.88888889	-67.3691372	-69.69637123	0.575342476	15.09433962	9.090909091	93.44262295	56.60377358	52.27272727	85.12396694	305.9168667	-63.19650348
Epochs 80	0.541284382	6.52173913	7.407407407	94.06779661	52.17391304	49.05660377	89.83050847	-53.4055292	-69.69637123	0.648401797	14.89361702	12.5	93.57142857	57.44680851	53.125	84.17266187	55.36021043	-63.19650348
Epochs 100	0.614678919	8.108108108	8.510638298	94.7761194	51.35135135	45.65217391	88.05970149	-69.46488358	-69.69637123	0.684931517	15.38461538	10.71428571	92.76315789	58.97435897	50	84.10596026	-83.92926428	-63.19650348
Epochs 120	0.665137589	3.571428571	9.756097561	93.95973154	46.42857143	48.7804878	87.16216216	-79.96100262	-69.69637123	0.712328792	13.33333333	8.333333333	90.90909091	60	45.83333333	81.70731707	-84.95614681	-63.19650348
Epochs 140	0.720183492	4	7.142857143	93.33333333	60	50	87.19512195	-6.304110353	-69.69637123	0.735159814	12	9.090909091	90.69767442	56	45.45454545	82.45614035	-69.05897756	-63.19650348
Epochs 160	0.766055048	4.545454545	9.523809524	93.71428571	63.63636364	47.61904762	87.35632184	-4.939567733	-69.69637123	0.762557089	13.63636364	5.882352941	90.55555556	63.63636364	47.05882353	82.68156425	-47.16379845	-63.19650348
Epochs 180	0.788990855	4.761904762	15.78947368	94.38202247	61.9047619	52.63157895	88.13559322	125.259849	-69.69637123	0.767123282	15	5.555555556	90.60773481	60	44.44444444	82.22222222	-47.29199078	-63.19650348
Epochs 200	0.798165143	0	6.666666667	93.01075269	58.82352941	46.66666667	87.02702703	126.193107	-69.69637123	0.812785387	20	7.692307692	91.09947644	60	46.15384615	82.63157895	-68.77479567	-63.19650348
American Airlines LSTM Model																		
Hawaiian Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.201834857	3.311258278	12.5	83.72093023	40.66666667	50	76.74418605	158.9116269	-2.642012201	0.182648405	4.972375691	28.57142857	93.5483871	39.44444444	57.14285714	87.09677419	47.08256336	-51.27594162
Epochs 40	0.426605493	6.896551724	10	91.11111111	44.82758621	56.52173913	82.22222222	312.9428799	-2.642012201	0.497716904	7.01754386	8.163265306	89.38053097	43.85964912	44.89795918	81.25	181.6644073	-51.27594162

Epochs 60	0.513761461	9.302325581	8.064516129	91.15044248	44.18604651	55.73770492	82.30088496	965.7086834	-2.642012201	0.625570774	12.5	8.510638298	92.14285714	43.75	40.42553191	84.17266187	-67.39288758	-51.27594162
Epochs 80	0.596330285	8.823529412	8.163265306	91.11111111	47.05882353	52.08333333	80.74074074	50.35050169	-2.642012201	0.671232879	8	7.894736842	91.02564103	32	44.73684211	82.58064516	-84.60322789	-51.27594162
Epochs 100	0.655963302	7.142857143	7.894736842	90.78947368	46.42857143	56.75675676	81.57894737	81.20776107	-2.642012201	0.739726007	11.76470588	10	91.27906977	29.41176471	43.33333333	83.62573099	-77.00252534	-51.27594162
Epochs 120	0.674311936	4.166666667	5.882352941	90	45.83333333	58.82352941	80.50314465	-17.39891487	-2.642012201	0.767123282	13.33333333	11.11111111	92.09039548	26.66666667	40.74074074	84.65909091	-74.17338554	-51.27594162
Epochs 140	0.688073397	0	6.666666667	89.6969697	34.7826087	63.33333333	81.09756098	-5.185781139	-2.642012201	0.767123282	8.333333333	10.71428571	91.62011173	16.66666667	39.28571429	83.70786517	-80.84283269	-51.27594162
Epochs 160	0.733944952	0	7.407407407	89.77272727	33.33333333	62.96296296	81.14285714	-41.37346594	-2.642012201	0.780821919	7.692307692	9.090909091	91.30434783	30.76923077	45.45454545	83.60655738	-90.63883429	-51.27594162
Epochs 180	0.752293587	0	4.166666667	89.56043956	41.66666667	58.33333333	79.55801105	-84.59872518	-2.642012201	0.79908675	9.090909091	5.555555556	91.05263158	36.36363636	38.88888889	83.5978836	-99.01556414	-51.27594162
Epochs 200	0.75688076	0	4.166666667	89.13043478	40	62.5	79.78142077	32.2043828	-2.642012201	0.79908675	11.11111111	5	91.05263158	33.33333333	45	83.5978836	-58.72736008	-51.27594162
Jet blue Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.24311927	4.026845638	10	91.83673469	39.18918919	65	79.59183673	-66.04118848	19.48199225	0.200913236	4.938271605	5.555555556	89.74358974	45.96273292	38.88888889	84.61538462	-67.46066939	-44.84408332
Epochs 40	0.490825683	8.771929825	3.846153846	91.74311927	45.61403509	43.1372549	82.56880734	-78.04049737	19.48199225	0.429223746	10.16949153	10	90	47.45762712	60	83.14606742	-20.68418344	-44.84408332
Epochs 60	0.550458729	4.87804878	5.882352941	91.26984127	36.58536585	48	81.74603175	-77.25607034	19.48199225	0.552511394	12.12121212	9.375	90.98360656	57.57575758	53.125	85.95041322	-60.24228006	-44.84408332
Epochs 80	0.591743112	5	4.87804878	91.24087591	37.5	45	81.75182482	-72.28292666	19.48199225	0.671232879	15.78947368	8.695652174	90.90909091	57.89473684	50	84.96732026	-65.79374851	-44.84408332
Epochs 100	0.665137589	6.060606061	6.25	92.15686275	33.33333333	48.38709677	82.35294118	-31.71971986	19.48199225	0.716894984	10	10	89.9408284	60	50	84.52380952	8.015690422	-44.84408332
Epochs 120	0.706422031	7.692307692	6.666666667	92.59259259	34.61538462	51.72413793	83.33333333	-74.52216377	19.48199225	0.762557089	14.28571429	9.677419355	90.05524862	57.14285714	48.38709677	84.44444444	85.12754399	-44.84408332
Epochs 140	0.733944952	10	3.571428571	92.35294118	35	51.85185185	83.52941176	-58.35034437	19.48199225	0.771689475	0	11.53846154	89.72972973	50	46.15384615	84.7826087	43.5309357	-44.84408332
Epochs 160	0.793577969	14.28571429	4.761904762	92.89617486	50	45	84.15300546	-53.60700064	19.48199225	0.789954364	0	9.090909091	89.52879581	50	40.90909091	84.73684211	41.07416264	-44.84408332
Epochs 180	0.784403682	13.33333333	4.545454545	92.81767956	46.66666667	47.61904762	83.97790055	-53.73694432	19.48199225	0.803652942	0	10	89.69072165	60	45	84.97409326	332.1862224	-44.84408332
Epochs 200	0.788990855	12.5	0	92.39130435	43.75	41.17647059	83.69565217	-57.63054381	19.48199225	0.808219194	0	10	89.74358974	50	55	85.05154639	322.5798773	-44.84408332
American Airlines Test Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.284403682	4.794520548	21.05263158	96.22641509	35.86206897	63.15789474	88.67924528	-44.61065692	-69.69637123	0.19178082	3.658536585	5.882352941	92.10526316	43.29268293	52.94117647	81.08108108	-30.83326864	-63.19650348
Epochs 40	0.477064222	9.230769231	4	93.2038835	43.07692308	48	84.31372549	-76.19944831	-69.69637123	0.525114179	8.888888889	7.407407407	89.16666667	51.11111111	53.7037037	78.1512605	1927.591387	-63.19650348
Epochs 60	0.559633017	6.976744186	2.173913043	91.47286822	44.18604651	43.47826087	83.59375	-80.0641758	-69.69637123	0.584474862	11.42857143	9.433962264	90.83969466	57.14285714	56.60377358	80.76923077	1640.364058	-63.19650348
Epochs 80	0.660550475	10	3.448275862	93.2885906	45	51.72413793	85.81081081	-79.02177521	-69.69637123	0.611872137	10	6.52173913	89.51048951	53.33333333	54.34782609	79.57746479	4932.211423	-63.19650348
Epochs 100	0.715596318	11.11111111	4.761904762	93.78881988	38.88888889	52.38095238	86.25	-75.65931692	-69.69637123	0.680365324	10.52631579	5.263157895	89.50617284	57.89473684	52.63157895	79.50310559	563.9884458	-63.19650348
Epochs 120	0.752293587	10	0	93.06358382	36.66666667	46.66666667	86.04651163	-73.498187	-69.69637123	0.703196347	5.882352941	6.060606061	89.34911243	58.82352941	51.51515152	79.76190476	811.7084445	-63.19650348
Epochs 140	0.770642221	11.53846154	0	93.22033898	42.30769231	46.66666667	86.36363636	-73.498187	-69.69637123	0.735159814	8.333333333	6.451612903	89.77272727	58.33333333	54.83870968	80.57142857	1280.647478	-63.19650348
Epochs 160	0.834862411	11.76470588	0	93.2642487	52.94117647	87.5	86.97916667	-51.53193799	-69.69637123	0.753424644	7.692307692	4.166666667	89.56043956	53.84615385	54.16666667	80.11049724	1081.94652	-63.19650348

Epochs 180	0.844036698	7.142857143	0	92.89340102	50	85.71428571	86.73469388	-60.39425528	-69.69637123	0.776255727	10	4.545454545	89.83957219	60	50	80.64516129	1493.583525	-63.19650348
Epochs 200	0.862385333	16.66666667	0	93.46733668	50	85.71428571	87.37373737	-72.7219318	-69.69637123	0.776255727	8.333333333	5	89.83957219	50	55	81.1827957	2004.121163	-63.19650348

Table 17-5 LSTM Models Results for Variation 6

Sichuan Swellfun Co.,Ltd LSTM Model																		
Sichuan SwellfunTest Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.222222224	6.481481481	9.230769231	97.05882353	45.79439252	41.53846154	88.23529412	224.6065851	2068.314051	0.326923072	7.5	7.462686567	93.44262295	46.25	49.25373134	90	-27.72052326	400.9406907
Epochs 40	0.400966197	10	8.695652174	94.66666667	56.41025641	42.39130435	86.66666667	114.8741249	2068.314051	0.403846145	7.5	4.761904762	91.66666667	47.5	44.57831325	86.9047619	-11.6653812	400.9406907
Epochs 60	0.468599021	9.090909091	8.75	92.55319149	50	41.25	84.04255319	110.5864242	2068.314051	0.495192319	8.571428571	4.411764706	92.38095238	51.42857143	44.7761194	87.61904762	-42.16784894	400.9406907
Epochs 80	0.560386479	10	10.9375	93.80530973	46.66666667	40.625	84.82142857	152.8250461	2068.314051	0.596153855	9.677419355	5.882352941	93.65079365	54.83870968	46	88.88888889	10.06023283	400.9406907
Epochs 100	0.603864729	9.090909091	11.47540984	93.5483871	54.54545455	39.3442623	86.17886179	40.04228416	2068.314051	0.625	7.692307692	6.382978723	92.59259259	46.15384615	47.82608696	87.40740741	-16.43687038	400.9406907
Epochs 120	0.642512083	6.666666667	13.95348837	93.28358209	56.66666667	41.86046512	83.45864662	102.6849441	2068.314051	0.673076928	7.142857143	6.25	91.89189189	53.57142857	50	87.07482993	105.1895153	400.9406907
Epochs 140	0.71980679	10	14.28571429	93.42105263	60	37.14285714	84.10596026	59.42245619	2068.314051	0.735576928	7.142857143	10.52631579	92.54658385	57.14285714	47.36842105	87.5	96.72281892	400.9406907
Epochs 160	0.724637687	9.090909091	10.34482759	92.94871795	54.54545455	34.48275862	83.87096774	50.24915475	2068.314051	0.716346145	3.448275862	5.555555556	91.30434783	58.62068966	44.44444444	86.25	57.87783735	400.9406907
Epochs 180	0.748792291	9.523809524	15.38461538	93.125	57.14285714	38.46153846	83.01886792	79.19771705	2068.314051	0.725961566	3.846153846	5.263157895	91.41104294	65.38461538	47.36842105	85.80246914	65.66394685	400.9406907
Epochs 200	0.768115938	11.11111111	12.5	93.33333333	55.55555556	37.5	83.53658537	127.1327259	2068.314051	0.764423072	4.545454545	6.666666667	91.8128655	68.18181818	60	86.47058824	41.49670286	400.9406907
Wuliangye Yibin Co.,Ltd	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.236714974	6.666666667	6.557377049	92.68292683	49.03846154	52.45901639	87.80487805	767.4147855	2331.201715	0.269230783	8.860759494	3.797468354	92	41.7721519	43.58974359	84	51.8111804	604.1107527
Epochs 40	0.444444448	7.407407407	5.952380952	88.54166667	59.25925926	44.57831325	81.25	26.47555742	2331.201715	0.360576928	19.35483871	3.773584906	91.54929577	74.19354839	43.80952381	90.14084507	140.0695222	604.1107527
Epochs 60	0.545893729	9.523809524	5.970149254	89.91596639	52.38095238	46.96969697	83.19327731	124.6869639	2331.201715	0.427884609	24	3.125	91.95402299	80	43.15789474	89.65517241	105.4949457	604.1107527
Epochs 80	0.603864729	8.695652174	7.547169811	90.83969466	56.52173913	46.15384615	83.20610687	89.16276872	2331.201715	0.456730783	16	3.488372093	90.72164948	76	45.88235294	86.59793814	91.90180157	604.1107527
Epochs 100	0.657004833	5.882352941	6.818181818	90.4109589	64.70588235	46.51162791	84.24657534	834.1703973	2331.201715	0.514423072	18.18181818	3.896103896	91.74311927	68.18181818	46.05263158	88.0733945	103.8128543	604.1107527
Epochs 120	0.685990334	3.703703704	7.692307692	90.25974026	40.74074074	42.30769231	84.31372549	776.7565641	2331.201715	0.5625	19.23076923	3.174603175	92.43697479	61.53846154	46.77419355	89.07563025	111.9614103	604.1107527
Epochs 140	0.768115938	5.882352941	0	90.28571429	52.94117647	26.66666667	84.48275862	398.2022953	2331.201715	0.663461566	20.83333333	4.651162791	92.90780142	50	46.51162791	87.85714286	73.70041335	604.1107527
Epochs 160	0.811594188	7.692307692	0	90.76086957	53.84615385	40	84.15300546	379.3838044	2331.201715	0.774038434	18.18181818	7.692307692	91.8128655	63.63636364	42.30769231	86.47058824	49.09021364	604.1107527
Epochs 180	0.821256042	9.090909091	0	90.86021505	45.45454545	30	84.32432432	30.6813463	2331.201715	0.788461566	22.22222222	8	91.95402299	66.66666667	40	86.12716763	49.09021364	604.1107527
Epochs 200	0.835748792	11.11111111	0	91.00529101	55.55555556	44.44444444	84.04255319	34.46436104	2331.201715	0.807692289	0	8.695652174	91.20879121	33.33333333	39.13043478	85.63535912	28.29935461	604.1107527
Kweichow Moutai Co., Ltd	Non-Recession									Recession								

	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.222222224	7.777777778	8.974358974	82.05128205	50.56179775	41.02564103	79.48717949	1521.38097	1666.892281	0.25	11.11111111	6.315789474	92.68292683	45.83333333	47.36842105	87.5	1097.344516	678.7940879
Epochs 40	0.405797094	15.625	8.333333333	89.87341772	62.5	47.91666667	85.8974359	522.832989	1666.892281	0.322115391	14.28571429	6.722689076	90.16393443	53.57142857	50	90.16393443	94.51816231	678.7940879
Epochs 60	0.478260875	16	9.302325581	90.625	68	50	87.36842105	248.2577664	1666.892281	0.350961536	9.523809524	6.896551724	88.73239437	52.38095238	49.56521739	85.91549296	132.8684158	678.7940879
Epochs 80	0.512077272	13.63636364	9.090909091	88.88888889	63.63636364	49.35064935	86.91588785	672.8013419	1666.892281	0.423076928	8.333333333	8.24742268	89.65517241	58.33333333	52.08333333	86.20689655	561.3325004	678.7940879
Epochs 100	0.584541082	18.75	10.14492754	90.98360656	62.5	49.27536232	89.25619835	290.7172561	1666.892281	0.5	11.76470588	8.139534884	90.47619048	52.94117647	50	84.61538462	2030.386044	678.7940879
Epochs 120	0.63285023	14.28571429	8.510638298	89.20863309	57.14285714	48.93617021	86.23188406	259.2589489	1666.892281	0.596153855	9.523809524	10	91.33858268	57.14285714	46.66666667	84.92063492	2151.884616	678.7940879
Epochs 140	0.69082123	15.78947368	8.571428571	89.54248366	52.63157895	48.57142857	86.18421053	1277.712819	1666.892281	0.673076928	11.76470588	10.86956522	91.72413793	58.82352941	41.30434783	86.11111111	45.44041287	678.7940879
Epochs 160	0.729468584	17.64705882	10.34482759	90.0621118	52.94117647	48.27586207	86.875	1248.864433	1666.892281	0.740384638	7.692307692	12.5	91.41104294	61.53846154	40.625	85.80246914	70.44881112	678.7940879
Epochs 180	0.758454084	23.52941176	12	90.90909091	58.82352941	52	86.58536585	74.25669187	1666.892281	0.735576928	7.142857143	7.142857143	90.36144578	71.42857143	39.28571429	84.84848485	1427.60018	678.7940879
Epochs 200	0.758454084	23.07692308	4.347826087	89.47368421	61.53846154	47.82608696	85.29411765	87.54331749	1666.892281	0.788461566	11.11111111	9.090909091	90.96045198	66.66666667	31.81818182	85.22727273	91.45537056	678.7940879

Wuliangye Yibin Co.,Ltd LSTM Model

Sichuan SwellfunTest Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.376811594	6.153846154	8.695652174	93.15068493	53.125	42.02898551	89.04109589	25.04700711	2068.314051	0.331730783	8.695652174	5.333333333	92.1875	46.37681159	51.35135135	87.5	34.86931383	400.9406907
Epochs 40	0.444444448	4.347826087	10.41666667	93.33333333	48.52941176	45.83333333	88.88888889	11.57277648	2068.314051	0.355769217	8.771929825	5	91.54929577	50.87719298	46.83544304	87.32394366	56.42073763	400.9406907
Epochs 60	0.492753625	4.838709677	11.62790698	92.15686275	49.18032787	48.8372093	86.2745098	33.18646811	2068.314051	0.432692319	10.34482759	4.761904762	93.10344828	50	46.77419355	87.35632184	73.57968839	400.9406907
Epochs 80	0.642512083	3.03030303	15.38461538	93.33333333	54.54545455	48.71794872	88.05970149	-28.28169632	2068.314051	0.538461566	10.52631579	3.571428571	92.98245614	57.89473684	40	86.84210526	149.4704417	400.9406907
Epochs 100	0.71980679	3.225806452	22.72727273	92.85714286	48.38709677	54.54545455	86.92810458	11.36579269	2068.314051	0.634615362	12.12121212	5	93.33333333	54.54545455	43.58974359	87.40740741	49.50074282	400.9406907
Epochs 120	0.748792291	0	25	92.59259259	40	60	85.71428571	171.3664356	2068.314051	0.697115362	12.5	5.714285714	93.95973154	54.16666667	47.05882353	87.24832215	134.0328365	400.9406907
Epochs 140	0.739130437	0	23.80952381	92.5	38.46153846	61.9047619	84.27672956	77.69094007	2068.314051	0.644230783	9.375	0	92.90780142	53.125	44.11764706	86.5248227	26.26205559	400.9406907
Epochs 160	0.724637687	0	21.05263158	91.82389937	41.37931034	63.15789474	83.5443038	66.25429239	2068.314051	0.673076928	6.451612903	3.333333333	93.19727891	58.06451613	44.82758621	87.75510204	146.5220227	400.9406907
Epochs 180	0.734299541	0	17.64705882	91.41104294	48.14814815	58.82352941	82.71604938	66.25429239	2068.314051	0.706730783	6.666666667	4.347826087	92.90322581	63.33333333	50	87.74193548	146.6178718	400.9406907
Epochs 200	0.763285041	0	18.75	91.71597633	40.90909091	62.5	83.33333333	66.25429239	2068.314051	0.754807711	10	4.347826087	93.33333333	65	50	87.27272727	53.96026408	400.9406907

Wuliangye Yibin Co.,Ltd	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.415458947	9.375	6.557377049	92.68292683	57.8125	46.66666667	84.14634146	1593.871903	2331.201715	0.360576928	13.63636364	5.319148936	91.42857143	59.09090909	50.53763441	85.71428571	348.5550178	604.1107527
Epochs 40	0.454106271	13.33333333	5.714285714	91.30434783	55.55555556	49.27536232	82.60869565	227.7581017	2331.201715	0.317307681	13.95348837	4.807692308	90.16393443	62.79069767	54.36893204	83.60655738	122.3674394	604.1107527
Epochs 60	0.555555582	15.78947368	3.846153846	91.45299145	60.52631579	47.05882353	83.76068376	23.80354025	2331.201715	0.379807681	16.66666667	5.319148936	93.05555556	69.04761905	54.83870968	87.5	106.1976823	604.1107527
Epochs 80	0.61835748	20	4.255319149	92.30769231	63.33333333	44.68085106	83.72093023	22.48878187	2331.201715	0.447115391	18.42105263	3.797468354	91.20879121	73.68421053	56.96202532	86.66666667	121.1471008	604.1107527

Epochs 100	0.666666687	18.75	3.03030303	92.25352113	50	48.48484848	82.26950355	57.32717677	2331.201715	0.543269217	18.18181818	3.333333333	91.30434783	69.6969697	53.33333333	86.84210526	119.6096258	604.1107527
Epochs 120	0.724637687	21.05263158	3.333333333	91.7721519	57.89473684	43.33333333	82.80254777	60.98400407	2331.201715	0.600961566	17.24137931	3.921568627	92.1875	68.96551724	47.05882353	87.4015748	59.12632808	604.1107527
Epochs 140	0.695652187	11.11111111	0	90.38461538	51.85185185	41.66666667	81.29032258	58.53903634	2331.201715	0.625	16.66666667	4.545454545	91.79104478	73.33333333	50	87.21804511	-41.65346392	604.1107527
Epochs 160	0.734299541	11.11111111	0	90.85365854	55.55555556	37.5	82.82208589	323.8558699	2331.201715	0.649038434	16.12903226	5.263157895	92.08633094	70.96774194	52.63157895	87.68115942	0.897372541	604.1107527
Epochs 180	0.768115938	12.5	0	91.22807018	54.16666667	33.33333333	83.52941176	40.73525887	2331.201715	0.692307711	16.12903226	6.896551724	92.56756757	67.74193548	58.62068966	88.43537415	59.19442073	604.1107527
Epochs 200	0.801932395	12.5	0	91.11111111	56.25	36.36363636	83.24022346	31.24493562	2331.201715	0.745192289	20	7.407407407	92.54658385	70	62.96296296	88.125	3505.554325	604.1107527
Kweichow Moutai Co., Ltd	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.328502417	12.12121212	6.41025641	87.3015873	57.57575758	46.75324675	84.12698413	7510.974627	1666.892281	0.447115391	10	8.860759494	92.13483146	55	49.36708861	87.5	287.3172782	678.7940879
Epochs 40	0.33816424	9.433962264	8.139534884	85.29411765	54.71698113	50.58823529	80.88235294	2289.289175	1666.892281	0.331730783	11.11111111	6.930693069	91.93548387	53.33333333	52.47524752	86.8852459	103.0038293	678.7940879
Epochs 60	0.458937198	14	8.955223881	91.11111111	54	54.54545455	85.55555556	2772.605313	1666.892281	0.451923072	10.41666667	8.450704225	93.25842697	52.08333333	54.92957746	89.77272727	21.80072415	678.7940879
Epochs 80	0.516908228	16.21621622	9.230769231	90.47619048	56.75675676	57.8125	85.71428571	3104.301132	1666.892281	0.538461566	11.42857143	8.064516129	92.79279279	57.14285714	51.61290323	89.09090909	136.1118918	678.7940879
Epochs 100	0.628019333	15.15151515	13.63636364	91.53846154	54.54545455	62.79069767	87.69230769	12152.05396	1666.892281	0.634615362	12.12121212	11.36363636	93.89312977	54.54545455	61.36363636	89.23076923	176.2581085	678.7940879
Epochs 120	0.652173936	16.66666667	11.36363636	90.64748201	58.33333333	62.79069767	86.33093525	11110.96015	1666.892281	0.668269217	11.53846154	5.555555556	91.78082192	53.84615385	55.55555556	86.89655172	139.7892121	678.7940879
Epochs 140	0.64734298	11.11111111	12.5	90	51.85185185	64.1025641	85	4656.471165	1666.892281	0.653846145	6.896551724	5.882352941	91.03448276	55.17241379	61.76470588	86.11111111	94.82831842	678.7940879
Epochs 160	0.67632848	13.79310345	10	89.86486486	58.62068966	70	85.03401361	9267.423479	1666.892281	0.668269217	6.666666667	6.666666667	91.21621622	56.66666667	63.33333333	84.3537415	124.0587298	678.7940879
Epochs 180	0.729468584	16	13.04347826	90.56603774	60	69.56521739	86.70886076	20679.57759	1666.892281	0.721153855	7.407407407	5	91.30434783	51.85185185	65	85	31.55704407	678.7940879
Epochs 200	0.758454084	18.75	12.5	90.41916168	56.25	70.83333333	86.14457831	10383.43005	1666.892281	0.75	9.523809524	5	91.61676647	52.38095238	65	85.54216867	20.43560297	678.7940879
Kweichow Moutai Co., Ltd LSTM Model																		
Sichuan SwellfunTest Set	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.30917874	5	7.692307692	91.80327869	43.69747899	26.92307692	85.24590164	111.3273842	2068.314051	0.519230783	7.407407407	10	93.45794393	46.91358025	40	87.73584906	30.48596954	400.9406907
Epochs 40	0.434782594	6.41025641	7.5	92.13483146	48.05194805	42.5	84.26966292	202.3165523	2068.314051	0.432692319	9.459459459	8	94.04761905	48.64864865	56	91.56626506	239.1935825	400.9406907
Epochs 60	0.560386479	6.896551724	9.375	93.16239316	50.87719298	50	86.32478632	102.8554097	2068.314051	0.514423072	7.8125	12.19512195	94.17475728	50	65.85365854	90.19607843	40.81161415	400.9406907
Epochs 80	0.603864729	5.454545455	9.523809524	91.60305344	50	47.61904762	83.96946565	83.80088447	2068.314051	0.552884638	6.896551724	9.090909091	92.30769231	48.27586207	66.66666667	87.06896552	164.9039924	400.9406907
Epochs 100	0.695652187	5.405405405	10.52631579	92.71523179	47.22222222	42.10526316	86.09271523	83.58111108	2068.314051	0.600961566	4.347826087	6.896551724	90.97744361	43.47826087	62.06896552	84.84848485	53.39905517	400.9406907
Epochs 120	0.729468584	3.333333333	7.692307692	90.85365854	48.27586207	38.46153846	82.31707317	61.25133577	2068.314051	0.711538434	6.451612903	9.523809524	92.30769231	48.38709677	66.66666667	86.4516129	16.7480181	400.9406907
Epochs 140	0.792270541	0	10	91.06145251	41.17647059	30	82.68156425	-2.219307705	2068.314051	0.75	7.692307692	6.25	92.1686747	50	68.75	86.66666667	54.40725402	400.9406907
Epochs 160	0.772946835	0	0	90.90909091	44.44444444	25	82.38636364	-25.81984127	2068.314051	0.774038434	8	8.333333333	92.39766082	44	66.66666667	87.64705882	49.42500687	400.9406907
Epochs 180	0.792270541	0	8.333333333	91.57303371	50	33.33333333	83.14606742	-34.45196029	2068.314051	0.793269217	9.523809524	8.333333333	92.57142857	47.61904762	75	87.35632184	51.72829009	400.9406907

Epochs 200	0.801932395	0	10	91.66666667	43.75	30	83.33333333	-19.4324759	2068.314051	0.8125	9.523809524	12.5	92.73743017	47.61904762	75	87.07865169	21.1546561	400.9406907
Wuliangye Yibin Co.,Ltd	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.318840593	5.128205128	0	88.23529412	45.68965517	50	80.88235294	883.126452	2331.201715	0.543269217	10.81081081	10.34482759	97.14285714	48.64864865	46.42857143	91.42857143	311.2335386	604.1107527
Epochs 40	0.400966197	9.375	4.761904762	92.5	50	50	80	844.1122921	2331.201715	0.3125	13.1147541	4.444444444	92.98245614	59.01639344	53.93258427	87.71929825	140.3463838	604.1107527
Epochs 60	0.487922698	6	3.921568627	90.56603774	48	48	82.0754717	309.5017122	2331.201715	0.403846145	13.95348837	4.761904762	91.35802469	65.11627907	55.42168675	83.95061728	346.7423219	604.1107527
Epochs 80	0.531400979	5.660377358	5.128205128	91.30434783	49.05660377	52.63157895	83.47826087	455.1907808	2331.201715	0.480769217	15	4.347826087	91.91919192	65	60.29411765	85.85858586	337.908744	604.1107527
Epochs 100	0.584541082	5.128205128	5.128205128	90.69767442	48.71794872	50	83.72093023	70.85012582	2331.201715	0.548076928	14.28571429	4.6875	92.24137931	60.71428571	55.55555556	87.06896552	255.9058748	604.1107527
Epochs 120	0.681159437	4.761904762	3.125	90.25974026	52.38095238	48.38709677	83.11688312	91.34925384	2331.201715	0.653846145	20	5.769230769	92.19858156	66.66666667	52.94117647	87.94326241	76.19256838	604.1107527
Epochs 140	0.739130437	6.666666667	3.846153846	90.96385542	53.33333333	48	83.73493976	64.55315351	2331.201715	0.721153855	22.22222222	5	91.82389937	77.77777778	55	87.97468354	84.97039488	604.1107527
Epochs 160	0.763285041	6.25	5	91.22807018	56.25	45	83.52941176	58.83018052	2331.201715	0.759615362	28.57142857	5.882352941	92.21556886	71.42857143	55.88235294	87.34939759	49.6821444	604.1107527
Epochs 180	0.753623188	0	4.166666667	90.64327485	50	41.66666667	82.94117647	14.97787349	2331.201715	0.764423072	20	5.882352941	92.30769231	60	55.88235294	87.5	18.15662746	604.1107527
Epochs 200	0.787439585	0	0	90.05524862	50	50	82.77777778	45.07077457	2331.201715	0.788461566	20	3.846153846	91.52542373	40	53.84615385	86.93181818	13.50450628	604.1107527
Kweichow Moutai Co., Ltd	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.507246375	9.89010989	13.33333333	93.06930693	50	46.66666667	90.0990099	1619.797437	1666.892281	0.524038434	8.974358974	0	92.72727273	43.58974359	50	86.23853211	252.4984421	678.7940879
Epochs 40	0.439613521	15.51724138	7.8125	90.58823529	58.62068966	50.79365079	84.70588235	3440.368675	1666.892281	0.355769217	12.96296296	6.741573034	93.84615385	59.25925926	50	90.76923077	232.9211664	678.7940879
Epochs 60	0.516908228	11.36363636	10.71428571	89.71962617	56.81818182	54.54545455	84.11214953	3030.218276	1666.892281	0.408653855	10.86956522	7.317073171	92.5	63.04347826	51.85185185	86.25	244.1038764	678.7940879
Epochs 80	0.584541082	10.52631579	11.36363636	89.6	60.52631579	55.81395349	84.8	20183.22148	1666.892281	0.480769217	10.25641026	5.882352941	91.08910891	66.66666667	49.25373134	86.13861386	25.10558129	678.7940879
Epochs 100	0.628019333	7.407407407	11.9047619	89.13043478	55.55555556	58.53658537	84.7826087	6269.326072	1666.892281	0.552884638	15.38461538	4.6875	91.52542373	73.07692308	44.44444444	87.28813559	51.44251513	678.7940879
Epochs 120	0.705313981	5.882352941	14.70588235	89.74358974	64.70588235	58.82352941	85.80645161	7484.472197	1666.892281	0.649038434	16.66666667	5.555555556	91.54929577	83.33333333	42.59259259	87.23404255	1126.838806	678.7940879
Epochs 140	0.743961334	0	17.24137931	89.75903614	66.66666667	65.51724138	86.06060606	4837.53244	1666.892281	0.764423072	16.66666667	8.823529412	92.26190476	100	50	88.0239521	117.9287836	678.7940879
Epochs 160	0.763285041	0	20.83333333	90	69.23076923	62.5	86.39053254	4657.54588	1666.892281	0.769230783	0	3.703703704	90.34090909	100	40.74074074	85.14285714	133.5153849	678.7940879
Epochs 180	0.763285041	0	20	90	66.66666667	64	86.39053254	2244.401786	1666.892281	0.774038434	0	3.846153846	90.39548023	100	42.30769231	85.22727273	106.2606738	678.7940879
Epochs 200	0.801932395	12.5	15.78947368	90	62.5	57.89473684	85.47486034	2071.813955	1666.892281	0.802884638	0	4.761904762	90.71038251	100	47.61904762	85.71428571	72.51616914	678.7940879

Table 17-6 LSTM Models Results for Variation 6

First BanCorp LSTM Model																		
First BanCorp	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.412844032	4.285714286	5.769230769	87.5	51.42857143	39.21568627	80.20833333	-95.00341343	-15.16491294	0.429223746	9.090909091	9.615384615	91.11111111	50.64935065	60.78431373	85.55555556	309.9576671	-8.209536376
Epochs 40	0.422018349	6.12244898	6.666666667	89.36170213	57.14285714	43.24324324	80.85106383	-94.9367485	-15.16491294	0.420091331	12.5	8	89.77272727	55.35714286	54.05405405	85.22727273	152.1428646	-8.209536376
Epochs 60	0.610091746	6.25	8.695652174	90.71428571	62.5	43.47826087	84.17266187	-68.14838051	-15.16491294	0.579908669	16.21621622	9.090909091	91.33858268	54.05405405	63.63636364	84.12698413	167.228082	-8.209536376
Epochs 80	0.720183492	4.166666667	12	90.53254438	70.83333333	44	83.92857143	-22.07780466	-15.16491294	0.698630154	20.83333333	8.333333333	91.19496855	58.33333333	75	83.5443038	261.6229838	-8.209536376
Epochs 100	0.761467874	4.166666667	18.75	91.01123596	70.83333333	43.75	82.48587571	14.7296093	-15.16491294	0.726027369	18.18181818	7.142857143	90.53254438	54.54545455	71.42857143	83.33333333	41.88659886	-8.209536376
Epochs 120	0.770642221	0	20	90.2173913	70.83333333	40	82.5136612	9.211860929	-15.16491294	0.739726007	16.66666667	4.761904762	90.22988506	50	61.9047619	83.8150289	49.60735209	-8.209536376
Epochs 140	0.798165143	5	20	90.95744681	70	40	82.88770053	9.211860929	-15.16491294	0.762557089	16.66666667	5	90.05524862	44.44444444	60	83.88888889	-22.84269602	-8.209536376
Epochs 160	0.802752316	0	25	90.57591623	78.94736842	50	82.63157895	75.92725278	-15.16491294	0.776255727	5.555555556	7.692307692	89.36170213	38.88888889	53.84615385	83.42245989	-49.12633465	-8.209536376
Epochs 180	0.80733943	0	10	90.20618557	64.28571429	50	82.9015544	-17.36882356	-15.16491294	0.785388112	0	7.692307692	89.0625	35.71428571	61.53846154	83.2460733	-2.778290223	-8.209536376
Epochs 200	0.802752316	0	9.090909091	90.15544041	71.42857143	54.54545455	82.29166667	25.1075008	-15.16491294	0.808219194	8.333333333	8.333333333	89.74358974	50	58.33333333	83.50515464	40.40091514	-8.209536376
American Financial Group, Inc	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.284403682	8	5.952380952	86.44067797	55.40540541	44.04761905	83.05084746	393.156352	566.6403159	0.401826471	6.41025641	13.1147541	93.75	44.15584416	52.45901639	88.75	25.73447044	-42.76165206
Epochs 40	0.32110092	5.555555556	8.163265306	89.39393939	57.40740741	42.85714286	84.61538462	1013.170026	566.6403159	0.415525109	1.923076923	10.66666667	89.13043478	45.09803922	56	86.95652174	104.7053912	-42.76165206
Epochs 60	0.504587173	9.375	9.210526316	90.90909091	62.5	51.31578947	83.48623853	640.3942191	566.6403159	0.561643839	0	12.96296296	89.92248062	37.14285714	55.55555556	85.27131783	66.24553653	-42.76165206
Epochs 80	0.651376128	9.523809524	11.76470588	91.78082192	57.14285714	54.90196078	85.51724138	226.7403751	566.6403159	0.657534242	0	15	90.78947368	38.46153846	60	86.18421053	40.63261936	-42.76165206
Epochs 100	0.683486223	10.52631579	7.5	90.56603774	63.15789474	52.5	84.81012658	83.52660008	566.6403159	0.698630154	0	16.66666667	90.79754601	44	70	85.88957055	223.5912964	-42.76165206
Epochs 120	0.733944952	10	0	89.26553672	60	57.14285714	83.52272727	116.3513307	566.6403159	0.730593622	0	20	91.17647059	41.66666667	68	85.79881657	81.2977761	-42.76165206
Epochs 140	0.775229335	10.52631579	0	89.78494624	57.89473684	46.15384615	84.86486486	111.9108923	566.6403159	0.767123282	0	16.66666667	90.65934066	42.10526316	61.11111111	84.53038674	374.1871641	-42.76165206
Epochs 160	0.770642221	5.882352941	0	89.30481283	52.94117647	42.85714286	84.40860215	-29.33892031	566.6403159	0.767123282	0	13.33333333	89.72972973	36.84210526	66.66666667	83.69565217	125.0099025	-42.76165206
Epochs 180	0.761467874	5.555555556	0	89.18918919	44.44444444	53.33333333	83.69565217	-26.39303311	566.6403159	0.785388112	0	7.142857143	89.52879581	35.71428571	64.28571429	83.15789474	109.959346	-42.76165206
Epochs 200	0.766055048	7.142857143	0	89.24731183	50	61.11111111	83.78378378	0.13014574	566.6403159	0.794520557	0	8.333333333	89.6373057	35.71428571	58.33333333	82.8125	109.0531781	-42.76165206
JPMorgan Chase & Co	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.380733937	12.06896552	2.5	92.5	56.89655172	41.7721519	85	3867.030953	1576.179166	0.401826471	7.142857143	6.557377049	89.77272727	45.71428571	47.54098361	81.6091954	-28.79359976	-31.90034799
Epochs 40	0.298165143	9.615384615	2.884615385	91.93548387	50	43.68932039	83.87096774	4938.407766	1576.179166	0.429223746	8	8	89.36170213	48	46.66666667	80.64516129	-13.17167318	-31.90034799

Epochs 60	0.440366983	8.333333333	3.703703704	89.10891089	52.77777778	49.38271605	82	3078.965707	1576.179166	0.561643839	8.823529412	7.272727273	89.23076923	58.82352941	49.09090909	80.62015504	-21.05312503	-31.90034799
Epochs 80	0.596330285	9.375	4.081632653	91.24087591	53.125	44.89795918	84.55882353	4961.785027	1576.179166	0.707762539	4.761904762	10	89.88095238	61.9047619	53.33333333	82.03592814	-47.56452338	-31.90034799
Epochs 100	0.669724762	7.692307692	5.405405405	91.61290323	53.84615385	40.54054054	83.76623377	596.8381139	1576.179166	0.753424644	4.761904762	15	90.4494382	61.9047619	55	82.48587571	77.31205585	-31.90034799
Epochs 120	0.747706413	12	4.761904762	92.44186047	56	33.33333333	84.79532164	3055.11369	1576.179166	0.757990897	5	10.52631579	90.55555556	45	42.10526316	81.56424581	-35.35000528	-31.90034799
Epochs 140	0.802752316	14.28571429	7.692307692	92.93478261	61.9047619	30.76923077	85.79234973	3236.810982	1576.179166	0.785388112	0	6.666666667	89.52879581	53.84615385	46.66666667	81.05263158	49.8126482	-31.90034799
Epochs 160	0.821100891	15	10	93.08510638	60	50	86.09625668	3462.741732	1576.179166	0.771689475	0	0	88.94736842	46.15384615	43.75	80.42328042	106.5728684	-31.90034799
Epochs 180	0.834862411	11.76470588	12.5	92.74611399	52.94117647	50	85.9375	6142.242805	1576.179166	0.780821919	0	0	89.0625	50	46.66666667	80.62827225	114.6776162	-31.90034799
Epochs 200	0.844036698	13.33333333	12.5	92.82051282	53.33333333	37.5	86.08247423	4968.852406	1576.179166	0.812785387	0	0	89.44723618	37.5	41.66666667	81.31313131	-48.57016864	-31.90034799
American Financial Group, Inc LSTM Model																		
First BanCorp	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.311926603	5.084745763	8.823529412	89.39393939	48.30508475	52.94117647	76.92307692	-76.6117864	-15.16491294	0.397260278	7.142857143	13.63636364	89.41176471	48.21428571	63.63636364	83.33333333	151.1712883	-8.209536376
Epochs 40	0.348623842	3.797468354	8.064516129	88.31168831	50.63291139	48.38709677	78.94736842	-82.50429394	-15.16491294	0.442922384	8.75	9.302325581	89.58333333	53.75	54.76190476	84.375	-30.82001465	-8.209536376
Epochs 60	0.477064222	4.838709677	8.510638298	88.99082569	50	53.19148936	80.55555556	-72.64619365	-15.16491294	0.598173499	10	12.5	90.37037037	55	62.5	84.32835821	-46.07071436	-8.209536376
Epochs 80	0.504587173	5.882352941	6	88.88888889	52.94117647	46.93877551	82.05128205	-59.16069503	-15.16491294	0.648401797	8.695652174	9.523809524	89.47368421	54.34782609	66.66666667	83.44370861	-41.92629953	-8.209536376
Epochs 100	0.596330285	4.87804878	9.756097561	91.17647059	53.65853659	50	84.55882353	-94.60822561	-15.16491294	0.694063902	5.128205128	14.28571429	89.15662651	51.28205128	71.42857143	83.63636364	-44.22618476	-8.209536376
Epochs 120	0.665137589	6.060606061	9.375	91.50326797	51.51515152	43.75	84.86842105	-94.04834395	-15.16491294	0.730593622	6.451612903	8.333333333	89.20454545	58.06451613	66.66666667	84	-55.11687683	-8.209536376
Epochs 140	0.660550475	6.25	8.823529412	91.44736842	50	36.36363636	84.86842105	-93.66889268	-15.16491294	0.735159814	4	6.666666667	88.82681564	60	66.66666667	83.14606742	-46.62828437	-8.209536376
Epochs 160	0.724770665	8	14.28571429	92.12121212	52	39.28571429	85.36585366	-5.735733388	-15.16491294	0.748858452	0	6.666666667	89.07103825	61.9047619	60	82.96703297	-66.85774015	-8.209536376
Epochs 180	0.747706413	9.523809524	12	91.86046512	52.38095238	44	84.79532164	87.52458367	-15.16491294	0.780821919	0	0	89.0625	68.75	54.54545455	83.2460733	-66.01331181	-8.209536376
Epochs 200	0.75688076	6.25	8.333333333	91.01123596	43.75	41.66666667	83.61581921	190.1437083	-15.16491294	0.789954364	0	0	88.71794872	69.23076923	54.54545455	82.98969072	-64.68217382	-8.209536376
American Financial Group, Inc	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.298165143	7.070707071	6.779661017	90	52.04081633	42.37288136	83.33333333	100.5918826	566.6403159	0.374429226	6.481481481	12.12121212	91.02564103	45.79439252	63.63636364	84.61538462	-30.91296382	-42.76165206
Epochs 40	0.298165143	5.555555556	3.896103896	84.05797101	50.70422535	44.15584416	79.71014493	-0.556949498	566.6403159	0.465753436	8.695652174	11.53846154	91.83673469	52.94117647	63.46153846	85.71428571	40.0858304	-42.76165206
Epochs 60	0.431192666	3.174603175	5.555555556	88.11881188	50	40.74074074	84.15841584	-21.78584276	566.6403159	0.534246564	7.936507937	13.51351351	89.91596639	43.5483871	62.16216216	84.03361345	17.54102043	-42.76165206
Epochs 80	0.472477078	0	3.703703704	87.82608696	43.75	37.03703704	81.73913043	-72.03861538	566.6403159	0.547945201	6.666666667	14.28571429	89.51612903	47.45762712	65.71428571	82.25806452	-62.34747686	-42.76165206
Epochs 100	0.555045843	0	4.444444444	87.5	38.88888889	44.44444444	81.61764706	98.65248071	566.6403159	0.639269412	7.142857143	13.79310345	89.86486486	43.90243902	58.62068966	83.78378378	14.77081236	-42.76165206
Epochs 120	0.633027494	0	6.451612903	88.88888889	42.42424242	41.93548387	82.35294118	145.1958224	566.6403159	0.689497709	6.060606061	13.04347826	89.57055215	39.39393939	65.2173913	82.71604938	-42.83400591	-42.76165206

Epochs 140	0.642201841	3.225806452	8.333333333	90.06622517	43.33333333	41.66666667	83.44370861	218.9750189	566.6403159	0.684931517	6.666666667	8	89.02439024	40	60	82.20858896	-43.3608755	-42.76165206
Epochs 160	0.688073397	3.846153846	6.896551724	90.18404908	48	41.37931034	82.20858896	124.731589	566.6403159	0.721461177	5	4.347826087	88.63636364	30	65.2173913	82.28571429	-22.99137852	-42.76165206
Epochs 180	0.706422031	4.545454545	3.703703704	89.9408284	42.85714286	37.03703704	82.24852071	117.129786	566.6403159	0.757990897	5.882352941	10	89.56043956	29.41176471	70	82.32044199	19.14249428	-42.76165206
Epochs 200	0.729357779	6.25	3.571428571	90.22988506	40	39.28571429	82.75862069	99.36890643	566.6403159	0.780821919	10	9.090909091	89.83957219	40	63.63636364	82.25806452	-4.493660257	-42.76165206
JPMorgan Chase & Co	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.399082571	8.641975309	3.703703704	93.97590361	43.20987654	35.18518519	86.58536585	150.9567786	1576.179166	0.378995448	6.956521739	15.38461538	91.02564103	47.36842105	61.53846154	83.33333333	55.10059353	-31.90034799
Epochs 40	0.348623842	9.375	2.564102564	89.47368421	48.4375	49.35064935	82.89473684	51.49783455	1576.179166	0.392694056	8.24742268	13.33333333	93.50649351	48.95833333	51.11111111	85.71428571	46.37807493	-31.90034799
Epochs 60	0.509174287	11.9047619	1.639344262	91.30434783	50	53.33333333	86.08695652	535.9660553	1576.179166	0.442922384	8.602150538	13.88888889	93.33333333	47.82608696	58.33333333	84.44444444	103.3662478	-31.90034799
Epochs 80	0.541284382	13.95348837	1.818181818	92.5	51.1627907	50	89.16666667	535.9660553	1576.179166	0.534246564	10.38961039	13.79310345	92.92035398	48.68421053	65.51724138	84.07079646	-5.207926036	-31.90034799
Epochs 100	0.600917459	12.5	2.040816327	91.97080292	46.875	46.93877551	88.97058824	1021.473348	1576.179166	0.552511394	7.042253521	9.523809524	89.76377953	48.57142857	57.14285714	81.88976378	34.58846881	-31.90034799
Epochs 120	0.683486223	16	0	92.3566879	48	44.44444444	87.17948718	1513.090983	1576.179166	0.602739751	7.692307692	7.692307692	89.36170213	50	61.53846154	82.26950355	-48.07466787	-31.90034799
Epochs 140	0.669724762	17.39130435	0	91.61290323	52.17391304	43.58974359	87.09677419	1289.416973	1576.179166	0.616438329	6.779661017	7.142857143	89.04109589	48.27586207	42.85714286	81.50684932	-63.04164471	-31.90034799
Epochs 160	0.720183492	17.64705882	0	91.66666667	41.17647059	39.39393939	86.82634731	112.8123758	1576.179166	0.689497709	7.317073171	12.5	90.12345679	39.02439024	56.25	83.22981366	-61.2631152	-31.90034799
Epochs 180	0.747706413	18.75	0	91.95402299	37.5	46.42857143	86.70520231	64.27560658	1576.179166	0.698630154	7.5	7.692307692	89.75903614	37.5	53.84615385	83.03030303	-65.74651852	-31.90034799
Epochs 200	0.75688076	20	0	91.57303371	30	51.72413793	87.64044944	16.84178681	1576.179166	0.730593622	6.451612903	7.692307692	89.71428571	38.70967742	61.53846154	82.75862069	-29.79661689	-31.90034799
JPMorgan Chase & Co LSTM Model																		
First BanCorp	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.353211015	7.52688172	7.547169811	91.66666667	50.53763441	46.15384615	84.72222222	-92.81962122	-15.16491294	0.378995448	6.666666667	8.196721311	87.95180723	45.33333333	60.6557377	81.70731707	-38.32542577	-8.209536376
Epochs 40	0.403669715	7.228915663	12.72727273	93.75	54.21686747	51.85185185	86.25	-97.4591309	-15.16491294	0.415525109	8.333333333	9.722222222	90.8045977	51.66666667	54.92957746	87.35632184	6.624578089	-8.209536376
Epochs 60	0.467889905	8.219178082	10.86956522	91.91919192	50.68493151	44.44444444	83.83838384	-77.76673111	-15.16491294	0.557077646	9.090909091	10	90.4	52.27272727	57.14285714	83.2	5.161666162	-8.209536376
Epochs 80	0.509174287	7.246376812	10.81081081	91.07142857	49.27536232	45.94594595	84.68468468	-52.07325375	-15.16491294	0.625570774	9.523809524	11.76470588	90.20979021	52.38095238	52.94117647	83.09859155	-9.80727219	-8.209536376
Epochs 100	0.614678919	9.090909091	14.28571429	92.59259259	50.90909091	39.28571429	85.07462687	-75.47392388	-15.16491294	0.666666687	7.894736842	14.81481481	90.25974026	60.52631579	66.66666667	83.66013072	18.5495866	-8.209536376
Epochs 120	0.660550475	11.11111111	14.28571429	93.10344828	48.88888889	42.85714286	85.41666667	-70.71769085	-15.16491294	0.698630154	9.677419355	14.81481481	90.68322981	54.83870968	74.07407407	85	-18.58653974	-8.209536376
Epochs 140	0.646789014	10.41666667	13.79310345	93.61702128	45.83333333	44.82758621	85.71428571	-61.68039178	-15.16491294	0.716894984	9.677419355	13.63636364	90.96385542	58.06451613	68.18181818	84.84848485	5.176326029	-8.209536376
Epochs 160	0.715596318	13.15789474	20	94.19354839	47.36842105	48	87.01298701	-56.53960543	-15.16491294	0.748858452	7.407407407	14.28571429	89.88764045	55.55555556	78.57142857	84.18079096	-47.0210041	-8.209536376
Epochs 180	0.75688076	16.66666667	15	93.45238095	43.33333333	40	86.22754491	-52.50257519	-15.16491294	0.785388112	5	18.18181818	89.89361702	60	72.72727273	83.42245989	-49.95919067	-8.209536376
Epochs 200	0.75688076	16.66666667	15.78947368	92.89940828	53.33333333	36.84210526	85.71428571	-49.26358728	-15.16491294	0.808219194	6.25	12.5	89.74358974	62.5	75	83.50515464	-52.18786368	-8.209536376

American Financial Group, Inc	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.275229365	8.219178082	7.368421053	94	52.05479452	44.68085106	92	302.3785006	566.6403159	0.356164396	6.097560976	10.9375	90.4109589	48.14814815	51.5625	86.30136986	-16.08980305	-42.76165206
Epochs 40	0.311926603	6.756756757	8.43373494	91.80327869	55.40540541	47.56097561	81.96721311	181.3290543	566.6403159	0.378995448	7.594936709	11.29032258	89.74358974	51.28205128	61.29032258	85.8974359	33.58265536	-42.76165206
Epochs 60	0.394495428	8.474576271	8.974358974	91.35802469	53.44827586	46.15384615	82.71604938	587.120459	566.6403159	0.456620991	7.246376812	13.20754717	90.72164948	57.35294118	60.37735849	87.62886598	-7.302360694	-42.76165206
Epochs 80	0.463302761	7.142857143	9.677419355	91	54.54545455	46.77419355	82	1038.619995	566.6403159	0.557077646	8.333333333	15.78947368	91.73553719	55.93220339	60.52631579	85.12396694	19.9577578	-42.76165206
Epochs 100	0.541284382	8.695652174	9.615384615	90.83333333	53.33333333	42.30769231	80.83333333	1947.536224	566.6403159	0.616438329	9.803921569	8	89.51048951	54	56	83.21678322	4.928942719	-42.76165206
Epochs 120	0.596330285	13.15789474	8.333333333	91.66666667	56.75675676	43.75	82.57575758	1378.844438	566.6403159	0.662100434	9.523809524	12.5	90.19607843	51.2195122	50	83.66013072	-23.10451335	-42.76165206
Epochs 140	0.623853207	10	8.571428571	90.20979021	58.97435897	42.85714286	81.81818182	798.0059777	566.6403159	0.684931517	9.090909091	13.33333333	90	51.1627907	33.33333333	82.5	-53.76077673	-42.76165206
Epochs 160	0.651376128	11.11111111	9.090909091	90.60402685	65.71428571	42.42424242	82.55033557	623.3171045	566.6403159	0.721461177	10.81081081	14.28571429	90.47619048	54.05405405	42.85714286	83.83233533	-42.8902379	-42.76165206
Epochs 180	0.678899109	6.896551724	10	89.93710692	64.28571429	40	81.76100629	687.2699388	566.6403159	0.757990897	13.33333333	9.090909091	90.4494382	46.66666667	27.27272727	83.05084746	-65.70502672	-42.76165206
Epochs 200	0.706422031	4	8.333333333	89.34911243	58.33333333	41.66666667	81.65680473	110.8855509	566.6403159	0.780821919	11.11111111	14.28571429	90.27027027	46.15384615	42.85714286	83.24324324	-65.67875291	-42.76165206
JPMorgan Chase & Co	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.298165143	13.1147541	4.854368932	96.2962963	55.73770492	46.07843137	92.59259259	9633.334812	1576.179166	0.415525109	11.29032258	8.219178082	92.85714286	46.77419355	57.53424658	83.13253012	7.644792193	-31.90034799
Epochs 40	0.252293587	10	4.854368932	95.55555556	52.85714286	48.03921569	86.66666667	1925.577795	1576.179166	0.301369876	8.988764045	7.142857143	88.33333333	48.31460674	52.85714286	74.57627119	-81.99366368	-31.90034799
Epochs 60	0.380733937	8.474576271	5.063291139	92.5	52.54237288	50	85	3197.336952	1576.179166	0.415525109	5.479452055	11.32075472	87.09677419	50.68493151	50.94339623	75	-73.42982576	-31.90034799
Epochs 80	0.417431206	8.474576271	4.347826087	92.22222222	47.45762712	50	81.11111111	3907.903264	1576.179166	0.488584489	5.882352941	14.28571429	88.99082569	50	59.52380952	78.7037037	-43.21969761	-31.90034799
Epochs 100	0.518348634	8.510638298	5.357142857	92.17391304	46.80851064	49.09090909	82.60869565	5032.742922	1576.179166	0.570776284	7.272727273	14.28571429	89.92248062	52.72727273	62.85714286	80.46875	-37.95412573	-31.90034799
Epochs 120	0.577981651	12.5	5.172413793	92.96875	46.875	52.63157895	84.375	5484.868906	1576.179166	0.621004581	6.818181818	15.15151515	90.14084507	56.81818182	66.66666667	82.9787234	9.614999106	-31.90034799
Epochs 140	0.605504572	12.5	5.882352941	92.59259259	50	50	85.92592593	5895.320012	1576.179166	0.579908669	5.357142857	8	88.4057971	50	60	81.02189781	-13.56598518	-31.90034799
Epochs 160	0.651376128	13.33333333	4.87804878	92.5170068	56.66666667	50	85.71428571	10367.94822	1576.179166	0.643835604	6.976744186	4.545454545	88.96103896	51.1627907	54.54545455	82.35294118	-1.028331291	-31.90034799
Epochs 180	0.711009145	19.04761905	5.405405405	93.125	61.9047619	50	86.25	12967.94645	1576.179166	0.689497709	8.108108108	5.555555556	89.63414634	56.75675676	50	80.98159509	-47.76258002	-31.90034799
Epochs 200	0.75688076	22.72727273	7.142857143	94.04761905	59.09090909	55.55555556	86.9047619	16583.95887	1576.179166	0.707762539	6.25	6.25	88.88888889	59.375	56.25	81.17647059	-30.35028834	-31.90034799

Table 17-7 LSTM Models Results for Variation 6

Vaxart, Inc LSTM Model																		
Vaxart, Inc	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.37155962	5.208333333	2.380952381	93.75	47.36842105	47.61904762	76.25	-89.47913606	-97.40654205	0.251141548	6.481481481	7.575757576	95.55555556	42.05607477	48.48484848	86.66666667	138.0580726	3138.165411
Epochs 40	0.596330285	7.317073171	2.43902439	92.64705882	52.5	63.41463415	76.47058824	-54.23414045	-97.40654205	0.452054799	8.333333333	5.333333333	94.79166667	48.93617021	45.33333333	86.45833333	43.32762494	3138.165411
Epochs 60	0.646789014	8.888888889	3.448275862	94.44444444	57.77777778	72.4137931	78.32167832	69.38913527	-97.40654205	0.461187214	7.843137255	5.633802817	95.87628866	46	47.88732394	87.62886598	91.68475813	3138.165411
Epochs 80	0.729357779	8.571428571	5.555555556	93.93939394	51.42857143	72.22222222	73.7804878	-65.39782598	-97.40654205	0.493150681	8.333333333	6.060606061	95.23809524	44.68085106	45.45454545	85.71428571	75.14415261	3138.165411
Epochs 100	0.738532126	7.894736842	7.142857143	94.57831325	50	64.28571429	73.93939394	-80.75584048	-97.40654205	0.525114179	9.090909091	6.349206349	95.53571429	46.51162791	44.44444444	85.71428571	72.04443853	3138.165411
Epochs 120	0.779816508	7.692307692	0	93.33333333	50	58.33333333	72.06703911	-87.72706912	-97.40654205	0.575342476	8.333333333	3.703703704	93.79844961	48.57142857	40.74074074	83.72093023	-20.36320089	3138.165411
Epochs 140	0.788990855	8.695652174	0	93.40659341	47.82608696	53.84615385	72.37569061	-91.76142823	-97.40654205	0.639269412	10.34482759	2.222222222	93.79310345	53.57142857	42.22222222	84.82758621	-63.61834494	3138.165411
Epochs 160	0.816513777	11.11111111	0	93.61702128	55.55555556	50	72.72727273	-89.82289875	-97.40654205	0.671232879	12	2.43902439	93.46405229	50	41.46341463	84.31372549	-43.1386414	3138.165411
Epochs 180	0.825688064	11.11111111	0	93.68421053	55.55555556	60	73.01587302	-91.11433724	-97.40654205	0.730593622	11.11111111	3.125	92.89940828	64.70588235	43.75	83.43195266	309.7687474	3138.165411
Epochs 200	0.821100891	12.5	0	93.15789474	62.5	58.33333333	73.01587302	-87.71037348	-97.40654205	0.753424644	13.33333333	3.333333333	93.10344828	71.42857143	40	83.90804598	714.8587102	3138.165411
Inovio Pharmaceuticals, Inc.	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.293577969	6.422018349	6	91.52542373	46.2962963	56	86.44067797	-79.39172112	-73.87057277	0.342465758	6	10.41666667	90.14084507	49	52.08333333	85.71428571	3667.448848	2086.781994
Epochs 40	0.463302761	5.263157895	7.142857143	89.52380952	50.87719298	58.92857143	77.88461538	-42.97430756	-73.87057277	0.493150681	10.20408163	8.955223881	94.17475728	53.06122449	50.74626866	88.23529412	191.2971261	2086.781994
Epochs 60	0.522935808	10.34482759	8.510638298	92.03539823	54.38596491	57.44680851	81.4159292	-43.65117175	-73.87057277	0.529680371	10.41666667	10	94.59459459	52.08333333	53.33333333	89.09090909	213.642068	2086.781994
Epochs 80	0.587155938	9.302325581	7.142857143	90.97744361	61.9047619	54.76190476	80.45112782	-71.55508314	-73.87057277	0.575342476	11.62790698	4.255319149	92.24806202	53.48837209	53.19148936	85.9375	31.33534957	2086.781994
Epochs 100	0.596330285	9.090909091	11.62790698	92.36641221	62.79069767	60.46511628	82.44274809	52.41434689	-73.87057277	0.602739751	17.64705882	5.555555556	93.89312977	58.82352941	53.7037037	87.69230769	186.7675133	2086.781994
Epochs 120	0.655963302	5.714285714	6.666666667	90.8496732	61.76470588	66.66666667	81.69934641	136.3461593	-73.87057277	0.694063902	21.05263158	2.43902439	92.45283019	63.15789474	56.09756098	86.70886076	171.9380387	2086.781994
Epochs 140	0.701834857	3.448275862	12	90.85365854	64.28571429	68	81.09756098	1599.184449	-73.87057277	0.730593622	21.42857143	2.702702703	92.85714286	57.14285714	51.35135135	86.82634731	6.624335321	2086.781994
Epochs 160	0.74311924	0	13.63636364	90.85714286	61.9047619	68.18181818	81.03448276	1332.252967	-73.87057277	0.767123282	25	3.03030303	92.69662921	62.5	54.54545455	87.00564972	97.40605796	2086.781994
Epochs 180	0.798165143	0	7.692307692	90.57591623	64.28571429	61.53846154	80	216.072802	-73.87057277	0.803652942	22.22222222	0	92.06349206	66.66666667	61.9047619	86.70212766	79.03249523	2086.781994
Epochs 200	0.793577969	0	0	90.10416667	58.33333333	64.28571429	80.10471204	280.1160184	-73.87057277	0.803652942	22.22222222	0	91.57894737	77.77777778	55	85.71428571	24.09580265	2086.781994
Novavax, Inc	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.316513747	6.086956522	4.87804878	96.77419355	42.60869565	53.65853659	88.52459016	-52.53667521	-97.62028238	0.246575341	4.819277108	6.818181818	91.66666667	40.96385542	42.52873563	85.41666667	82.03269353	5802.379195
Epochs 40	0.490825683	4	8.571428571	93.51851852	48	57.14285714	83.17757009	-90.34773216	-97.62028238	0.342465758	6.52173913	5.208333333	87.01298701	50	43.15789474	80.51948052	25.25511101	5802.379195

Epochs 60	0.522935808	3.896103896	12	93.10344828	49.35064935	60	83.47826087	-75.28005336	-97.62028238	0.378995448	7.142857143	4.347826087	89.41176471	52.38095238	39.56043956	81.17647059	2.671008562	5802.379195
Epochs 80	0.573394477	4.545454545	5.263157895	90.97744361	45.45454545	47.36842105	81.81818182	-81.96640486	-97.62028238	0.406392694	4.545454545	4.87804878	89.24731183	52.27272727	41.46341463	81.52173913	170.7794276	5802.379195
Epochs 100	0.527522922	5.479452055	4.166666667	90.90909091	50.68493151	50	83.33333333	-76.52871474	-97.62028238	0.465753436	7.317073171	5.479452055	90.47619048	48.7804878	40.27777778	84.76190476	371.201618	5802.379195
Epochs 120	0.614678919	7.272727273	11.53846154	92.70072993	50.90909091	53.84615385	84.55882353	-89.35740469	-97.62028238	0.557077646	6.060606061	6.779661017	91.33858268	45.45454545	39.65517241	85.03937008	161.7027372	5802.379195
Epochs 140	0.651376128	6.382978723	5	91.39072848	57.44680851	50	82	-91.87344045	-97.62028238	0.643835604	7.142857143	4.761904762	91.94630872	42.85714286	42.85714286	85.13513514	81.61217801	5802.379195
Epochs 160	0.697247684	8.333333333	4.761904762	91.92546584	61.11111111	47.61904762	83.75	-95.94103257	-97.62028238	0.680365324	9.523809524	0	90.74074074	38.0952381	38.88888889	84.47204969	122.6945134	5802.379195
Epochs 180	0.733944952	8.571428571	7.142857143	92.30769231	62.85714286	42.85714286	83.92857143	-97.06306799	-97.62028238	0.726027369	10	0	91.27906977	40	40.74074074	84.79532164	163.1295004	5802.379195
Epochs 200	0.75688076	9.090909091	9.090909091	92.52873563	66.66666667	36.36363636	83.8150289	-95.67547323	-97.62028238	0.767123282	13.33333333	0	91.71270718	40	34.7826087	85.55555556	67.32663057	5802.379195

Inovio Pharmaceuticals, Inc. LSTM Model

Vaxart, Inc	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.412844032	7.142857143	5.479452055	92.13483146	41.07142857	63.01369863	76.13636364	36.54969001	-97.40654205	0.392694056	5	7.792207792	93.90243902	50	49.35064935	85.18518519	123.2661092	3138.165411
Epochs 40	0.444954127	5.633802817	4.347826087	90.0990099	38.02816901	63.04347826	69	-88.90482313	-97.40654205	0.410958916	5	8.333333333	93.10344828	36.66666667	44.44444444	86.04651163	-14.64905732	3138.165411
Epochs 60	0.591743112	5.084745763	8.333333333	91.85185185	35.59322034	62.5	68.65671642	-75.61660073	-97.40654205	0.547945201	6	8.510638298	92.62295082	38	48.93617021	83.47107438	73.01059895	3138.165411
Epochs 80	0.665137589	6.12244898	11.11111111	92.71523179	34.69387755	61.11111111	70	-87.49693217	-97.40654205	0.593607306	7.317073171	4.651162791	92.59259259	41.46341463	46.51162791	82.08955224	-14.79981494	3138.165411
Epochs 100	0.733944952	8.333333333	7.142857143	92.85714286	30.55555556	57.14285714	69.46107784	-88.04761713	-97.40654205	0.671232879	6.896551724	3.03030303	91.71974522	37.93103448	42.42424242	82.05128205	5.633511093	3138.165411
Epochs 120	0.75688076	8.823529412	9.090909091	93.06358382	29.41176471	54.54545455	70.34883721	-81.69186285	-97.40654205	0.721461177	6.451612903	9.090909091	92.77108434	41.93548387	40.90909091	83.03030303	-22.7368905	3138.165411
Epochs 140	0.766055048	6.896551724	8.333333333	92.65536723	34.48275862	50	69.88636364	-84.4580957	-97.40654205	0.771689475	5.882352941	4.761904762	92.26519337	23.52941176	47.61904762	83.88888889	6.792811165	3138.165411
Epochs 160	0.793577969	9.090909091	7.692307692	92.89617486	27.27272727	53.84615385	70.87912088	-76.4807248	-97.40654205	0.771689475	6.666666667	4.347826087	92.26519337	13.33333333	52.17391304	82.77777778	-21.18086655	3138.165411
Epochs 180	0.779816508	8.695652174	6.666666667	92.77777778	30.43478261	60	70.39106145	-76.4807248	-97.40654205	0.780821919	7.142857143	4.545454545	92.34972678	7.142857143	45.45454545	82.96703297	-33.74101675	3138.165411
Epochs 200	0.793577969	10.52631579	6.25	92.89617486	42.10526316	56.25	70.32967033	-73.75297445	-97.40654205	0.785388112	7.692307692	4.545454545	92.39130435	7.692307692	40.90909091	83.06010929	-24.05740149	3138.165411

Inovio Pharmaceuticals, Inc.	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.532110095	6.666666667	7.352941176	90.83333333	46.66666667	54.41176471	78.1512605	-80.66726824	-73.87057277	0.452054799	3.703703704	11.5942029	92.70833333	50	55.07246377	85.26315789	60.81639074	2086.781994
Epochs 40	0.440366983	7.692307692	8.474576271	91.4893617	48.4375	62.71186441	81.91489362	-91.29601611	-73.87057277	0.515981734	9.433962264	5.882352941	91.30434783	56.60377358	43.1372549	85.0877193	171.9114078	2086.781994
Epochs 60	0.541284382	8.620689655	7.692307692	90.90909091	54.38596491	69.23076923	80.16528926	-16.66255795	-73.87057277	0.625570774	7.692307692	5.714285714	91.03448276	51.28205128	31.42857143	86.11111111	15.47102827	2086.781994
Epochs 80	0.619266033	8.695652174	9.090909091	92.08633094	55.55555556	66.66666667	82.01438849	38.69256939	-73.87057277	0.652968049	8.823529412	5.882352941	91.39072848	54.54545455	32.35294118	86.75496689	-12.60824792	2086.781994
Epochs 100	0.729357779	6.451612903	11.11111111	91.71597633	53.33333333	66.66666667	80.47337278	479.7314555	-73.87057277	0.712328792	7.407407407	4.166666667	91.07142857	57.69230769	29.16666667	85.71428571	-57.84829954	2086.781994
Epochs 120	0.761467874	6.896551724	15.38461538	92.04545455	57.14285714	69.23076923	80.68181818	-83.60902953	-73.87057277	0.739726007	8	5	91.37931034	54.16666667	25	86.20689655	-21.86279966	2086.781994

Epochs 140	0.775229335	4.761904762	13.33333333	91.20879121	65	60	80.76923077	-91.14099586	-73.87057277	0.79908675	11.76470588	6.666666667	91.97860963	68.75	33.33333333	87.1657754	70.31147924	2086.781994
Epochs 160	0.816513777	7.692307692	8.333333333	91.19170984	58.33333333	66.66666667	80.82901554	-84.56049928	-73.87057277	0.826484025	16.66666667	7.142857143	92.22797927	72.72727273	28.57142857	87.56476684	-12.65574834	2086.781994
Epochs 180	0.825688064	9.090909091	8.333333333	91.28205128	60	66.66666667	81.02564103	-91.01802152	-73.87057277	0.826484025	15.38461538	7.692307692	92.22797927	66.66666667	23.07692308	87.04663212	-12.65574834	2086.781994
Epochs 200	0.834862411	0	11.11111111	90.95477387	66.66666667	66.66666667	80.90452261	-78.31766034	-73.87057277	0.826484025	16.66666667	7.142857143	92.22797927	63.63636364	28.57142857	86.52849741	4.695980457	2086.781994
Novavax, Inc	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.472477078	7.692307692	8.928571429	95.87628866	43.07692308	57.14285714	86.45833333	282.5771393	-97.62028238	0.506849289	7.692307692	8.43373494	92.72727273	57.69230769	45.12195122	86.36363636	75.57121645	5802.379195
Epochs 40	0.440366983	6.593406593	11.11111111	94.50549451	45.55555556	66.66666667	89.01098901	-77.15779437	-97.62028238	0.456620991	5.769230769	7.462686567	92	53.84615385	53.73134328	85.85858586	360.0580724	5802.379195
Epochs 60	0.559633017	6.944444444	14.81481481	94.95798319	47.88732394	74.07407407	89.07563025	-51.0727281	-97.62028238	0.570776284	5	6.52173913	90.22556391	52.5	47.82608696	81.06060606	328.5068307	5802.379195
Epochs 80	0.610091746	7.936507937	16	95.38461538	45.16129032	76	87.69230769	-64.2121192	-97.62028238	0.652968049	6.451612903	5.714285714	90.8496732	58.06451613	48.57142857	82.89473684	390.1505165	5802.379195
Epochs 100	0.646789014	6.25	8.695652174	92.5170068	42.55319149	73.91304348	84.3537415	-87.58973403	-97.62028238	0.707762539	9.090909091	6.25	91.51515152	50	40.625	84.14634146	66.0994853	5802.379195
Epochs 120	0.651376128	5.882352941	5.882352941	92	38	64.70588235	84	-72.7214444	-97.62028238	0.735159814	9.523809524	4	91.32947977	52.38095238	36	83.72093023	304.4336434	5802.379195
Epochs 140	0.715596318	5.405405405	6.666666667	92.1686747	37.83783784	60	84.24242424	-71.66739796	-97.62028238	0.748858452	6.25	4	91.01123596	56.25	28	83.61581921	22.27203959	5802.379195
Epochs 160	0.738532126	3.225806452	7.692307692	91.37931034	38.70967742	69.23076923	81.50289017	2.840242075	-97.62028238	0.776255727	7.692307692	4.545454545	91.30434783	61.53846154	31.81818182	84.15300546	-7.653496835	5802.379195
Epochs 180	0.747706413	9.375	6.666666667	92.98245614	43.75	60	82.94117647	-69.66100339	-97.62028238	0.762557089	7.692307692	4	91.16022099	61.53846154	36	83.88888889	-10.75637935	5802.379195
Epochs 200	0.784403682	10.34482759	10	93.29608939	41.37931034	70	83.70786517	-36.44047172	-97.62028238	0.771689475	7.142857143	8.333333333	91.71270718	64.28571429	33.33333333	84.44444444	-7.653496835	5802.379195
Novavax, Inc LSTM Model																		
Vaxart, Inc	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.403669715	5.681818182	2.43902439	92.13483146	42.52873563	56.09756098	71.91011236	-80.87791156	-97.40654205	0.365296811	7.594936709	4.6875	93.42105263	49.36708861	45.3125	84	43.85209456	3138.165411
Epochs 40	0.467889905	1.388888889	7.692307692	91.58878505	41.66666667	61.53846154	67.9245283	-57.44517918	-97.40654205	0.461187214	7.936507937	5.263157895	93.93939394	50.79365079	43.85964912	86.73469388	225.4993092	3138.165411
Epochs 60	0.568807364	1.724137931	10	92.30769231	43.10344828	60	71.31782946	-75.22054776	-97.40654205	0.557077646	8	2.325581395	92.85714286	54	40.47619048	86.50793651	1239.625605	3138.165411
Epochs 80	0.646789014	2.222222222	9.090909091	91.39072848	44.44444444	68.18181818	72	-79.97278606	-97.40654205	0.634703219	8.888888889	3.333333333	93.05555556	57.77777778	51.72413793	86.80555556	799.5017315	3138.165411
Epochs 100	0.674311936	0	9.523809524	91.19496855	47.36842105	61.9047619	71.51898734	-85.24575789	-97.40654205	0.675799072	9.756097561	4	93.46405229	56.09756098	41.66666667	85.62091503	230.737887	3138.165411
Epochs 120	0.711009145	0	5.263157895	91.12426036	56.66666667	52.63157895	71.42857143	-53.64781276	-97.40654205	0.680365324	7.894736842	4	92.94871795	52.63157895	41.66666667	84.61538462	179.9242507	3138.165411
Epochs 140	0.75688076	0	6.25	92.13483146	66.66666667	50	73.44632768	-43.50172	-97.40654205	0.716894984	7.142857143	7.407407407	93.29268293	53.57142857	42.30769231	84.75609756	354.64563	3138.165411
Epochs 160	0.788990855	0	8.333333333	92.43243243	71.42857143	50	72.2826087	-53.79665248	-97.40654205	0.744292259	8.333333333	4.545454545	92.48554913	58.33333333	42.85714286	84.39306358	340.5781082	3138.165411
Epochs 180	0.80733943	0	11.11111111	92.59259259	70	55.55555556	71.80851064	-64.13507108	-97.40654205	0.757990897	8.333333333	9.523809524	93.10344828	58.33333333	45	84.48275862	552.4805761	3138.165411
Epochs 200	0.825688064	0	14.28571429	92.74611399	72.22222222	57.14285714	72.39583333	-65.84458801	-97.40654205	0.785388112	5	11.76470588	92.85714286	50	43.75	84.61538462	797.6323111	3138.165411

Inovio Pharmaceuticals, Inc.	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.302752286	5.434782609	6.557377049	87.69230769	46.73913043	52.45901639	73.4375	-11.74598026	-73.87057277	0.474885851	8.196721311	10.34482759	93	48.33333333	44.82758621	89	562.730108	2086.781994
Epochs 40	0.389908254	8.450704225	6.153846154	91.46341463	49.29577465	60.9375	80.48780488	417.0556421	-73.87057277	0.479452044	8	7.8125	91.42857143	56	42.1875	86.53846154	392.7744132	2086.781994
Epochs 60	0.541284382	4.761904762	4.081632653	89.76377953	50	57.14285714	76.19047619	-16.58713611	-73.87057277	0.575342476	5.555555556	4.255319149	89.70588235	50	31.91489362	85.18518519	271.4932465	2086.781994
Epochs 80	0.619266033	10.81081081	5	91.4893617	51.35135135	55	79.28571429	94.29330787	-73.87057277	0.652968049	6.896551724	5.405405405	90.8496732	51.72413793	35.13513514	85.52631579	345.1769445	2086.781994
Epochs 100	0.678899109	10.71428571	5.882352941	91.66666667	46.42857143	52.94117647	79.35483871	-14.04399674	-73.87057277	0.703196347	10.52631579	5.714285714	90.90909091	57.89473684	37.14285714	85.36585366	186.024221	2086.781994
Epochs 120	0.715596318	4.761904762	6.896551724	91.07142857	47.61904762	51.72413793	79.64071856	73.35056349	-73.87057277	0.735159814	0	3.333333333	89.88764045	54.54545455	40	84.18079096	146.1793536	2086.781994
Epochs 140	0.770642221	6.666666667	9.090909091	91.16022099	46.66666667	54.54545455	80	124.0489106	-73.87057277	0.762557089	0	3.571428571	90.2173913	57.14285714	39.28571429	84.69945355	180.6113617	2086.781994
Epochs 160	0.802752316	8.333333333	11.11111111	91.4893617	41.66666667	61.11111111	80.7486631	134.8412035	-73.87057277	0.757990897	0	3.571428571	90.16393443	62.5	39.28571429	85.16483516	157.4228334	2086.781994
Epochs 180	0.80733943	9.090909091	11.11111111	91.53439153	45.45454545	55.55555556	80.85106383	954.7314535	-73.87057277	0.762557089	0	3.703703704	90.2173913	62.5	40.74074074	85.24590164	137.4841187	2086.781994
Epochs 200	0.830275238	11.11111111	13.33333333	91.75257732	44.44444444	60	80.82901554	557.3592288	-73.87057277	0.794520557	0	4.545454545	90.57591623	66.66666667	36.36363636	85.78947368	125.0769686	2086.781994
Novavax, Inc	Non-Recession									Recession								
	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit	Test accuracy	Correct buys	Correct sells	Correct holds	Correct low buys	Correct high sells	Correct mid holds	Profit gained	Buy and hold profit
Epochs 20	0.293577969	7.142857143	8.955223881	96.22641509	45.36082474	56.71641791	90.56603774	-39.58392078	-97.62028238	0.424657524	4.761904762	9.230769231	92.30769231	46.03174603	52.30769231	83.33333333	313.8315245	5802.379195
Epochs 40	0.449541271	4	10.86956522	92.78350515	45.94594595	58.69565217	84.53608247	-84.59703227	-97.62028238	0.374429226	2.857142857	5.102040816	88.37209302	48.57142857	44.89795918	83.52941176	5.489831076	5802.379195
Epochs 60	0.605504572	1.886792453	14.28571429	92.70072993	42.30769231	64.28571429	85.40145985	-83.9108437	-97.62028238	0.529680371	3.125	6.153846154	90.98360656	50	44.61538462	86.7768595	29.45265097	5802.379195
Epochs 80	0.674311936	0	16.66666667	93.46405229	37.5	62.5	85.62091503	-83.87168428	-97.62028238	0.607305944	0	4	90.34482759	41.66666667	38	85.41666667	128.271166	5802.379195
Epochs 100	0.701834857	0	10.52631579	92.63803681	37.14285714	52.63157895	84.04907975	-78.67903121	-97.62028238	0.643835604	0	2.380952381	89.74358974	47.61904762	42.85714286	85.16129032	128.271166	5802.379195
Epochs 120	0.733944952	0	11.11111111	91.86046512	33.33333333	55.55555556	83.72093023	-87.64707417	-97.62028238	0.721461177	0	0	89.77272727	53.33333333	35.71428571	83.42857143	461.5135658	5802.379195
Epochs 140	0.784403682	0	13.33333333	92.34972678	42.10526316	60	84.15300546	-78.02184926	-97.62028238	0.748858452	0	0	90.10989011	50	37.03703704	83.97790055	85.15058114	5802.379195
Epochs 160	0.802752316	0	15.38461538	92.51336898	47.05882353	69.23076923	83.95721925	-30.46795068	-97.62028238	0.762557089	0	0	90.27027027	60	41.66666667	84.23913043	261.6626025	5802.379195
Epochs 180	0.802752316	0	14.28571429	92.51336898	43.75	64.28571429	83.42245989	131.0187112	-97.62028238	0.748858452	0	0	90.10989011	72.72727273	42.30769231	83.97790055	155.7435384	5802.379195
Epochs 200	0.839449525	0	11.11111111	92.3857868	45.45454545	77.77777778	83.24873096	287.1362157	-97.62028238	0.767123282	0	0	90.32258065	75	44	84.32432432	40.84187368	5802.379195

Table 17-8 LSTM Models Results for Variation

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