Mini-Project 4: Stock price prediction using neural network, lstm and cnn

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Contents

[1. Problem Statement 3](#_Toc528983269)

[2. Methodology 3](#_Toc528983270)

[2.1 Fully Connected Neural Network 4](#_Toc528983271)

[2.2 LSTM (Long Short-Term Memory) 4](#_Toc528983272)

[2.3 CNN (Convolutional Neural Network) 4](#_Toc528983273)

[3. Experimental Results and Analysis 5](#_Toc528983274)

[Regression Lift chart 6](#_Toc528983275)

[4. Task Division 7](#_Toc528983276)

[4.1. Chandini Nagendra: 7](#_Toc528983277)

[4.2. Siddharth Chittora 7](#_Toc528983278)

[5. Project Reflection 7](#_Toc528983279)

[6. Additional Features 7](#_Toc528983280)

[6.1 Different Data Sets 7](#_Toc528983281)

[6.1.1 Regression Lift chart 7](#_Toc528983282)

[6.2 Yahoo finance data, LSTM vs CNN for stock Prediction 7](#_Toc528983283)

[6.2.1 Regression Lift chart 8](#_Toc528983284)

[6.3 Predict Stock Price for Continues time period 8](#_Toc528983285)

[6.3.1 Regression Lift chart 8](#_Toc528983286)

[7. References 8](#_Toc528983287)

# Problem Statement

Task 1: Use the daily [Open, High, Low, Volume] to predict [Close] on that day using **a fully-connected neural network**. Use the first 70% of the records for training and the remaining 30% of the records for test. Report the RMSE of the model. Show the “regression lift chart” of your test data.

Task 2: Predict [Close] of a day based on the last 7 days’ data [Open, High, Low, Volume, Close] using a **LSTM model**. In other words, we want to predict the price in the green cell using all the numbers in the red cell. Use the first 70% of the available records for training and the remaining 30% of the available records for test. Report the RMSE of the model. Show the “regression lift chart” of your test data.

Task 3: Do the same as Task 2 but use a **CNN model**. Report the RMSE of the model. Show the “regression lift chart” of your test data.

# Methodology

* The data set considered for this project consist of following columns. Date, Open, High, Low, Close, Adj\_Close and Volume
* For data pre-processing, removed the columns Date and Adj\_Close
* Removed the null values if any from the data set.
* Normalized the columns Open, High, Low, Close and Volume
* Did not Normalize the column Close as this will be the label used for prediction
* Converted pandas dataframe to xy input that tensorflow requires
* Finally Split the data, 70% for training and 30% for testing.

## 2.1 Fully Connected Neural Network

* Trained the Tensorflow models with activation function ReLU, Sigmoid and Tanh.
* Using each of the activation function mentioned above experiment by using optimizers adam, sgd and rmsprop.
* Also experimented with 2, 3 and 4 layers and altered neuron counts
* Used early stopping and Model checkpointing to save the best weights
* Added a dropout layer to see how it affected the model
* Calculated RMSE and R2 score for each model
* Details of experimental results are as shown in the table 1.0

## 2.2 LSTM (Long Short-Term Memory)

* Using the data in the given dataset for seven days, predicting the close price for the 8th day
* Separated the Close field and saved it in a different dataframe to be used as a label
* Normalized the columns Open, High, Low, Volume and Close and used it as input data for the seven-day dataframe
* Did not normalize the separated close dataframe.
* Modified the function **to\_sequences(seq\_size, data, label)** (given in the tutorials for LSTM) to be able to use it for 7 day sliding window, extracted the x and y in the form of numpy arrays
* Using the x and y obtained, split the data into 70% training data and 30% testing data
* Trained the LSTM model. Experimented with 1 and 2 layers for LSTM
* Used the optimizer function adam
* Used early stopping and model checkpointing
* Performed prediction on test data
* Calculated the RMSE and R2 score. Details of the experiment is given below in the table 1.0

## 2.3 CNN (Convolutional Neural Network)

* Using the data in the given dataset for seven days, predicting the close price for the 8th day
* Separated the Close field and saved it in a different dataframe to be used as a label
* Normalized the columns Open, High, Low, Volume and Close and used it as input data for the seven-day dataframe
* Did not normalize the separated close dataframe.
* Modified the function **to\_sequences(seq\_size, data, label)** (given in the tutorials for LSTM) to be able to use it for 7 day sliding window, extracted the x and y in the form of numpy arrays
* Using the x and y obtained, split the data into 70% training data and 30% testing data
* CNN model expects the data to be in 4d, therefore reshaped the train and test data using reshape ()
* Visualized the sliding window as an image as CNN model is specifically made for an image. Visualized the window as an image with one row, seven columns and 5 channels
* Trained the cnn model with 1 and 2 Conv2d layer and Kernel size (1,5)
* Used max pooling and dropout in the model.
* Used early stopping and model checkpointing
* Used the activation function ReLU and optimizer adam
* Used a Dense layer
* Predicted the eight-day stock price using the last seven-day data
* Calculated the RMSE and R2 score
* Detailed experimental results are shown in the table 1.0

# Experimental Results and Analysis

|  |  |  |
| --- | --- | --- |
| **Model & Tuning** | **RMSE** | **R2 Score** |
| **Tensor flow regression neural network models** |  |  |
| ReLU + adam + 2 layers + early stopping + model checkpointing |  |  |
| ReLU + adam + 3 layers + early stopping + model checkpointing |  |  |
| ReLU + adam + 4 layers + early stopping + Model Checkpointing |  |  |
| ReLU + adam + 4 layers + dropout |  |  |
| ReLU + sgd + 3 layers + early stopping + Model Checkpoint |  |  |
| ReLU + sgd + 3 layers + dropout |  |  |
| ReLU + rmsprop + 3 layers + early stopping + Model Checkpointing |  |  |
| ReLU + rmsprop + 3 layers + dropout |  |  |
| Sigmoid + adam + 2 layers + early stopping + model checkpointing |  |  |
| Sigmoid + adam + 3 layers + early stopping + model checkpointing |  |  |
| Sigmoid + adam + 4 layers + early stopping + Model Checkpointing |  |  |
| Sigmoid + adam + 4 layers + dropout |  |  |
| Sigmoid + sgd + 3 layers + early stopping + Model Checkpoint |  |  |
| Sigmoid + sgd + 3 layers + dropout |  |  |
| Sigmoid + rmsprop + 3 layers + early stopping + Model Checkpointing |  |  |
| Sigmoid + rmsprop + 3 layers + dropout |  |  |
| Tanh + adam + 2 layers + early stopping + model checkpointing |  |  |
| Tanh + adam + 3 layers + early stopping + model checkpointing |  |  |
| Tanh + adam + 4 layers + early stopping + Model Checkpointing |  |  |
| Tanh + adam + 4 layers + dropout |  |  |
| Tanh + sgd + 3 layers + early stopping + Model Checkpoint |  |  |
| Tanh + sgd + 3 layers + dropout |  |  |
| Tanh + rmsprop + 3 layers + early stopping + Model Checkpointing |  |  |
| Tanh + rmsprop + 3 layers + dropout |  |  |
| **LSTM** |  |  |
| 1 layer + early stopping + Model Checkpointing |  |  |
| 2 layers + early stopping + Model Checkpointing |  |  |
| 2 layers + early stopping + Model Checkpointing + Dropout |  |  |
| **CNN** |  |  |
| 1 layer + early stopping + Model Checkpointing |  |  |
| 2 layers + early stopping + Model Checkpointing |  |  |
| 2 layers + early stopping + Model Checkpointing + Dropout |  |  |

## 

## Regression Lift chart

Put charts of only best from nn, LSTM and CNN experiments

# Task Division

## Chandini Nagendra:

* Fully Connected Neural Network
* CNN
* Report

## Siddharth Chittora

* Fully Connected Neural Network
* LSTM
* Report

Discussed together on how to improve the model and came up with the solution discussed in the additional features section.

# Project Reflection

# Additional Features

## 6.1 Different Data Sets

### 6.1.1 Regression Lift chart

## 6.2 Yahoo finance data, LSTM vs CNN for stock Prediction

### 6.2.1 Regression Lift chart

## 6.3 Predict Stock Price for Continues time period

### 6.3.1 Regression Lift chart

|  |  |  |
| --- | --- | --- |
| **Model & Tuning** | **RMSE** | **R2 Score** |
| **LSTM on different datasets** |  |  |
| Apple |  |  |
| **LSTM VS CNN on yahoo dataset** |  |  |
| 2 layers + early stopping + Model Checkpointing + Dropout |  |  |
| **Predict 5 Close of 5 consecutive days** |  |  |
| 1 layer + early stopping + Model Checkpointing |  |  |

# References

Put different data frame download links here