# STOCK PRICE PREDICTION USING LSTM

# A CAPSTONE PROJECT REPORT

*Submitted in partial fulfillment of the*
*requirement for the award of the*
*Degree of*

**BACHELOR OF TECHNOLOGY**
**IN**
**COMPUTER SCIENCE AND ENGINEERING**

*by*

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# CERTIFICATE

This is to certify that the Capstone Project work titled "**STOCK PRICE PREDICTION USING LSTM**" that is being submitted by **A.N.V.Sivaram (19BCE7280) & Koduri Gokul (19BCD7006)** is in partial fulfillment of the requirements for the award of Bachelor of Technology, is a record of bonafide work done under my guidance. The contents of this Project work, in full or in parts, have neither been taken from any other source nor have been submitted to any other Institute or University for award of any degree or diploma and the same is certified.

**Dr. ESWARAIAH R**

**Guide**

**Approved by**

**PROGRAM CHAIR**

B. Tech. CSE

**DEAN**

SCOPE

# ACKNOWLEDGEMENTS

First and foremost, we would like to express our gratitude to our Guide Dr. ESWARAIAH R sir, Department of computer science and Engineering and VIT-AP University for helping us to guide throughout the project. His vast knowledge, extensive experience, and professional competence enabled us to successfully accomplish this project. This endeavor would not have been possible without his help and supervision. We truly appreciate and value his admired supervision and support from the start to the end of this project.

# ABSTRACT

Nowadays, a large number of people are very interested in the stock market and wish to engage in stocks. If someone attempts to invest in stocks with only a partial understanding of the stock market, there is a possibility that they could lose all of their money. Only a person with complete knowledge of the stock market can successfully gain money from stock investing. There are a lot of phone websites and applications that may entice users to invest in their products and then deceive them after the transaction. We therefore reasoned that we could assist them in stock investing. The goal of our project is to develop a technique for forecasting stock prices. In our project, we intend to apply deep learning techniques. Also, in addition we will develop a website. So that it will be very useful for the users (people) to know the price of the future stocks.

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# CHAPTER 1
# INTRODUCTION

Financial models have been used by investment companies, hedge funds, and even private investors to better understand market behavior and make profitable trades and investments. Historical stock prices and corporate performance data provide a plethora of information that can be processed by machine learning algorithms.

Can machine learning actually forecast stock prices? Investors use data analysis to create informed assumptions. They will read the news, research the background of the company, market trends, and many other pieces of information before making a prediction. The current theories claim that stock prices are completely random and unpredictable, which begs the question of why prestigious companies like Morgan Stanley and Citigroup employ quantitative analysts to create forecasting models. Nowadays, it's more common to see rows of machine learning specialists silently seated in front of computer displays rather than the image we have of a trading floor full of men racing around yelling into phones while high on adrenaline. In actuality, software currently places around 70% of all orders on Wall Street; this is the age of algorithms.

This research aims to forecast stock values using the Long-Short Term Memory (LSTM) Deep Learning model.

Using historical closing price and trade volume, we will construct an LSTM using Keras, and we will then visualize both the anticipated price values over time and the best model parameters.

## 1.1 OBJECTIVES

The following are the objectives of this project:

- Explore stock prices
- Implement LSTM model
- Calculating the risk by investing in a particular stock
- Compare the results
- Develop a website

## 1.2 BACKGROUND AND LITERATURE SURVEY

Some Literacy surveys for this project:

A. Research on Stock Price Prediction Method Based on Convolutional Neural Network, IEEE 2019- Sayavong Lounnapha et al. This paper intends for a prediction model for stock price which is centered at the convolutional neural networks, that has

exceptional capability of learning on its own. The data set is taught and tested relating the behaviors of both Convolutional Neural Networks and Thai stock market The result shows that the model on grounds of Convolutional Neural Networks can effectually recognize the altering trend in stock market price and envisage it which provides significant allusion for stock price forecast. The accuracy of the prediction is found to be elevated, and it could also be promoted in the field of finance.

B. Enhancing Profit by Predicting Stock Prices using Deep Neural Networks, IEEE 2019-Soheila Abrishami, et al., The prediction of economic time series is quite a herculean task, which has fascinated the attentiveness of many scholars and is extremely vital for investors. This paper focuses on presenting a deep learning system, which makes use of a range of facts for a part of the stocks on the NASDAQ exchange to predict the value of the stock. This model has been trained on the smallest of data for a particular stock and accurately estimates the concluding value of that stock for multi-stepahead. It consists of an auto encoder in order to remove noise and makes use of time series data engineering to syndicate the advanced features with the original features. These new features are given to a Stacked LSTM Autoencoder for multistep-ahead estimation of the stock concluding value. Further, this estimation is used by a profit maximization approach to offer

assistance on the right time for buying and selling a particular stock. The results indicate that the suggested framework outclasses the state of the art time series forecasting methodologies with respect to analytical accuracy and effectiveness.

C. An LSTM-Method for Bit-coin Price Prediction: A Case Study Yahoo Finance Stock Market, IEEE 2019- Ferdiansyah et al., Bit-coin is a type of Cryptocurrency and currently is one of a kind of investment on the stock market. Stock markets are inclined by several risks. And bit-coin is one kind of crypto currency that keeps rising in recent years, and sometimes suddenly falls without knowing the influence on the stock market. There's a need for automation tools to predict bit-coin on the stock market because of its fluctuations. This research study studies how to create mode prediction bit-coin stock market prediction using LSTM. Before confirming the results the paper tries to measure the results using RMSE (the Root Mean Square Error).The RMSE will at all times be larger or equal to the MAE. The RMSE metric assesses how well a model can calculate a continuous value. The method that is applied on this research to predict Bit-coin on the stock market Yahoo finance can forecast the result above $12600 USD for the next couple of days after prediction.

D. Share Price Prediction using Machine Learning Technique, IEEE 2019-Jeevan B et al., Lately stock market has been the talk of the

town with more and more people from academics and business showing interest in it. This paper mostly deals with the approach towards predicting stock prices using RNN (Recurrent Neural Network) and LSTM (Long Short Term Memory) on the National Stock Exchange using numerous elements such as the present-day market price as well as anonymous events. A recommendation system along with models constructed on RNN and LSTM methods are used in selecting the company is also mentioned in this paper.

E. Stock Market Prediction Using Machine Learning Techniques, IEEE 2020- Naadun Sirimevan et al., The Stock Market Prices play a crucial role in today' economy. Researchers have discovered that social media platforms such as twitter and web news tend to influence the decision making process of any individual. In this research behavioral reflex towards web news is taken into count to reduce the gap and make the prediction much more accurate Precise predictions.

## 1.3 ORGANIZATION OF REPORT

The remaining chapters of the project report are described as follows:

- Chapter 2 contains the proposed system, methodology, software details and standards.
- Chapter 3 Analysis part of the project.
- Chapter 4 discusses the results obtained after the project was implemented.
- Chapter 5 concludes the report.
- Chapter 6 consists of codes.
- Chapter 7 gives references.

# CHAPTER 2
# STOCK PRICE PREDICTION USING LSTM

This Chapter describes the proposed system, working methodology, and software details.

## 2.1 PROPOSED SYSTEM

We wanted to develop a website-based Stock price prediction. So, we used the LSTM model in Deep Learning for our project.

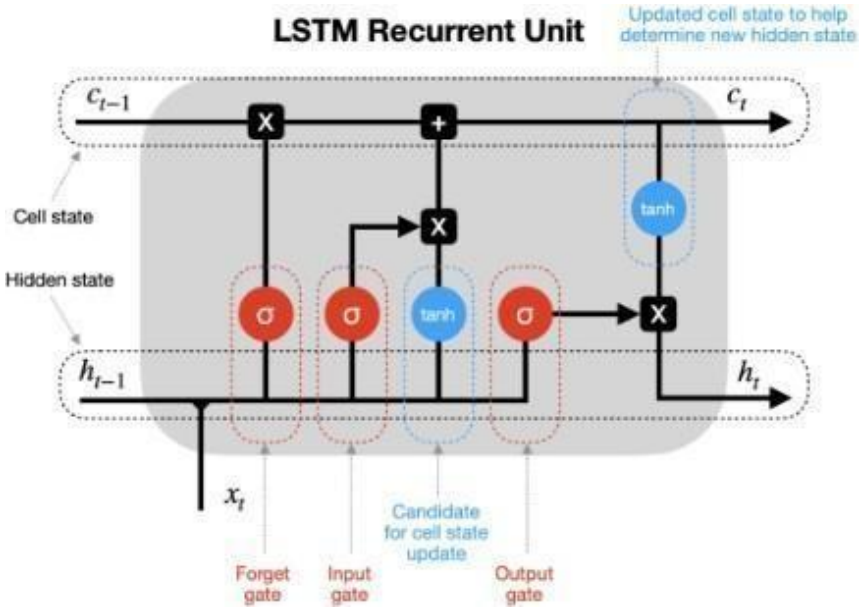
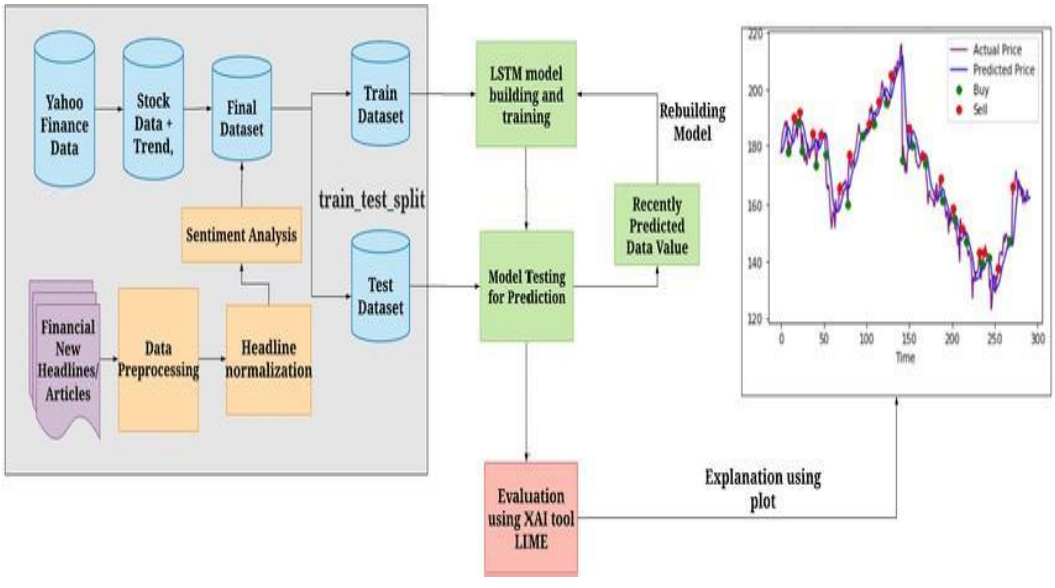



**Figure-1. LSTM recurrent Neural Network**

## 2.2 WORKING METHODOLOGY

Because there are numerous issues that have not been resolved and first don't appear to be statistical, stock market prediction appears to be a challenging topic. However, a number of machine learning algorithms have come to our aid, allowing us to effectively forecast current stock market patterns by leveraging references from historical data. The dataset in this case that we're going to use was compiled from Yahoo Finance.

For long-short term memory, use LSTM. In essence, it is composed of three layers: input, forget, and output. It is up to the input layer to determine how much data from the previous layer should be sent on to the next layer, and it is up to the output layer to determine how much data should be sent on to the next layer as input. The LSTM's unique ability to memorize the data is what accounts for its enormous popularity.



# Website Interaction pictures:

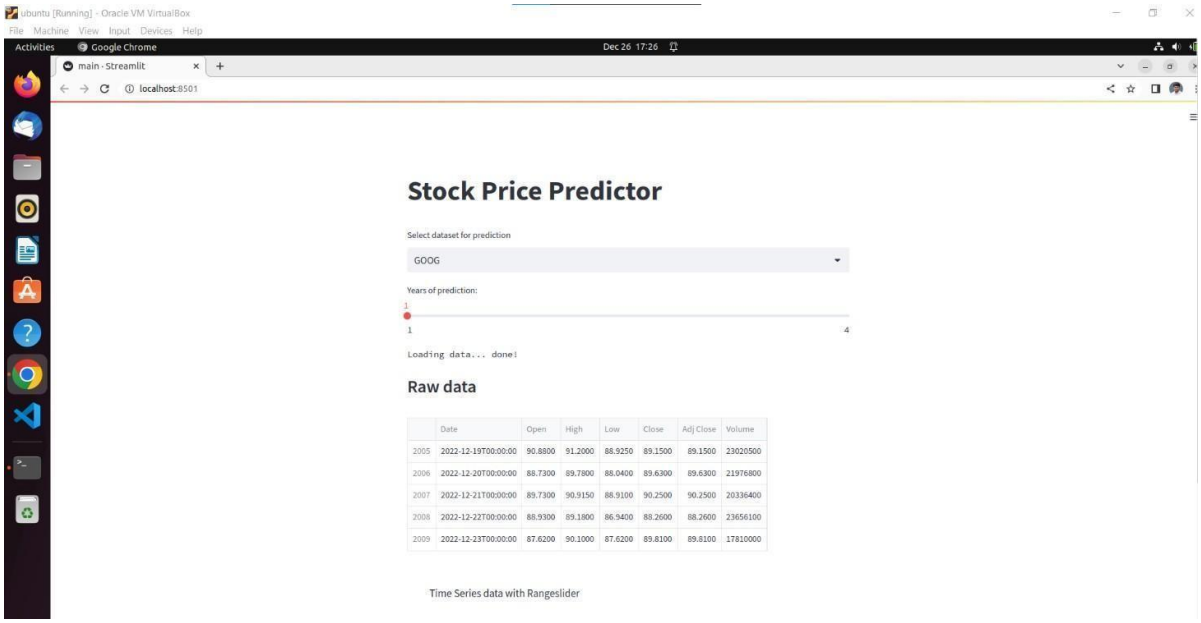



**Figure-3. Home Page**

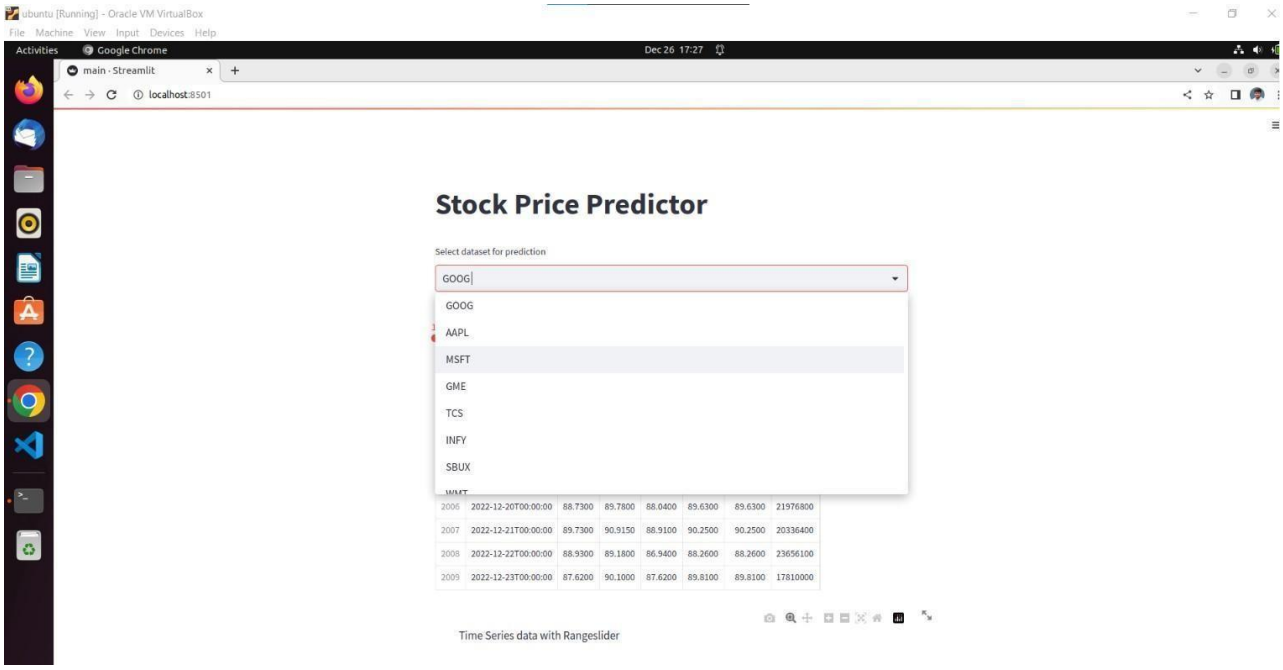



**Figure-4. Drop Down List**

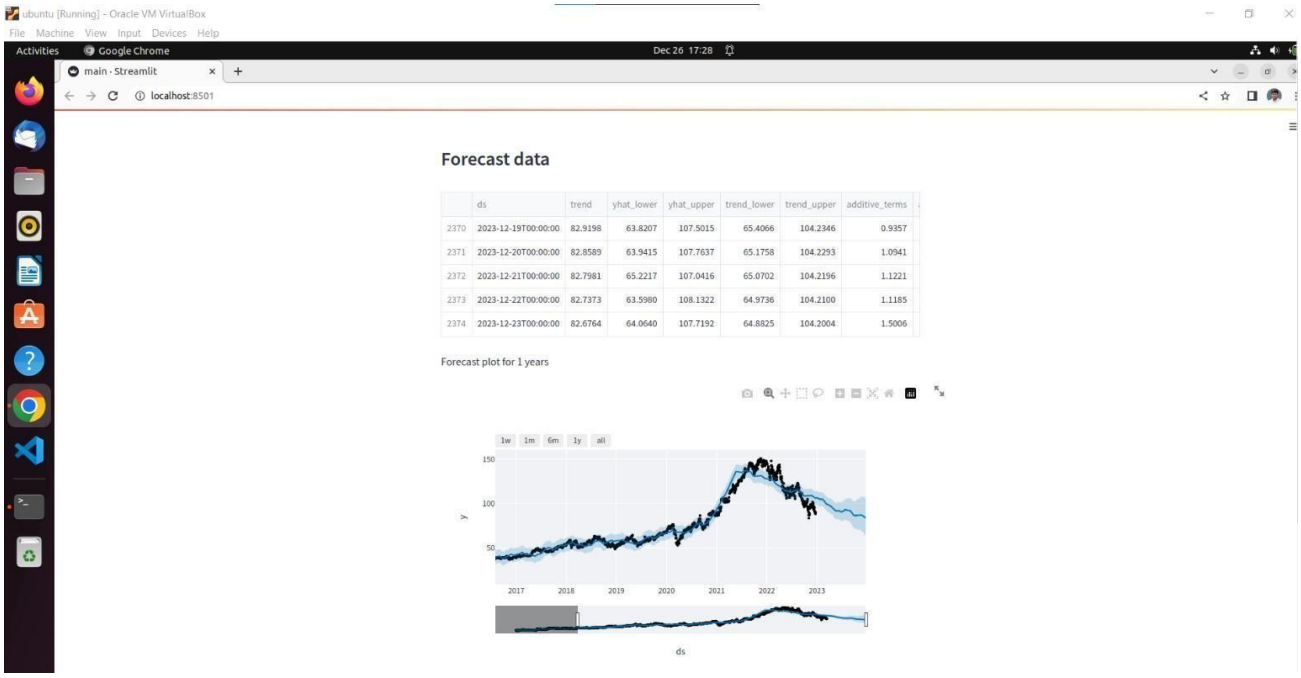



**Figure-5. Forecasting the Data**

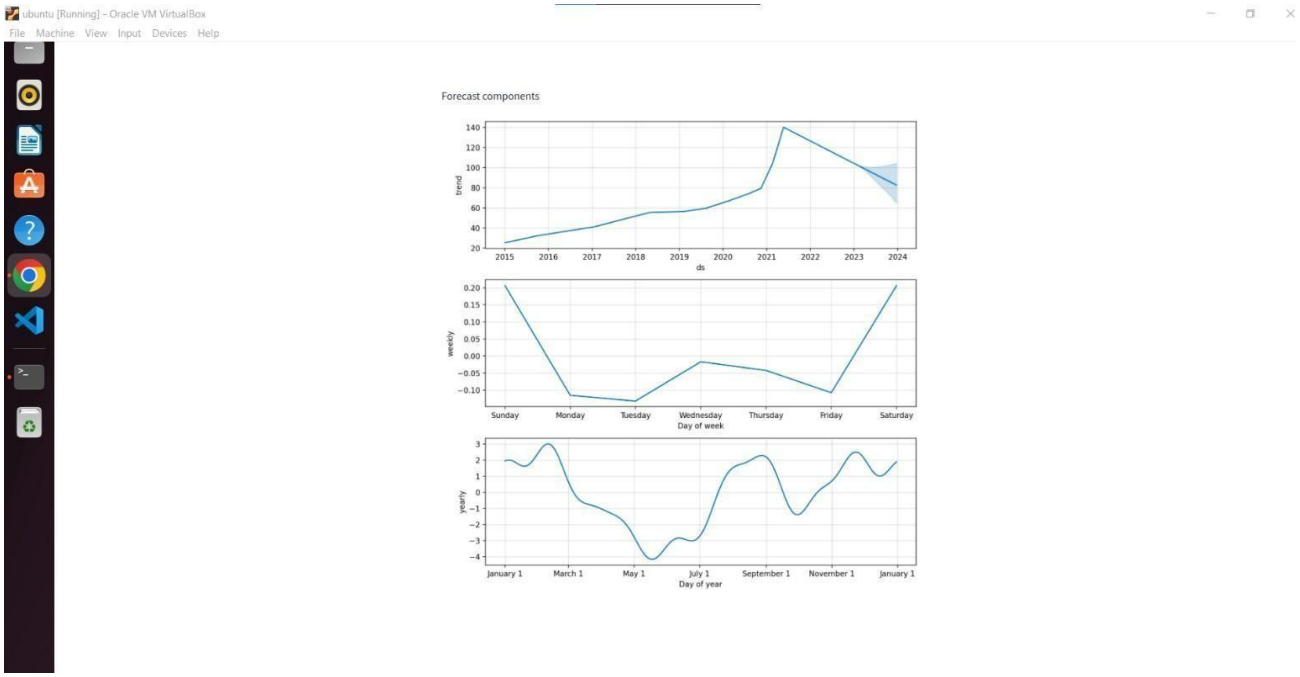



**Figure-6. Forecasting in other ways**

## 2.3 SYSTEM DETAILS

This section describes the software details of the system:

### 2.3.1 SOFTWARE DETAILS

Software Technologies like python, Streamlit (open source app framework in python).

**Python:**

The implementation of Stock price prediction in python coding is made easier by the variety of python modules and frameworks. Another plus is that it's easy to read. It speeds up communication and cuts down on development time.

**Streamlit:**

Streamlit is an open source app Framework in python language. It helps us create web apps for Data science and Machine Learning in a short time.

# CHAPTER 3

# ANALYSIS

## 3.1 CHANGE IN PRICE OF THE STOCK OVER TIME

After reading stock data from yahoo and taking the required stock data of the companies we are analyzing, the first thing we checked was the change in the price of the stock over time. For this we have to plot the closing price of the stock of a particular company.

## 3.2 MOVING AVERAGE OF VARIOUS STOCKS

After seeing the change in price of the stock over time we will move forward to see the moving averages of various stocks. A moving average is the stock indicator commonly used in technical analysis, used to help smooth out price data by creating a constantly updated average price. A rising moving average indicates that the security is in an uptrend, while a declining moving average indicates a downtrend.

## 3.3 DAILY RETURN OF THE STOCK ON AVERAGE

Now, after the basic analysis, to go deep and to find the risk of the stock, we need to take a closer look at the daily changes of the stock

And we have used pandas to retrieve the daily returns of the particular stock.

## 3.4 CORRELATION BETWEEN DIFFERENT STOCKS

And the next step in our analysis we are going to find the relation between the different stocks of different prices.

if two stocks are perfectly (and positively) correlated with each other a linear relationship between its daily return values should occur.

## 3.5 How much value do we put at risk by investing in a particular stock?

There are many ways we can quantify risk, one of the most basic ways using the information we've gathered on daily percentage returns is by comparing the expected return with the standard deviation of the daily returns.

# CHAPTER 4

# RESULTS AND DISCUSSIONS

This project will help to Analyze the stocks and predict the future stock.


**Figure-7. CHANGE IN PRICE OF THE STOCK OVER TIME**

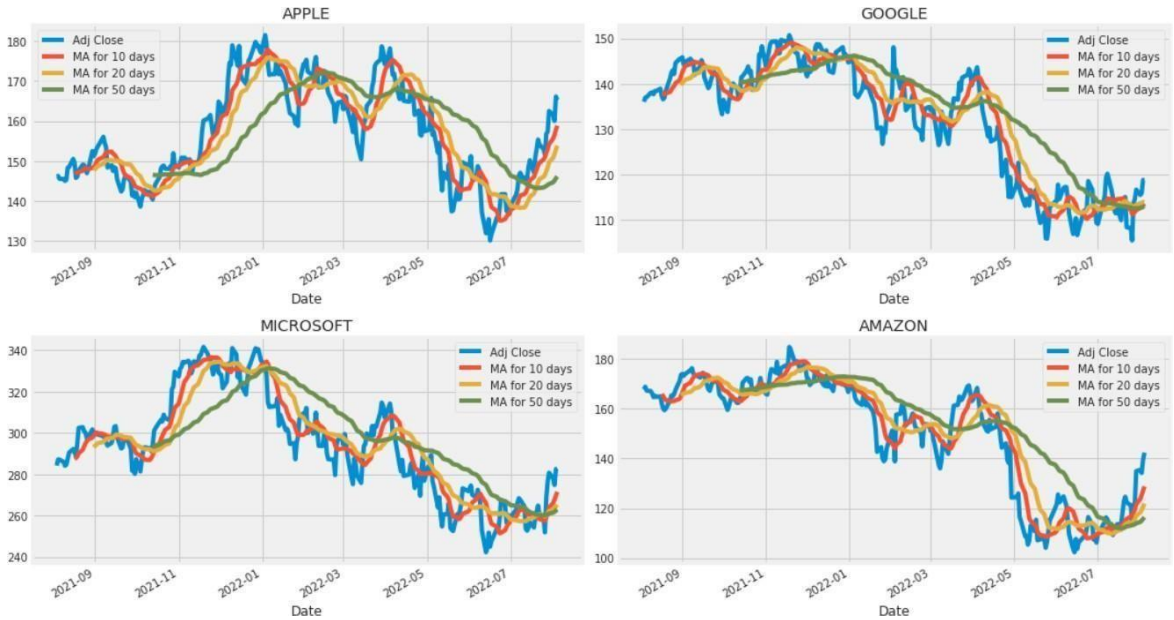



**Figure-8. MOVING AVERAGE OF VARIOUS STOCKS**

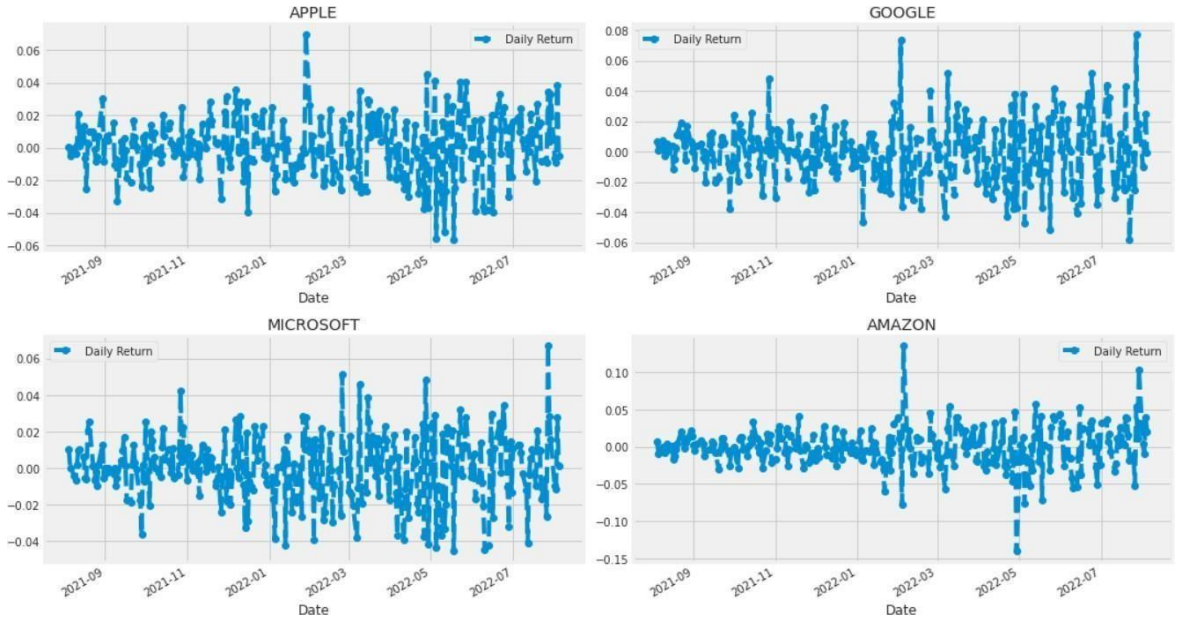



**Figure-9. DAILY RETURN OF THE STOCK ON AVERAGE**

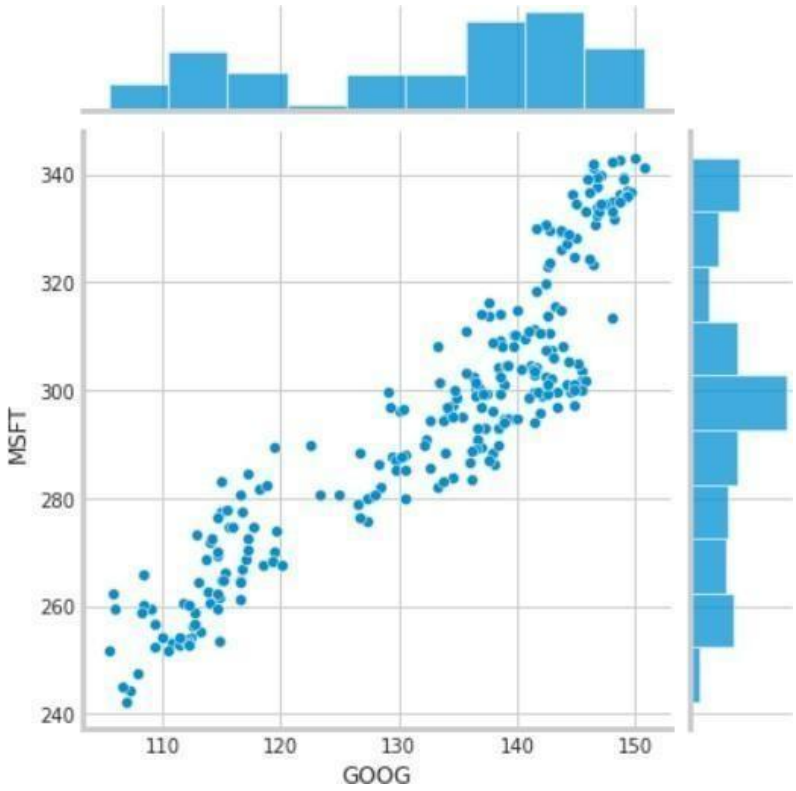



**Figure-10. CORRELATION BETWEEN DIFFERENT STOCKS**

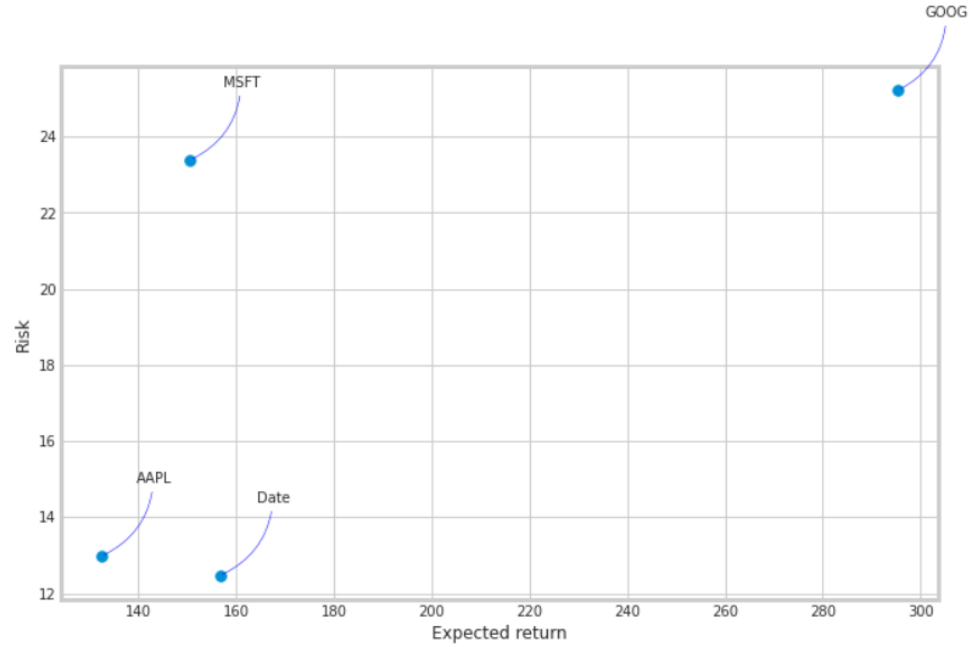



**Figure-11. Calculating Risk factor**

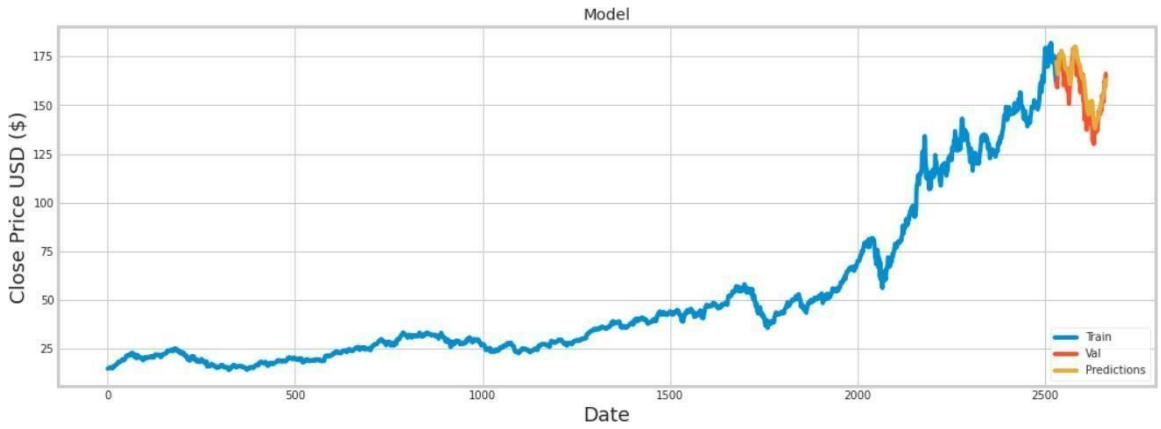



**Figure-12. Prediction in Graph**

valid

1 to 100 of 133 entries Filter

| index | Close | Predictions |
|---|---|---|
| 2531 | 161.619995 | 159.150909423828 |
| 2532 | 159.779999 | 157.495452880859 |
| 2533 | 159.690002 | 155.853363037109 |
| 2534 | 159.220001 | 154.465011596679 |
| 2535 | 170.330002 | 153.331253051758 |
| 2536 | 174.779999 | 154.083221435546 |
| 2537 | 174.610001 | 156.129318237304 |
| 2538 | 175.839996 | 158.421035766601 |
| 2539 | 172.899994 | 160.674057006835 |
| 2540 | 172.389999 | 162.134963989257 |
| 2541 | 171.660004 | 162.964874267578 |
| 2542 | 174.830002 | 163.267333984375 |
| 2543 | 176.279999 | 163.733978271484 |
| 2544 | 172.119995 | 164.373077392578 |
| 2545 | 168.639999 | 164.385971069335 |
| 2546 | 168.880005 | 163.659042358398 |
| 2547 | 172.789993 | 162.766235351562 |
| 2548 | 172.550003 | 162.480346679687 |
| 2549 | 168.880005 | 162.440475463867 |
| 2550 | 167.300003 | 162.006378173828 |
| 2551 | 164.320007 | 161.273590087890 |
| 2552 | 160.070007 | 160.097783203125 |
| 2553 | 162.740005 | 158.310424804687 |
| 2554 | 164.850006 | 156.925628662109 |
| 2555 | 165.119995 | 156.197860717773 |

**Figure-13. Comparison of valid and predicted**

# CHAPTER 5

# CONCLUSION AND FUTURE WORK

And as there is scope of improvement in each individual, so is the case with this project. This project though predicts closing prices with very minimum Mean Squared Error, still there are some ways to improve this project.

- Website can be done more attractively.
- The stocks used for this project are only of Alphabet Inc, we can surely add more S&P 500 in the list so as to make this project more comprehensive.

  These areas can be improved in the future.

# CHAPTER 6

# APPENDIX

## Analysis code:

```
!pip install -q yfinance

import pandas as pd
import numpy as np


import matplotlib.pyplot as plt
import seaborn as sns
sns.set_style('whitegrid')
plt.style.use("fivethirtyeight")
%matplotlib inline


from pandas_datareader.data import DataReader
import yfinance as yf


from datetime import datetime
tech_list = ['AAPL', 'GOOG', 'MSFT', 'AMZN']

tech_list = ['AAPL', 'GOOG', 'MSFT', 'AMZN']


end = datetime.now()
start = datetime(end.year - 1, end.month, end.day)
```

```
for stock in tech_list:
    globals()[stock] = yf.download(stock, start, end)

company_list = [AAPL, GOOG, MSFT, AMZN]
company_name = ["APPLE", "GOOGLE", "MICROSOFT", "AMAZON"]


for company, com_name in zip(company_list,
    company_name): company["company_name"] = com_name

df = pd.concat(company_list, axis=0)
df.head(5)

df.tail(5)

AAPL.describe()
GOOG.describe()

AAPL.info()


plt.figure(figsize=(15, 6))
plt.subplots_adjust(top=1.25, bottom=1.2)


for i, company in enumerate(company_list, 1):
    plt.subplot(2, 2, i)
```

```
    company['Adj Close'].plot()
    plt.ylabel('Adj Close')
    plt.xlabel(None)
    plt.title(f"Closing Price of {tech_list[i - 1]}")

plt.tight_layout()
plt.figure(figsize=(15,
7))
plt.subplots_adjust(top=1.25, bottom=1.2)


for i, company in enumerate(company_list,
    1): plt.subplot(2, 2, i)
    company['Volume'].plot()
    plt.ylabel('Volume')
    plt.xlabel(None)
    plt.title(f"Sales Volume for {tech_list[i - 1]}")

plt.tight_layout()

ma_day = [10, 20, 50]


for ma in ma_day:
```

```
    for company in company_list:
        column_name = f"MA for {ma}
        days"
        company[column_name] = company['Adj Close'].rolling(ma).mean()

fig, axes = plt.subplots(nrows=2, ncols=2)
fig.set_figheight(8)
fig.set_figwidth(15)

AAPL[['Adj Close', 'MA for 10 days', 'MA for 20 days', 'MA for 50
days']].plot(ax=axes[0,0])
axes[0,0].set_title('APPLE')

GOOG[['Adj Close', 'MA for 10 days', 'MA for 20 days', 'MA for 50
days']].plot(ax=axes[0,1])
axes[0,1].set_title('GOOGLE')

MSFT[['Adj Close', 'MA for 10 days', 'MA for 20 days', 'MA for 50
days']].plot(ax=axes[1,0])
axes[1,0].set_title('MICROSOFT')
```

```
AMZN[['Adj Close', 'MA for 10 days', 'MA for 20 days', 'MA for 50 days']].plot(ax=axes[1,1])

axes[1,1].set_title('AMAZON')


fig.tight_layout()

for company in company_list:

    company['Daily Return'] = company['Adj Close'].pct_change()


fig, axes = plt.subplots(nrows=2, ncols=2)

fig.set_figheight(8)

fig.set_figwidth(15)


AAPL['Daily Return'].plot(ax=axes[0,0], legend=True, linestyle='--', marker='o')

axes[0,0].set_title('APPLE')


GOOG['Daily Return'].plot(ax=axes[0,1], legend=True, linestyle='--', marker='o')

axes[0,1].set_title('GOOGLE')
```

```
MSFT['Daily Return'].plot(ax=axes[1,0], legend=True, linestyle='--',
marker='o')
axes[1,0].set_title('MICROSOFT')


AMZN['Daily Return'].plot(ax=axes[1,1], legend=True,
linestyle='--', marker='o')
axes[1,1].set_title('AMAZON')


fig.tight_layout()


plt.figure(figsize=(12, 7))


for i, company in enumerate(company_list, 1):
    plt.subplot(2, 2, i)
    company['Daily Return'].hist(bins=50)
    plt.ylabel('Daily Return')
    plt.title(f'{company_name[i - 1]}')


plt.tight_layout()


closing_df = pd.read_csv('AMZN.csv')
```

```
closing_df.head()

sns.jointplot(x='GOOG', y='GOOG', data=closing_df, kind='scatter',
color='seagreen')

sns.jointplot(x='GOOG', y='MSFT', data=closing_df, kind='scatter')

sns.pairplot(closing_df, kind='reg')


return_fig = sns.PairGrid(closing_df.dropna())


return_fig.map_upper(plt.scatter, color='purple')


return_fig.map_lower(sns.kdeplot, cmap='cool_d')


return_fig.map_diag(plt.hist, bins=30)

returns_fig = sns.PairGrid(closing_df)


returns_fig.map_upper(plt.scatter,color='purple')
```

```
returns_fig.map_lower(sns.kdeplot,cmap='cool_d')


returns_fig.map_diag(plt.hist,bins=30)

sns.heatmap(closing_df.corr(), annot=True, cmap='summer')

rets = closing_df.dropna()


area = np.pi * 20


plt.figure(figsize=(10, 7))
plt.scatter(rets.mean(), rets.std(), s=area)
plt.xlabel('Expected return')
plt.ylabel('Risk')


for label, x, y in zip(rets.columns, rets.mean(), rets.std()):
    plt.annotate(label, xy=(x, y), xytext=(50, 50), textcoords='offset
    points',
ha='right', va='bottom',
                arrowprops=dict(arrowstyle='-',
color='blue', connectionstyle='arc3,rad=-0.3'))
```

```
plt.figure(figsize=(16,6))
plt.title('Close Price History')
plt.plot(df['Close'])
plt.xlabel('Date', fontsize=18)
plt.ylabel('Close Price USD ($)', fontsize=18)
plt.show()
```

```
data = df.filter(['Close'])
dataset = data.values
training_data_len = int(np.ceil( len(dataset) * .95 ))
```

```
training_data_len
from sklearn.preprocessing import MinMaxScaler
```

```
scaler = MinMaxScaler(feature_range=(0,1))
scaled_data = scaler.fit_transform(dataset)
```

```
scaled_data
```

```
train_data = scaled_data[0:int(training_data_len), :]
```

```
x_train = []
```

```
y_train = []


for i in range(60, len(train_data)):
    x_train.append(train_data[i-60:i,
    0])
    y_train.append(train_data[i, 0])

    if i<= 61:
        print(x_train)
        print(y_train)
        print()



x_train, y_train = np.array(x_train), np.array(y_train)


x_train = np.reshape(x_train, (x_train.shape[0], x_train.shape[1], 1))
from keras.models import Sequential
from keras.layers import Dense, LSTM



model = Sequential()
model.add(LSTM(128, return_sequences=True, input_shape=
(x_train.shape[1], 1)))
model.add(LSTM(64, return_sequences=False))
model.add(Dense(25))
model.add(Dense(1))
```

```
model.compile(optimizer='adam', loss='mean_squared_error')

model.fit(x_train, y_train, batch_size=1, epochs=1)

test_data = scaled_data[training_data_len - 60: , :]

x_test = []
y_test = dataset[training_data_len:, :]
for i in range(60, len(test_data)):
    x_test.append(test_data[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 ))

predictions = model.predict(x_test)
predictions = scaler.inverse_transform(predictions)

rmse = np.sqrt(np.mean(((predictions - y_test) ** 2)))
rmse
```

```
train = data[:training_data_len]
valid = data[training_data_len:]
valid['Predictions'] =
predictions


plt.figure(figsize=(16,6))
plt.title('Model')
plt.xlabel('Date', fontsize=18)
plt.ylabel('Close Price USD ($)', fontsize=18)
plt.plot(train['Close'])
plt.plot(valid[['Close', 'Predictions']])
plt.legend(['Train', 'Val', 'Predictions'], loc='lower
right') plt.show()
Valid
```

## Website code:

```
import streamlit as st
from datetime import
date


import yfinance as yf
from prophet import Prophet
from prophet.plot import plot_plotly
from plotly import graph_objs as go


START = "2015-01-01"
TODAY = date.today().strftime("%Y-%m-%d")


st.title('Stock Price Predictor')


stocks = ('GOOG', 'AAPL', 'MSFT', 'GME', 'TCS', 'INFY', 'SBUX',
'WMT', 'TM','VWAGY' )
selected_stock = st.selectbox('Select dataset for prediction', stocks)


n_years = st.slider('Years of prediction:', 1, 4)
period = n_years * 365



@st.cache
def load_data(ticker):
data = yf.download(ticker, START, TODAY)
data.reset_index(inplace=True)
return data
```

```
data_load_state = st.text('Loading data...')
data = load_data(selected_stock)
data_load_state.text('Loading data... done!')


st.subheader('Raw data')
st.write(data.tail())


def plot_raw_data():
fig = go.Figure()
fig.add_trace(go.Scatter(x=data['Date'],
y=data['Open'], name="stock_open"))
fig.add_trace(go.Scatter(x=data['Date'],
y=data['Close'], name="stock_close"))
fig.layout.update(title_text='Time Series data with Rangeslider',
xaxis_rangeslider_visible=True)
st.plotly_chart(fig)


plot_raw_data()


df_train = data[['Date','Close']]
df_train = df_train.rename(columns={"Date": "ds", "Close": "y"})


m = Prophet()
m.fit(df_train)
future = m.make_future_dataframe(periods=period)
forecast = m.predict(future)
```

```
st.subheader('Forecast data')
st.write(forecast.tail())


st.write(f'Forecast plot for {n_years} years')
fig1 = plot_plotly(m, forecast)
st.plotly_chart(fig1)


st.write("Forecast components")
fig2 = m.plot_components(forecast)
st.write(fig2)
```

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