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PROJECT FILE

Data Science [BTIBM505]

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Introduction

Machine Learning to Predict Stock Prices

Utilizing a Keras LSTM model to forecast stock trends

As financial institutions begin to embrace artificial intelligence, machine learning is increasingly utilized to help make trading decisions. Although there is an abundance of stock data for machine learning models to train on, a high noise to signal ratio and the multitude of factors that affect stock prices are among the several reasons that predicting the market difficult. At the same time, these models don’t need to reach high levels of accuracy because even 60% accuracy can deliver solid returns. One method for predicting stock prices is using a long short-term memory neural network (LSTM) for times series forecasting.

Stock Price Prediction

Stock price analysis has been a critical area of research and is one of the top applications of machine learning. This tutorial will teach you how to perform stock price prediction using machine learning and deep learning techniques. Here, you will use an LSTM network to train your model with Google stocks data.

What is the Stock Market?

A stock market is a public market where you can buy and sell shares for publicly listed companies. The stocks, also known as equities, represent ownership in the company. The stock exchange is the mediator that allows the buying and selling of shares.

Importance of Stock Market

- Stock markets help companies to raise capital.
- It helps generate personal wealth.
- Stock markets serve as an indicator of the state of the economy.
- It is a widely used source for people to invest money in companies with high growth potential.

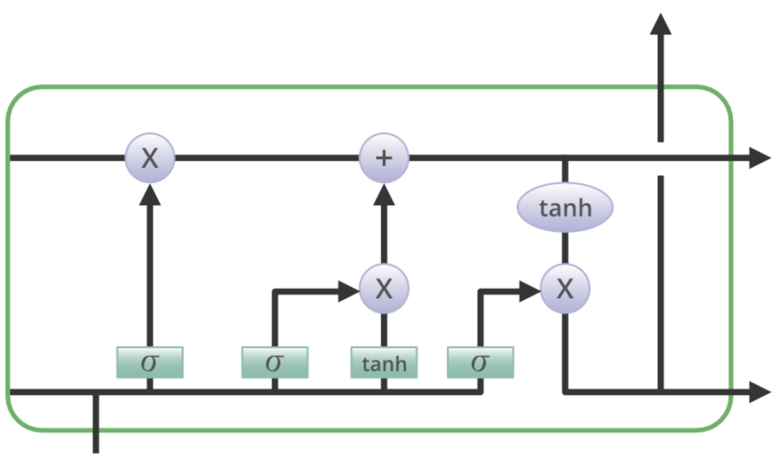
Stock Price Prediction

Stock Price Prediction using machine learning helps you discover the future value of company stock and other financial assets traded on an exchange. The entire idea of predicting stock prices is to gain significant profits. Predicting how the stock market will perform is a hard task to do. There are other factors involved in the prediction, such as physical and psychological factors, rational and irrational behavior, and so on. All these factors combine to make share prices dynamic and volatile. This makes it very difficult to predict stock prices with high accuracy.

Long Short Term Memory is a kind of recurrent neural network. In RNN output from the last step is fed as input in the current step. LSTM was designed by Hochreiter & Schmidhuber. It tackled the problem of long-term dependencies of RNN in which the RNN cannot predict the word stored in the long-term memory but can give more accurate predictions from the recent information. As the gap length increases RNN does not give an efficient performance. LSTM can by default retain the information for a long period of time. It is used for processing, predicting, and classifying on the basis of time-series data.

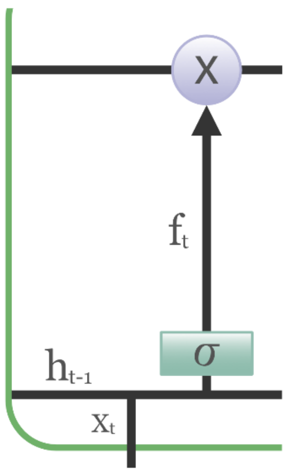
Structure Of LSTM:

LSTM has a chain structure that contains four neural networks and different memory blocks called cells.

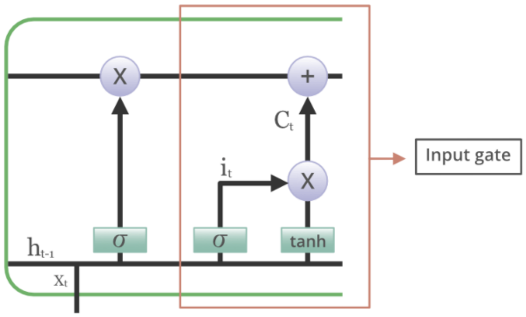


Information is retained by the cells and the memory manipulations are done by the gates. There are three gates –

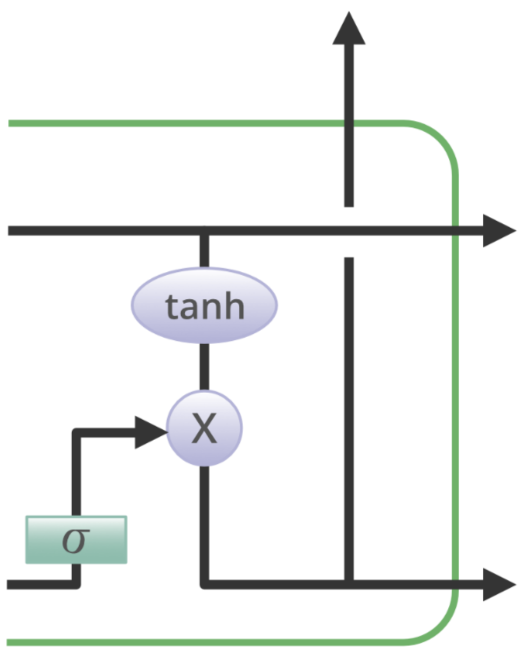
1. Forget Gate: The information that is no longer useful in the cell state is removed with the forget gate. Two inputs x_t (input at the particular time) and h_t-1 (previous cell output) are fed to the gate and multiplied with weight matrices followed by the addition of bias. The resultant is passed through an activation function which gives a binary output. If for a particular cell state the output is 0, the piece of information is forgotten and for output 1, the information is retained for future use.



2. Input gate: The addition of useful information to the cell state is done by the input gate. First, the information is regulated using the sigmoid function and filter the values to be remembered similar to the forget gate using inputs h_t-1 and x_t. Then, a vector is created using tanh function that gives an output from -1 to +1, which contains all the possible values from h_t-1 and x_t. At last, the values of the vector and the regulated values are multiplied to obtain the useful information



3. Output gate: The task of extracting useful information from the current cell state to be presented as output is done by the output gate. First, a vector is generated by applying tanh function on the cell. Then, the information is regulated using the sigmoid function and filter by the values to be remembered using inputs h_t-1 and x_t. At last, the values of the vector and the regulated values are multiplied to be sent as an output and input to the next cell.



Some of the famous applications of LSTM includes:

- Language Modelling
- Machine Translation
- Image Captioning
- Handwriting generation
- Question Answering Chatbots

Recurrent Neural Network

A recurrent neural network (RNN) is a special type of artificial neural network adapted to work for time series data or data that involves sequences. Ordinary feedforward neural networks are only meant for data points that are independent of each other. However, if we have data in a sequence such that one data point depends upon the previous data point, we need to modify the neural network to incorporate the dependencies between these data points. RNNs have the concept of "memory" that helps them store the states or information of previous inputs to generate the next output of the sequence.

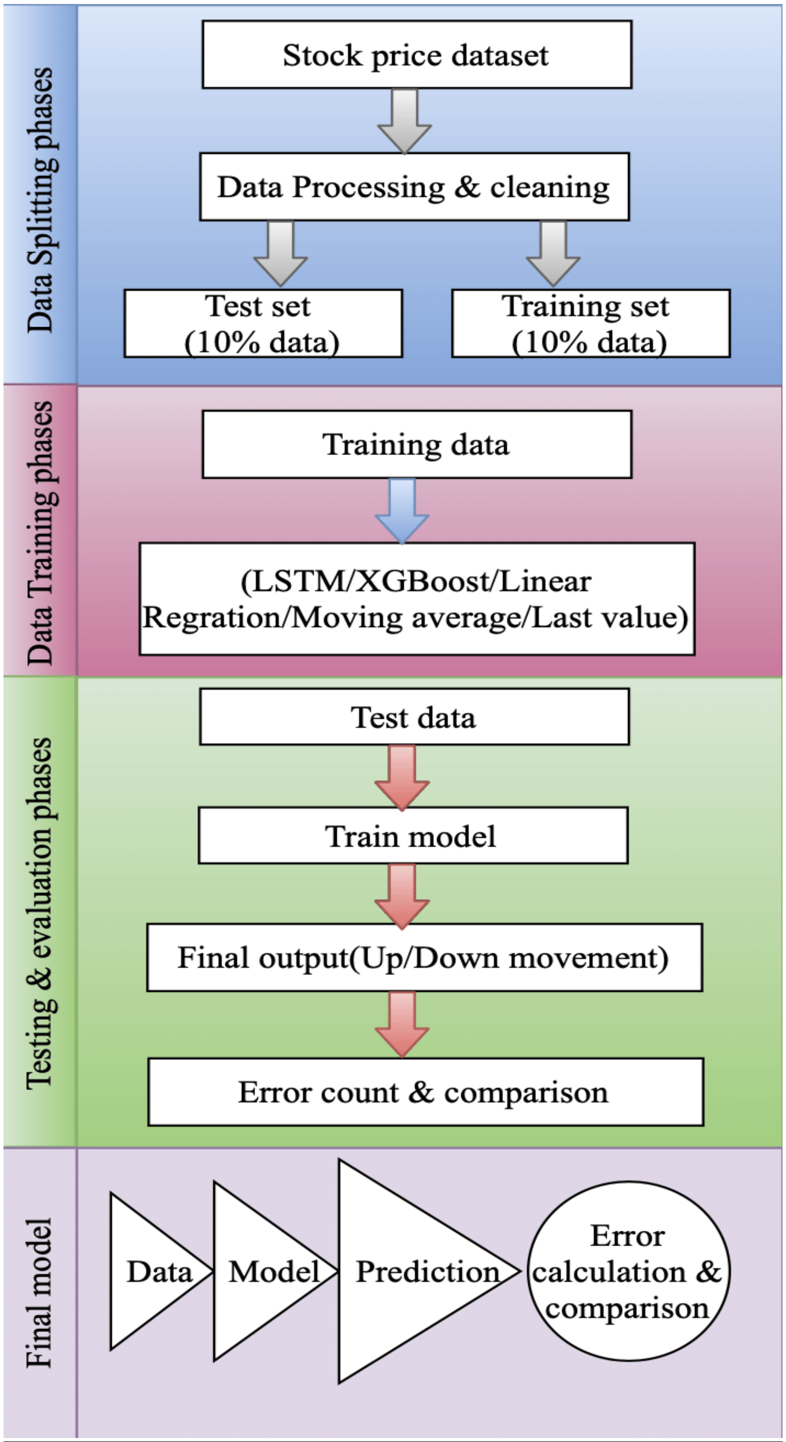
Problem Statement:

The stock market appears in the news every day. You hear about it every time it reaches a new high or a new low. The rate of investment and business opportunities in the Stock market can increase if an efficient algorithm could be devised to predict the short-term price of an individual stock.

Previous methods of stock predictions involve the use of Artificial Neural Networks and Convolution Neural Networks which has an error loss at an average of 20%.

In this report, we will see if there is a possibility of devising a model using Recurrent Neural Network which will predict stock price with a less percentage of error. And if the answer turns to be YES, we will also see how reliable and efficient this model will be.

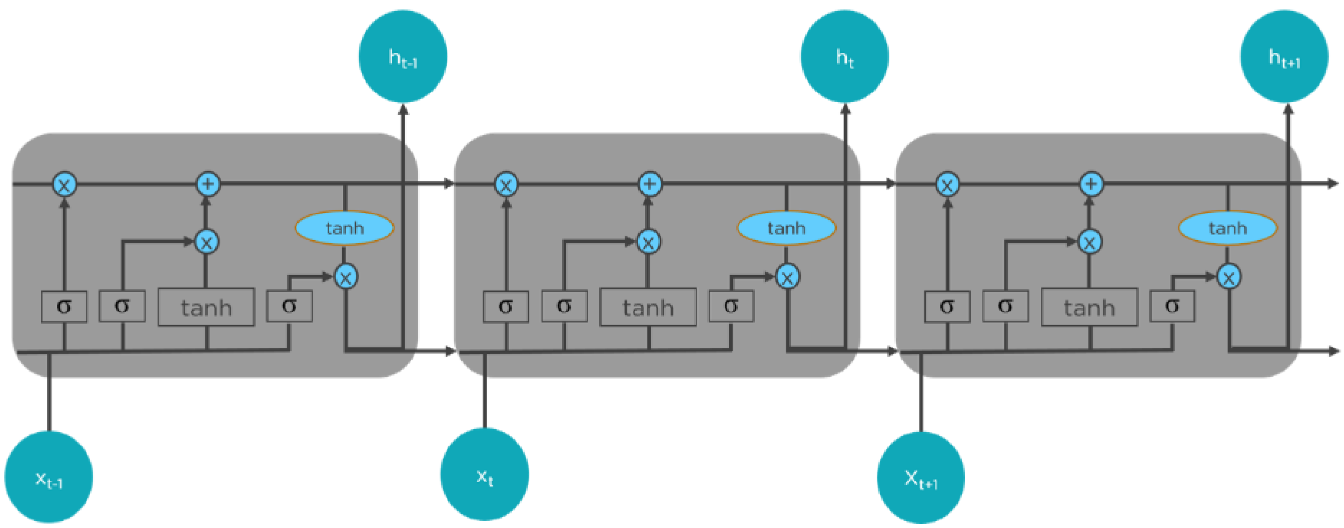
METHODOLOGY



Understanding Long Short Term Memory Network

Here, you will use a Long Short Term Memory Network (LSTM) for building your model to predict the stock prices of Google.

LTSMs are a type of Recurrent Neural Network for learning long-term dependencies. It is commonly used for processing and predicting time-series data.



From the image on the top, you can see LSTMs have a chain-like structure. General RNNs have a single neural network layer. LSTMs, on the other hand, have four interacting layers communicating extraordinarily.

LSTMs work in a three-step process.

- The first step in LSTM is to decide which information to be omitted from the cell in that particular time step. It is decided with the help of a sigmoid function. It looks at the previous state (ht-1) and the current input xt and computes the function.

- There are two functions in the second layer. The first is the sigmoid function, and the second is the tanh function. The sigmoid function decides which values to let through (0 or 1). The tanh function gives the weightage to the values passed, deciding their level of importance from -1 to 1.

- The third step is to decide what will be the final output. First, you need to run a sigmoid layer which determines what parts of the cell state make it to the output. Then, you must put the cell state through the tanh function to push the values between -1 and 1 and multiply it by the output of the sigmoid gate.

With this basic understanding of LSTM, you can dive into the hands-on demonstration part of this tutorial regarding stock price prediction using machine learning.

Google Stock Price Prediction Using LSTM

1. Import the Libraries.

```
#Import libraries
import os
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
%matplotlib inline
```

2. Load the Training Dataset.

The Google training data has information from 3 Jan 2012 to 30 Dec 2016. There are five columns. The Open column tells the price at which a stock started trading when the market opened on a particular day. The Close column refers to the price of an individual stock when the stock exchange closed the market for the day. The High column depicts the highest price at which a stock traded during a period. The Low column tells the lowest price of the period. Volume is the total amount of trading activity during a period of time.

```
dataset_train = pd.read_csv("Google_Stock_Price_Train.csv")
dataset_train.head()
```

	Date	Open	High	Low	Close	Volume
0	1/3/2012	325.25	332.83	324.97	663.59	7,380,500
1	1/4/2012	331.27	333.87	329.08	666.45	5,749,400
2	1/5/2012	329.83	330.75	326.89	657.21	6,590,300
3	1/6/2012	328.34	328.77	323.68	648.24	5,405,900
4	1/9/2012	322.04	322.29	309.46	620.76	11,688,800

3. Use the Open Stock Price Column to Train Your Model.

```
training_set = dataset_train.iloc[:,1:2].values

print(training_set)
print(training_set.shape)
```

```
[[325.25]
 [331.27]
 [329.83]
 ...
 [793.7 ]
 [783.33]
 [782.75]]
(1258, 1)
```

4. Normalizing the Dataset.

```
from sklearn.preprocessing import MinMaxScaler

scaler = MinMaxScaler(feature_range = (0,1))
scaled_training_set = scaler.fit_transform(training_set)

scaled_training_set
```

```
array([[0.08581368],
       [0.09701243],
       [0.09433366],
       ...,
       [0.95725128],
       [0.93796041],
       [0.93688146]])
```

5. Creating X_train and y_train Data Structures.

```
X_train = []
y_train = []
for i in range(60,1258):
    X_train.append(scaled_training_set[i-60:i, 0])
    y_train.append(scaled_training_set[i, 0])
X_train = np.array(X_train)
y_train = np.array(y_train)
```

```
print(X_train.shape)
print(y_train.shape)
```

```
(1198, 60)
(1198,)
```

6. Reshape the Data.

```
X_train = np.reshape(X_train,(X_train.shape[0], X_train.shape[1], 1))

X_train.shape
```

```
(1198, 60, 1)
```

7. Building the Model by Importing the Crucial Libraries and Adding Different Layers to LSTM.

```python
from keras.models import Sequential
from keras.layers import LSTM
from keras.layers import Dense
from keras.layers import Dropout
```

```python
regressor = Sequential()

regressor.add(LSTM(units = 50, return_sequences= True, input_shape = (X_train.shape[1], 1)))
regressor.add(Dropout(0.2))

regressor.add(LSTM(units = 50, return_sequences= True))
regressor.add(Dropout(0.2))

regressor.add(LSTM(units = 50, return_sequences= True))
regressor.add(Dropout(0.2))

regressor.add(LSTM(units = 50))
regressor.add(Dropout(0.2))

regressor.add(Dense(units=1))
```

8. Fitting the Model.

```python
regressor.compile(optimizer = 'adam', loss = 'mean_squared_error')
regressor.fit(X_train, y_train, epochs=100, batch_size=32)
```

```
Epoch 1/100
38/38 [==============================] - 11s 114ms/step - loss: 0.1011
Epoch 2/100
38/38 [==============================] - 4s 117ms/step - loss: 0.0061
Epoch 3/100
38/38 [==============================] - 4s 118ms/step - loss: 0.0063
Epoch 4/100
```

9. Extracting the Actual Stock Prices of Jan-2017.

```
dataset_test = pd.read_csv("Google_Stock_Price_Test.csv")
actual_stock_price = dataset_test.iloc[:,1:2].values
```

10. Preparing the Input for the Model.

```
# preparing input for the model
dataset_total = pd.concat((dataset_train['Open'], dataset_test['Open']), axis = 0)
inputs = dataset_total[len(dataset_total) - len(dataset_test) - 60:].values

inputs = inputs.reshape(-1, 1)
inputs = scaler.transform(inputs)

X_test = []
for i in range(60, 180):
    X_test.append(inputs[i - 60:i, 0])
X_test = np.array(X_test)
X_test = np.reshape(X_test, (X_test.shape[0], X_test.shape[1], 1))
```

11. Predicting the Values for Jan 2017 Stock Prices.

```
predicted_stock_price = regressor.predict(X_test)
predicted_stock_price = scaler.inverse_transform(predicted_stock_price)
```

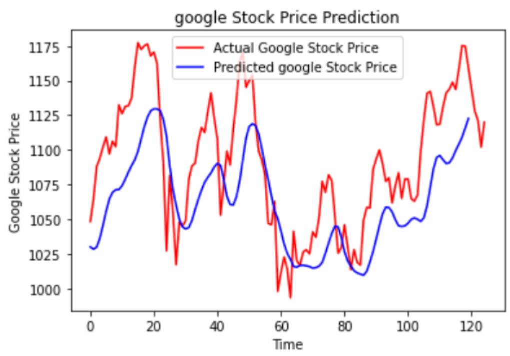
12. Plotting the Actual and Predicted Prices for Google Stocks.

```
# plotting graphs

plt.plot(actual_stock_price, color = 'red', label = 'Actual Google Stock Price')
plt.plot(predicted_stock_price, color = 'blue', label = 'Predicted google Stock Price')
plt.title('google Stock Price Prediction')
plt.xlabel('Time')
plt.ylabel('Google Stock Price')
plt.legend()
```

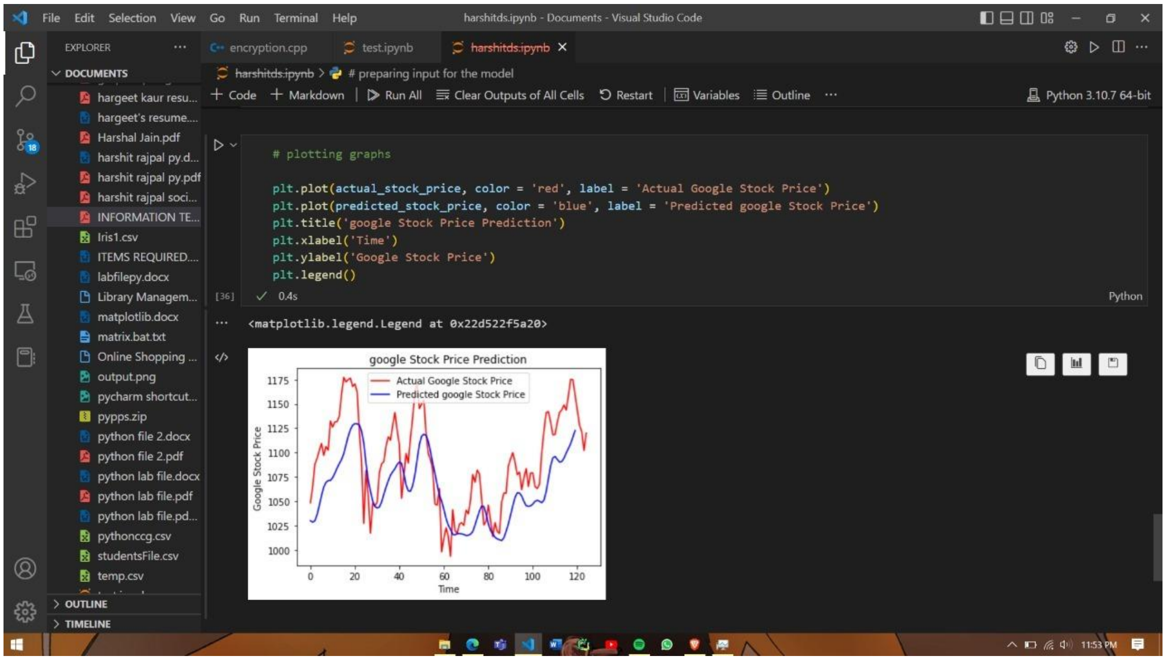
✓ 0.4s

```
<matplotlib.legend.Legend at 0x22d522f5a20>
```



As you can see above, the model can predict the trend of the actual stock prices very closely. The accuracy of the model can be enhanced by training with more data and increasing the LSTM layers

RESULT


harshitds.ipynb - Documents - Visual Studio Code
# plotting graphs
plt.plot(actual_stock_price, color = 'red', label = 'Actual Google Stock Price')
plt.plot(predicted_stock_price, color = 'blue', label = 'Predicted google Stock Price')
plt.title('google Stock Price Prediction')
plt.xlabel('Time')
plt.ylabel('Google Stock Price')
plt.legend()
<matplotlib.legend.Legend at 0x22d522f5a20>
google Stock Price Prediction
Actual Google Stock Price
Predicted google Stock Price
Google Stock Price
Time

CONCLUSION

The stock market plays a remarkable role in our daily lives. It is a significant factor in a country's GDP growth. In this tutorial, you learned the basics of the stock market and how to perform stock price prediction using machine learning.

Thankyou…

Presented By:- **Harshit Rajpal**

Dhruv Parmar

Sanskriti Sharma

Kinjal Dongre

Mahak Neema

```python
# Import Libraries

import os

import numpy as np

import pandas as pd

import matplotlib.pyplot as plt

%matplotlib inline



# Loading training dataset

dataset_train = pd.read_csv("trainset.csv")

dataset_train.head()
```

```python
training_set =
dataset_train.iloc[:, 1:2].values
```

```
print(training_set)
print(training_set.shape)
```

```
# normalizing the dataset
from sklearn.preprocessing
import MinMaxScaler

scaler =
MinMaxScaler(feature_range =
(0, 1))
scaled_training_set =
scaler.fit_transform(training_set)
scaled_training_set
```

```
X_train = []
Y_train = []
for i in range(60, 1259):

X_train.append(scaled_training_
set[i-60:i, 0])

Y_train.append(scaled_training_
set[i, 0])
X_train = np.array(X_train)
Y_train = np.array(Y_train)
print(X_train.shape)
print(Y_train.shape)
```

```
# reshape the data
X_train = np.reshape(X_train,
(X_train.shape[0],
X_train.shape[1], 1))
X_train.shape
```

```
from keras.models import
```

```
Sequential
from keras.layers import LSTM
from keras.layers import Dense
from keras.layers import
Dropout
```

```
regressor = Sequential()
```

```
regressor.add(LSTM(units = 50,
return_sequences= True,
input_shape = (X_train.shape[1],
1)))
regressor.add(Dropout(0.2))

regressor.add(LSTM(units = 50,
return_sequences = True))
regressor.add(Dropout(0.2))

regressor.add(LSTM(units=50,
return_sequences=True))
regressor.add(Dropout(0.2))
```

```
regressor.add(LSTM(units = 50))
regressor.add(Dropout(0.2))

regressor.add(Dense(units = 1))
```

```
# fitting the model
regressor.compile(optimizer =
'adam', loss =
'mean_squared_error')
regressor.fit(X_train, Y_train,
epochs = 100, batch_size = 32)
```

```
dataset_test =
pd.read_csv("testset.csv")
actual_stock_price =
dataset_test.iloc[:, 1:2].values
```

```
# preparing input for the model
dataset_total =
pd.concat((dataset_train['Open'],
dataset_test['Open']), axis = 0)
inputs =
dataset_total[len(dataset_total) -
len(dataset_test) - 60:].values

inputs = inputs.reshape(-1, 1)
```

```
inputs = scaler.transform(inputs)

X_test = []
for i in range(60, 180):
    X_test.append(inputs[i - 60:i,
0])
X_test = np.array(X_test)
X_test = np.reshape(X_test,
(X_test.shape[0],
X_test.shape[1], 1))
```

```
predicted_stock_price =
regressor.predict(X_test)
```

```
predicted_stock_price = scaler.inverse_transform(predicted_stock_price)
```

```
# plotting graphs

plt.plot(actual_stock_price, color = 'red', label = 'Actual Google Stock Price')
plt.plot(predicted_stock_price, color = 'blue', label = 'Predicted google Stock Price')
plt.title('google Stock Price Prediction')
```

```python
plt.xlabel('Time')
plt.ylabel('Google Stock Price')
plt.legend()
```

*****---

Testset dat

```
Date,Open,High,Low,Close,Adj Close,Volume

2018-01-02,1048.339966,1066.939941,1045.229980,1065.000000,1065.000000,1237600

2018-01-03,1064.310059,1086.290039,1063.209961,1082.479980,1082.479980,1430200

2018-01-04,1088.000000,1093.569946,1084.001953,1086.400024,1086.400024,1004600

2018-01-05,1094.000000,1104.250000,1092.000000,1102.229980,1102.229980,1279100

2018-01-08,1102.229980,1111.270020,1101.619995,1106.939941,1106.939941,1047600

2018-01-09,1109.400024,1110.569946,1101.230957,1106.260010,1106.260010,902500

2018-01-10,1097.099976,1104.599976,1096.109985,1102.609985,1102.609985,1042800

2018-01-11,1106.300049,1106.525024,1099.589966,1105.520020,1105.520020,978300

2018-01-12,1102.410034,1124.290039,1101.150024,1122.260010,1122.260010,1720500

2018-01-16,1132.510010,1139.910034,1117.832031,1121.760010,1121.760010,1575300

2018-01-17,1126.219971,1132.599976,1117.010010,1131.979980,1131.979980,1198700

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2018-01-25,1172.530029,1175.939941,1162.760010,1170.369995,1170.369995,1480500

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```

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2018-02-16,1088.410034,1104.670044,1088.312988,1094.800049,1094.800049,1681600

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2018-03-07,1089.189941,1112.219971,1085.482056,1109.640015,1109.640015,1292500

2018-03-08,1115.319946,1127.599976,1112.800049,1126.000000,1126.000000,1355100

2018-03-09,1136.000000,1160.800049,1132.461060,1160.040039,1160.040039,2128000

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2018-03-14,1145.209961,1158.589966,1141.439941,1149.489990,1149.489990,1291400

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SHRI VAISHNAV VIDYAPEETH VISHWAVIDYALAYA , INDORE
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DATA SCIENCE PROJECT

STOCK PRICE PREDICTION
USING
MACHINE LEARNING

UNDER THE GUIDANCE OF
MR. OM KANT SHARMA

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AGENDA

- ABSTRACT
- INTRODUCTION
- EXISTING METHODS
- PROPOSED SYSTEM
- SYSTEM DESIGN
- RESULT & DISCUSSION
- PERFORMANCE
- FUTURE ENHANCEMENT
- CONCLUSION

ABSTRACT

- TIME SERIES FORECASTING HAS BEEN WIDELY USED TO DETERMINE THE FUTURE PRICES OF STOCK, AND THE ANALYSIS AND MODELLING OF FINANCE TIME SERIES IMPORTANTLY GUIDE INVESTORS DECISION AND TRADES.
- THIS WORK PROPOSES AN INTELLIGENT TIME SERIES PREDICTION SYSTEM THAT USES SLIDING-WINDOW OPTIMISATION FOR THE PURPOSE OF PREDICTING THE STOCK PRICES.
- THE SYSTEM HAS A GRAPHICAL USER INTERFACE AND FUNCTIONS AS A STAND ALONE APPLICATION.
- THE PROPOSED MODEL IS A PROMISING PREDICTIVE TECHNIQUES FOR HIGHLY NON-LINEAR TIME SERIES, WHOSE PATTERNS ARE DIFFICULT TO CAPTURE BY TRADITIONAL MODELS.

INTRODUCTION

Stock Price analysis has been a critical area of research and is one of the top applications of machine learning. Financial markets are highly volatile and generate huge amounts of data daily. It is the most popular financial market instrument and its value changes quickly.

Stock prices are predicted to determine the future values of companies stock or other financial instruments that are marketed on financial exchanges.

However, the stock market is influenced by many factors such as political events, economic conditions and traders expectation.

WHAT IS MACHINE LEARNING

Machine Learning is the field of study that gives computers the ability to learn without being explicitly programmed.

More formally it can be defined as,
A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P, if its performance at tasks in T, as measured by P, improves with experience E

Example: playing checkers,

E = the experience of playing many games of checkers
T = the task of playing checkers
P = the probability that the program will win the next game.

MACHINE LEARNING IN STOCK PREDICTION

- The field of machine learning is vast and plays a key role in a wide range of critical applications.
- The concept of support vector machines (SVM) have advanced features that are reflected in their good generalization capacity and fast computation.
- Predicting the stock market involves predicting the closing prices of a company’s stock for any given number of days ahead.
- SVM can be used to perform Linear Regression on previous stock data to predict the closing prices using Time series forecasting and other optimisation algorithms.

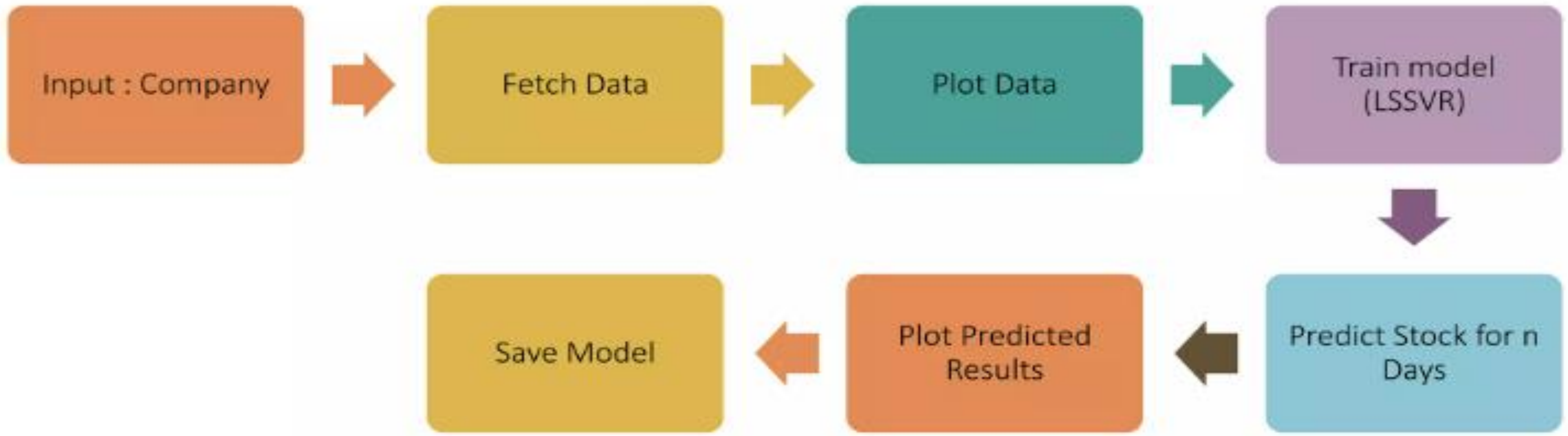
EXISTING METHODS

- Time series forecasting consists of a research area designed to solve various problems mainly in the financial area.
- Support vector regression (SVR), a variant of the SVM, is typically used to solve non linear regression problems by constructing the input-output mapping function.
- The least squares support vector regression (LSSVR) algorithm is a further development of SVR and its use considerably reduces computational complexity and increases efficiency compared to standard SVR.
- The Firefly Algorithm (FA), which is a nature-inspired metaheuristic method, has recently performed extremely well in solving various optimisation problems.

PROPOSED SYSTEM

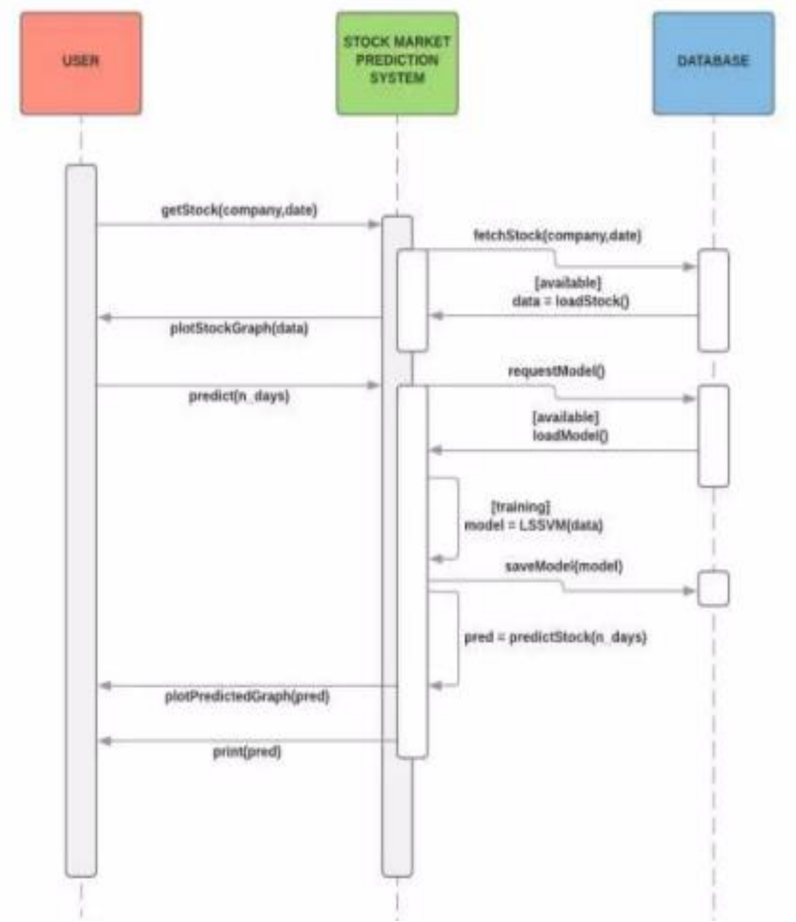
- To generalise the application of the existing systems, our work uses the system to estimate other stocks in similar emerging markets and mature markets.
- The system can be extended to analyse multivariate time series data and import raw dataset directly.
- Profit can be maximised even when the corporate stock market has lower value.
- The development of a web based application has been considered to improve the user friendliness and usability of the expert system.

ARCHITECTURE DATA FLOW DIAGRAM

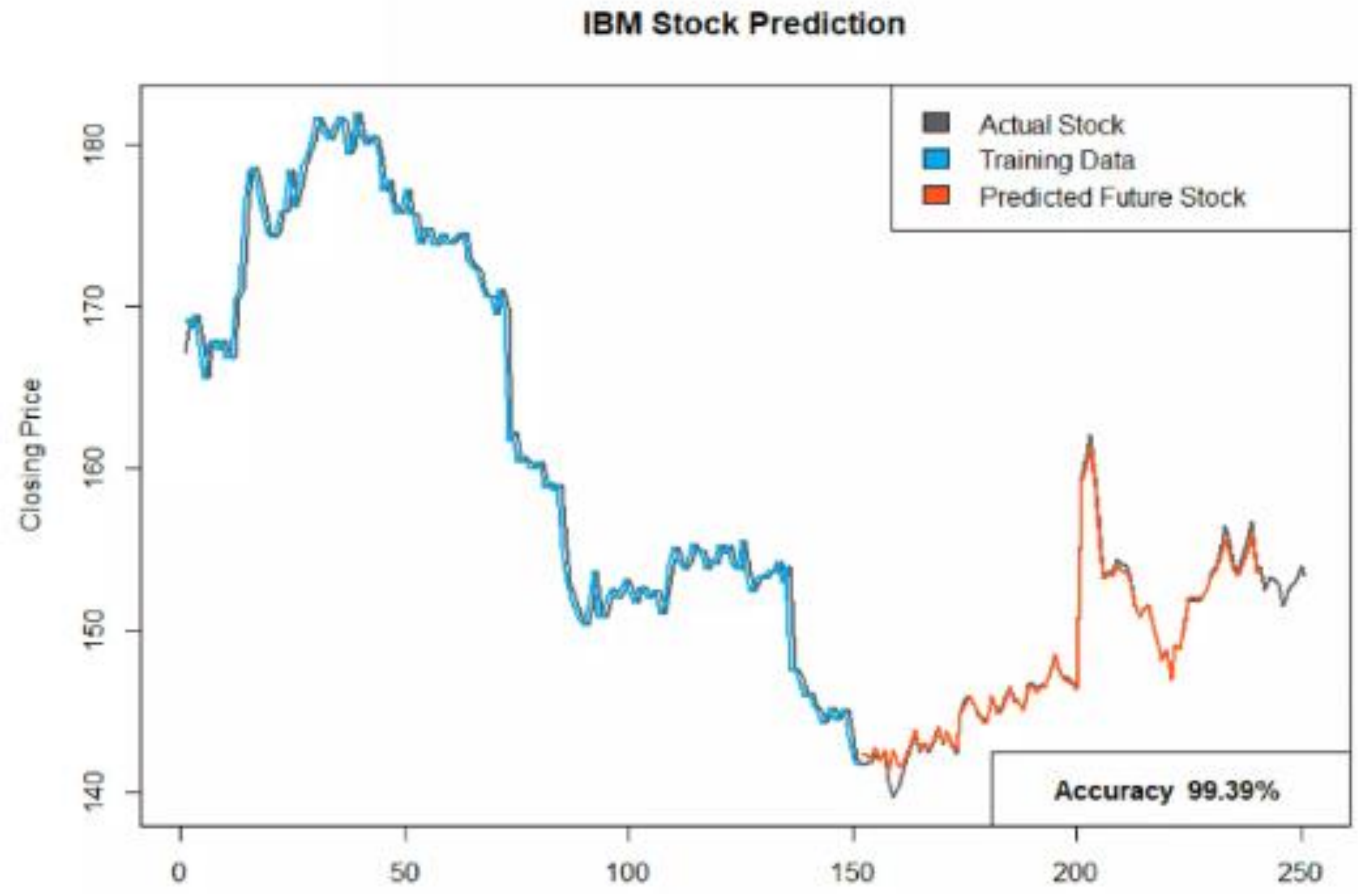


SEQUENCE DIAGRAM

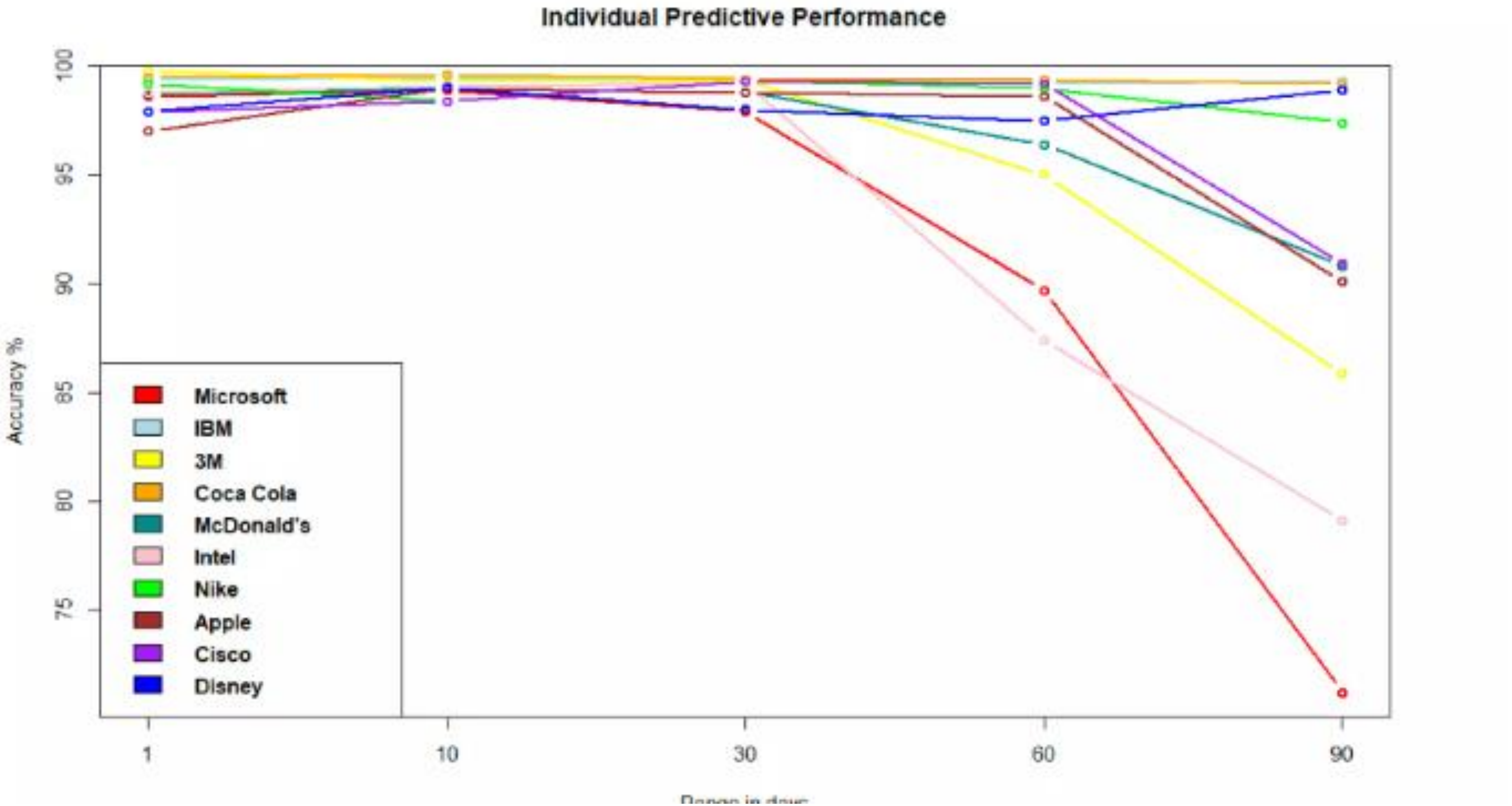
1. User visits the website/webapp.
2. Previously saved model is loaded.
3. User requests for a company's stock data.
4. He requests for prediction to be made.
5. The stock market prediction system trains a model using the data from the database.
6. The model is saved for further use and closing price is predicted.
7. Result is displayed along the graph.



RESULTS & DISCUSSIONS



PERFORMANCE



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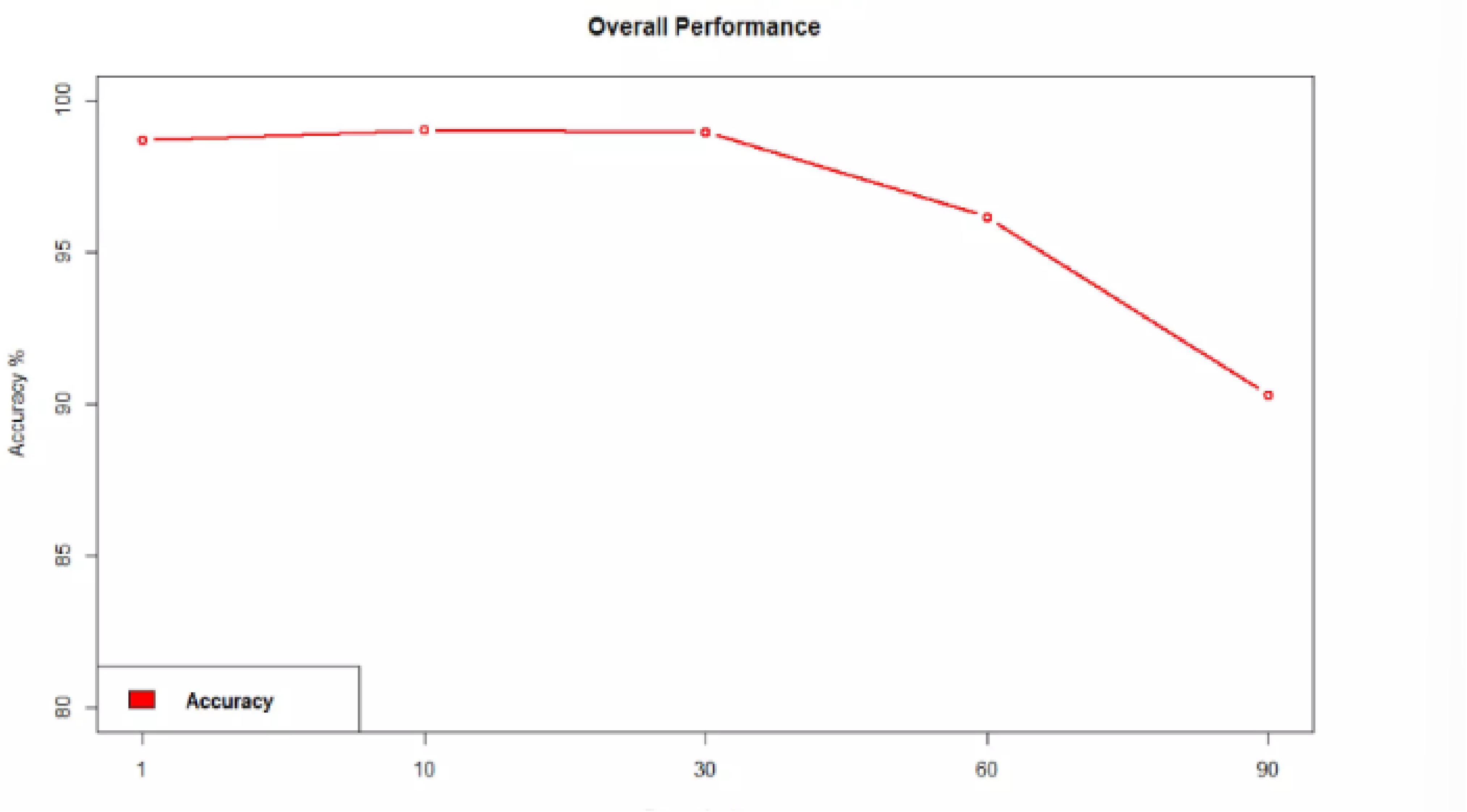

FUTURE ENHANCEMENT

- THE LIMITATION OF THE PROPOSED SYSTEM IS ITS COMPUTATIONAL SPEED, ESPECIALLY WITH RESPECT TO SLIDING WINDOW VALIDATION AS THE COMPUTATIONAL COST INCREASES WITH THE NUMBER OF FORWARD DAY PREDICTIONS.
- THE PROPOSED MODEL DOES NOT PREDICT WELL FOR SUDDEN CHANGES IN THE TREND OF STOCK DATA.
- THIS OCCURS DUE TO EXTERNAL FACTORS AND REAL WORLD CHANGES AFFECTING THE STOCK MARKET.
- WE CAN OVERCOME THIS BY IMPLEMENTING SENTIMENT ANALYSIS AND NEURAL NETWORKS TO ENHANCE THE PROPOSED MODEL.
- WE CAN MODIFY THE SAME SYSTEM TO AN ONLINE LEARNING SYSTEM THAT ADAPTS IN REAL TIME.

CONCLUSION

THUS, AS WE CAN SEE ABOVE IN THE PROPOSED METHOD, WE TRAIN THE DATA USING EXISTING STOCK DATASET THAT IS AVAILABLE. WE USE THIS DATA TO PREDICT AND FORECAST THE STOCK PRICE OF N-DAYS INTO THE FUTURE.

THE AVERAGE PERFORMANCE OF THE MODEL DECREASE WITH INCREASE IN NUMBER OF DAYS, DUE TO UNPREDICTABLE CHANGES IN TREND.

THE CURRENT SYSTEM CAN UPDATE ITS TRAINING SET AS EACH DAY PASSES O AS TO DETECT NEWER TRENDS AND BEHAVE LIKE AN ONLINE LEARNING SYSTEM THAT PREDICTS STOCK IN REAL TIME.

THANK YOU