

STOCK MARKET PREDICTION USING DEEP LEARNING

Submitted in partial fulfillment of the requirements
for the award of
Bachelor of Engineering Degree in Computer Science and Engineering

by

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**DEPARTMENT OF COMPUTER SCIENCE AND
ENGINEERING SCHOOL OF COMPUTING**

**SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY**

(DEEMED TO BE UNIVERSITY)

Accredited with Grade "A" by NAAC

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DEPARTMENT OF COMPUTER SCIENCE AND

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This is to certify that this Project Report is the bonafide work of **VEMPARALA ASHOK** (Reg.No.38110053), **CH.PVS GANGADHAR** (Reg.No.38110108) who carried out the project entitled "**STOCK MARKET PREDICTION USING DEEP LEARNING**" under our supervision from Nov 2021 to April 2022

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DECLARATION

**I, VEMPARALA ASHOK (Reg.No.38110053) ,CH.PVS
GANGADHAR (Reg.No.38110108)** hereby declare that the Project Report entitled

**“STOCK MARKET PREDICTION USING DEEP
LEARNING”** done by me under the guidance of **Dr.S.Jancy.MCA.MBA.,M.Tech.Ph.D.,i**
ssubmitted in partial fulfilment of the requirements for the award of Bachelor of Engineering
degree in Computer Science and Engineering.

DATE :

PLACE:

SIGNATURE OF THE CANDIDATE

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STOCK MARKET PREDICTION USING DEEP LEARNING

ABSTRACT

The neural network, one of the intelligent data mining technique that has been used by researchers in various areas for the past 10 years. Prediction and

analysis of stock market data have got an important role in today's economy. The various algorithms used for forecasting can be categorized into linear (AR, MA, ARIMA, ARMA) and non-linear models. In this paper, we are using four types of deep learning architectures i.e. Recurrent Neural Networks (RNN) for predicting the stock price of a company based on the historical prices available. Here we are using day-wise closing price of two different stock markets, National Stock Exchange (NSE) of India and New York Stock Exchange. The network was trained with the stock price of a single company from NSE and predicted for five different companies from both NSE and NYSE. It has been observed that CNN is outperforming the other models. The network was able to predict for NYSE even though it was trained with NSE data. This was possible because both the stock markets share some common inner dynamics. The results obtained were compared with ARIMA model and it has been observed that the neural networks are outperforming the existing linear model.

CHAPTER 1

INTRODUCTION

Stock market is a place where shares or stocks of a firm are traded. It can be split into two components:

- primary market
- secondary market

Primary market is where new issues are introduced to the market through Initial Public Offerings. Secondary market is where investors trade securities that they already own. Stock market is having a highly fluctuating and non-linear time series data. A time series is a set of data measured over time to acquire the status of some activity [6]. Linear models like AR, ARMA, ARIMA [9][10] have been used for stock market forecasting. The only problem with these models are, that they work only for a particular time series data, i.e the model identified for a particular company won't perform well for another. Due to the equivocal and unforeseeable nature of stock market, stock market forecasting takes higher risk compared to other sectors. It is one of the most important reason for the difficulty in stock market prediction. Here is where the application of deep-learning models in financial [4] forecasting comes in. Deep neural network got its name due to the use of neural network architecture in DL models. It is also called as ANN. ANNs are good approximators and they are capable to learn and generalize from experience. Practical application of ANN in

forecasting problems is very successful due to the following characteristics:

- ANN's are good function approximators, so the input and output relationship can be examined by them even if the data set is very complex.
- ANN's can identify new test samples even if they have not been used during the training of network. For the past few decades, ANN has been used for stock market prediction. Comparison study of different DL models of stock market prediction has already been done as we can see in [1]. CoskunHamzacebi has experimented forecast- ing using iterative and directive methods [6].

AjithKumar Rout et.al made use of a low complexity recurrent neural network for stock market prediction [7]. Yunus Yetis et.al applied ANN to predict NASDAQ's (National Association of Securities Dealers Automated Quotations) stock value with given input parameter of stock market [12]. Roman et.al performed an analysis on multiple stock market return using Back propagation and RNN [13]. Neini et.al conducted a comparison study between Feed Forward MLP and Elman Recurrent Network for predicting stock value of company [18]. Mizuno et.al applied neural networks to technical analysis as a prediction model [15]. Guresen in 2011 had conducted a study to know about the effectiveness of ANN in stock market forecasting [19]. In [20], they explored the interdependency between stock volume and stock price on a certain number of nifty 50 listed companies. In [21], Batres-Estrada explains about different applications of DL models on time series analysis. X Ding et.al in [22] conducted a study on combination of Natural language processing (NLP) and financial time series analysis. In [23], they used ML algorithms like Least Square Support Vector Machine (LSSVM) and Particle Swarm Optimization (PSO) for stock market prediction. In [24], Kim et.al proposed a different approach for stock market prediction. i.e They introduced a Genetic Algorithm(GA) for discretization of features in ANN for stock price forecasting. In [25], deals with multi-stage fuzzy inference and wavelet transform for forecasting stock trends. Here the short-term features present in the stock trend is described using wavelet transform.

Stock market is characterized as dynamic, unpredictable and non-linear in nature. Predicting stock prices is a challenging task as it depends on various factors including but not limited to political conditions, global economy, company's financial reports and performance etc. Thus, to maximize the profit and minimize the losses, techniques to predict values of the stock in advance by analyzing the trend over the last few years, could prove to be highly useful for making stock market movements

Traditionally, two main approaches have been proposed for predicting the stock price of an organization. Technical analysis method uses historical price of stocks like closing and opening price, volume traded, adjacent close values etc. of the stock for predicting the future price of the stock. The second type of analysis is qualitative, which is performed on the basis of external factors like company profile, market situation, political and economic factors, textual information in the form of financial news articles, social media and even blogs by economic analyst. Now a days, advanced intelligent techniques based on either technical or fundamental analysis are used for predicting stock prices. Particularly, for stock market analysis, the data size is huge and also non-linear. To deal with this variety of data an efficient model is needed that can identify the hidden patterns and complex relations in this large data set. Machine learning techniques in this area have proved to improve efficiencies by 60-86 percent as compared to the past methods

1.1 OBJECTIVE

The objective is to predict the stock prices in order to make more informed and accurate investment decisions. A stock market prediction is described as an action of attempting to classify the future value of the company stock or other financial investment traded on the stock exchange. The forthcoming price of a stock of the successful estimation is called the Yield significant profit. This helps you to invest wisely for making good profits.

1.2 EXISTING SYSTEM

1.2.1 DISADVANTAGES OF EXISTING ALGORITHM

- have a very significant effect on an organization's performance. This paper proposed a technique to reveal the performance of a company.

- The technique deployed in the paper is used to find the relationships between the frequencies of email exchange of the key employees and the performance of the company reflected in stock values.
- In order to detect association and non-association relationships, this paper proposed to use a data mining algorithm on a publicly available dataset of Enron Corp.
- The Enron Corporation was an energy, commodities, and services company based in Houston, Texas whose stock dataset is available for public use.

DISADVANTAGE

- The existing system fails when there are rare outcomes or predictors, as the algorithm is based on bootstrap sampling.
- The previous results indicate that the stock price is unpredictable when the traditional classifier is used.
- The existing system reported highly predictive values, by selecting an appropriate time period for their experiment to obtain highly predictive scores.
- The existing system does not perform well when there is a change in the operating environment. 🏢 It doesn't focus on external events in the environment, like news events or social media. It exploits only one data source, thus highly biased.

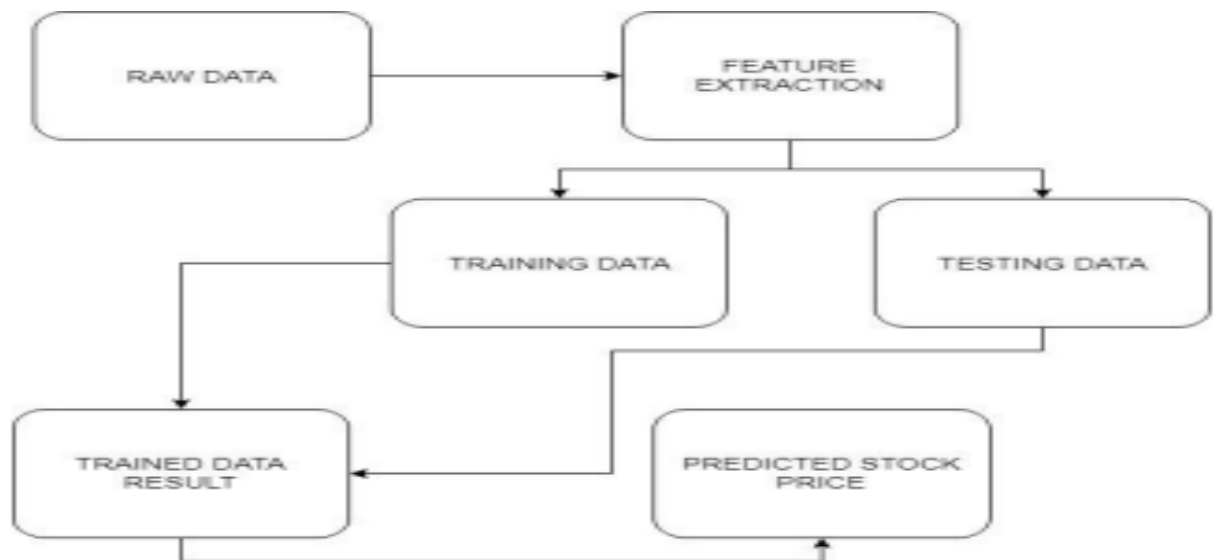
1.3 PROPOSED SYSTEM

- 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.

ADVANTAGE:

- 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.

block diagram:



CHAPTER 2

LITERATURE SURVEY

2.1 Stock Prices Prediction Using Machine Learning and Deep Learning Techniques (with Python codes)

Introduction

Predicting how the stock market will perform is one of the most difficult things to do. There are so many factors involved in the prediction – physical factors vs. psychological, rational and irrational behavior, etc. All these aspects combine to make share prices volatile and very difficult to predict with a high degree of accuracy.

Can we use machine learning as a game-changer in this domain? Using features like the latest announcements about an organization, their quarterly revenue results, etc., machine learning techniques have the potential to unearth patterns and insights we didn't see before, and these can be used to make unerringly accurate predictions.

In this article, we will work with historical data about the stock prices of a publicly listed company. We will implement a mix of machine learning algorithms to predict the future stock price of this company, starting with simple algorithms like averaging and linear regression, and then move on to advanced techniques like Auto ARIMA and LSTM. The above-stated machine learning algorithms can be easily learned from this ML Course online.

The core idea behind this article is to showcase how these algorithms are implemented. I will briefly describe the technique and provide relevant links to brush up on the concepts as and when necessary. In case you're a newcomer to the world of time series, I suggest going through the following articles first:

- A comprehensive beginner's guide to create a Time Series Forecast
- A Complete Tutorial on Time Series Modeling
- Free Course: Time Series Forecasting using Python

Understanding the Problem Statement

We'll dive into the implementation part of this article soon, but first it's important to establish what we're aiming to solve. Broadly, stock market analysis is divided into two parts – Fundamental Analysis and Technical Analysis.

- Fundamental Analysis involves analyzing the company's future profitability on the basis of its current business environment and financial performance.
- Technical Analysis, on the other hand, includes reading the charts and using statistical figures to identify the trends in the stock market.

As you might have guessed, our focus will be on the technical analysis part. We'll be using a dataset from Quandl (you can find historical data for various stocks here) and for this particular project, I have used the data for 'Tata Global Beverages'. Time to dive in!

There are multiple variables in the dataset – date, open, high, low, last, close, total_trade_quantity, and turnover.

- The columns Open and Close represent the starting and final price at which the stock is traded on a particular day.
- High, Low and Last represent the maximum, minimum, and last price of the share for the day.
- Total Trade Quantity is the number of shares bought or sold in the day and Turnover (Lacs) is the turnover of the particular company on a given date.

Another important thing to note is that the market is closed on weekends and public holidays. Notice the above table again, some date values are missing – 2/10/2018, 6/10/2018, 7/10/2018. Of these dates, 2nd is a national holiday while 6th and 7th fall on a weekend.

The profit or loss calculation is usually determined by the closing price of a stock for the day, hence we will consider the closing price as the target variable. Let's plot the target variable to understand how it's shaping up in our data:

Moving Average

Introduction

'Average' is easily one of the most common things we use in our day-to-day lives. For instance, calculating the average marks to determine overall performance, or finding the average temperature of the past few days to get an idea about today's temperature – these all are routine tasks we do on a regular basis. So this is a good starting point to use on our dataset for making predictions.

The predicted closing price for each day will be the average of a set of previously observed values. Instead of using the simple average, we will be using the moving average technique which uses the latest set of values for each

prediction. In other words, for each subsequent step, the predicted values are taken into consideration while removing the oldest observed value from the set. Here is a simple figure that will help you understand this with more clarity.

Inference

The RMSE value is close to 105 but the results are not very promising (as you can gather from the plot). The predicted values are of the same range as the observed values in the train set (there is an increasing trend initially and then a slow decrease).

In the next section, we will look at two commonly used machine learning techniques – Linear Regression and kNN, and see how they perform on our stock market data.

Linear Regression

Introduction

The most basic machine learning algorithm that can be implemented on this data is linear regression. The linear regression model returns an equation that determines the relationship between the independent variables and the dependent variable.

The equation for linear regression can be written as:

$$Y = \theta_1 X_1 + \theta_2 X_2 + \dots \theta_n X_n$$

Here, $x_1, x_2, \dots, x_n$ represent the independent variables while the coefficients $\theta_1, \theta_2, \dots, \theta_n$ represent the weights. You can refer to the following article to study linear regression in more detail:

- A comprehensive beginners guide for Linear, Ridge and Lasso Regression.

For our problem statement, we do not have a set of independent variables. We have only the dates instead. Let us use the date column to extract features like – day, month, year, mon/fri etc. and then fit a linear regression model.

Time series forecasting is a very intriguing field to work with, as I have realized during my time writing these articles. There is a perception in the community that it's a complex field, and while there is a grain of truth in there, it's not so difficult once you get the hang of the basic techniques.

I am interested in finding out how LSTM works on a different kind of time series problem and encourage you to try it out on your own as well. If you have any questions, feel free to connect with me in the comments section below.

2.2An Easy Guide to Stock Price Prediction Using Machine Learning

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.

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 (h_{t-1}) and the current input x_t 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.

1. Import the Libraries.

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.

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

4. Normalizing the Dataset.

5. Creating X_train and y_train Data Structures.

6. Reshape the Data.

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

8. Fitting the Model.

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

10. Preparing the Input for the Model.

11. Predicting the Values for Jan 2017 Stock Prices.

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

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.

Do you have any questions related to this tutorial on stock prediction using machine learning? In case you do, then please put them in the comments section. Our team of experts will help you answer your questions. To learn more, watch this video: [Stock Price Prediction](#).

If you are interested in learning further about Machine Learning, including the various ML applications across industries, do explore Simplilearn's Post Graduate Program in AI and Machine Learning in partnership with Purdue

University, and in collaboration with IBM. This comprehensive 12-month program covers everything from Statistics, Machine Learning, Deep Learning, Reinforcement Learning, to Natural Language Programming and more. You get to learn from global experts and at the end of the program walk away with great endorsements from industry and academic leaders and a skillset that is today the most in-demand in organizations across the world.

CHAPTER 3

SYSTEM MODEL

METHOD:

- Dataset collection
- Data Cleaning
- Feature Extraction
- Model training
- Testing model
- Performance Evaluation
- Prediction

Dataset collection

- Collecting data allows you to capture a record of past events so that we can use data analysis to find recurring patterns. From those patterns, you build predictive models using machine learning algorithms that look for trends and predict future changes.
- Predictive models are only as good as the data from which they are built, so good data collection practices are crucial to developing high-performing models.
- The data need to be error-free (garbage in, garbage out) and contain relevant information for the task at hand. For example, a loan default model would not benefit from tiger population sizes but could benefit from gas prices over time.
- In this module, we collect the data from kaggle dataset archives. This dataset contains the information of divorce in previous years.

Data Cleaning

- Data cleaning is a critically important step in any machine learning project.
- In this module data cleaning is done to prepare the data for analysis by removing or modifying the data that may be incorrect, incomplete, duplicated or improperly formatted.

- In tabular data, there are many different statistical analysis and data visualization techniques you can use to explore your data in order to identify data cleaning operations you may want to perform

Feature Extraction:

- This is done to reduce the number of attributes in the dataset hence providing advantages like speeding up the training and accuracy improvements.
- In machine learning, pattern recognition, and image processing, feature extraction starts from an initial set of measured data and builds derived values (features) intended to be informative and non-redundant, facilitating the subsequent learning and generalization steps, and in some cases leading to better human interpretations. Feature extraction is related to dimensionality reduction
- When the input data to an algorithm is too large to be processed and it is suspected to be redundant (e.g. the same measurement in both feet and meters, or the repetitiveness of images presented as pixels), then it can be transformed into a reduced set of features (also named a feature vector).
- Determining a subset of the initial features is called feature selection. The selected features are expected to contain the relevant information from the input data, so that the desired task can be performed by using this reduced representation instead of the complete initial data.

Model training

- A training model is a dataset that is used to train an ML algorithm. It consists of the sample output data and the corresponding sets of input data that have an influence on the output.
- The training model is used to run the input data through the algorithm to correlate the processed output against the sample output. The result from this correlation is used to modify the model.
- This iterative process is called “model fitting”. The accuracy of the training dataset or the validation dataset is critical for the precision of the model.
- Model training in machine language is the process of feeding an ML algorithm with data to help identify and learn good values for all attributes involved.
- There are several types of machine learning models, of which the most common ones are supervised and unsupervised learning.
- In this module we use supervised classification algorithms like linear regression to train the model on the cleaned dataset after dimensionality reduction.

Testing model:

- In this module we test the trained machine learning model using the test dataset

- Quality assurance is required to make sure that the software system works according to the requirements. Were all the features implemented as agreed? Does the program behave as expected? All the parameters that you test the program against should be stated in the technical specification document.
- Moreover, software testing has the power to point out all the defects and flaws during development. You don't want your clients to encounter bugs after the software is released and come to you waving their fists. Different kinds of testing allow us to catch bugs that are visible only during runtime.

Performance Evaluation

- In this module, we evaluate the performance of trained machine learning model using performance evaluation criteria such as F1 score, accuracy and classification error.
- In case the model performs poorly, we optimize the machine learning algorithms to improve the performance.
- Performance Evaluation is defined as a formal and productive procedure to measure an employee's work and results based on their job responsibilities. It is used to gauge the amount of value added by an employee in terms of increased business revenue, in comparison to industry standards and overall employee return on investment (ROI).
- All organizations that have learned the art of "winning from within" by focusing inward towards their employees, rely on a systematic performance

evaluation process to measure and evaluate employee performance regularly.

- Ideally, employees are graded annually on their work anniversaries based on which they are either promoted or are given suitable distribution of salary raises
- . Performance evaluation also plays a direct role in providing periodic feedback to employees, such that they are more self-aware in terms of their performance metrics.

Prediction

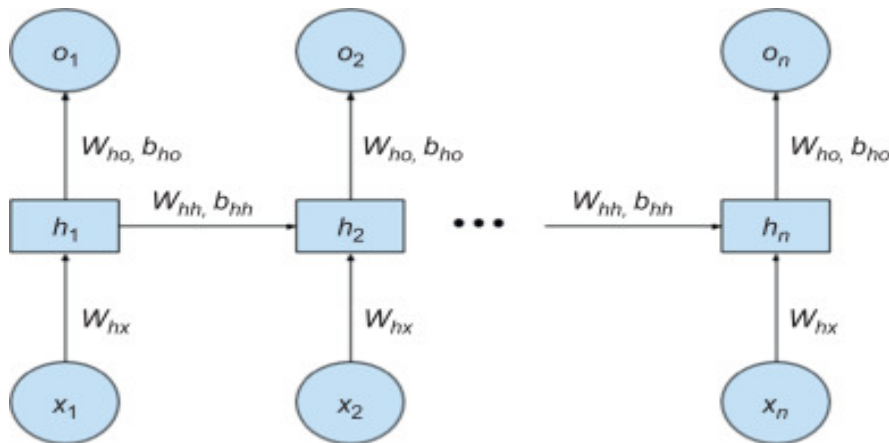
- Prediction” refers to the output of an algorithm after it has been trained on a historical dataset and applied to new data when forecasting the likelihood of a particular outcome, such as whether or not a customer will churn in 30 days.
- The algorithm will generate probable values for an unknown variable for each record in the new data, allowing the model builder to identify what that value will most likely be.
- The word “prediction” can be misleading. In some cases, it really does mean that you are predicting a future outcome, such as when you’re using machine learning to determine the next best action in a marketing campaign.
- Other times, though, the “prediction” has to do with, for example, whether or not a transaction that already occurred was fraudulent.

- In that case, the transaction already happened, but you're making an educated guess about whether or not it was legitimate, allowing you to take the appropriate action.
- In this module we use trained and optimized machine learning model to predict by dataset.

Algorithm used: RNN

- Recurrent neural networks (RNN) are the state of the art algorithm for sequential data and are used by Apple's Siri and Google's voice search. It is the first algorithm that remembers its input, due to an internal memory, which makes it perfectly suited for machine learning problems that involve sequential data.
- RNN's are mainly used for, Sequence Classification — Sentiment Classification & Video Classification. Sequence Labelling — Part of speech tagging & Named entity recognition. Sequence Generation — Machine translation & Transliteration.
- The backpropagation algorithm of an artificial neural network is modified to include the unfolding in time to train the weights of the network. This algorithm is based on computing the gradient vector and is called back propagation in time or BPTT algorithm for short.
- A recurrent neural network (RNN) is a special kind of artificial neural network that permits continuing information related to past knowledge by utilizing a special kind of looped architecture. They are employed in many

areas regarding data with sequences, such as predicting the next word of a sentence.



Recurrent Neural Networks

Why not Feedforward Networks?

Feedforward networks are used to classify images. Let us understand the concept of a feedforward network with an example given below in which we trained our network for classifying various images of animals. If we feed an image of a cat, it will identify that image and provide a relevant label to that particular image. Similarly, if you feed an image of a dog, it will provide a relevant label to that image a particular image as well.

Consider the following diagram:

And if you notice the new output that we have got is classifying, a dog has no relation to the previous output that is of a cat, or you can say that the output at the time ' t ' is independent of output at a time ' $t-1$ '. It can be clearly seen that

there is no relation between the new output and the previous output. So, we can say that in feedforward networks, the outputs are independent of each other.

There are a few scenarios where we will actually need the previous output to get the new output. Let us discuss one such scenario where we will necessitate using the output that has been previously obtained.

Now, what happens when you read a book. You will understand that book only on the understanding of the previous words. So, if we use a feedforward network and try to predict the next word in the sentence, then in such a case, we will not be able to do that because our output will actually depend on previous outputs. But in the feedforward network, the new output is independent of the previous outputs, i.e., output at ' $t+1$ ' has no relation with the output at ' $t-2$ ', ' $t-1$ ', and ' t .' Therefore, it can be concluded that we cannot use feedforward networks for predicting the next word in the sentence. Similarly, many other examples can also be taken where we need the previous output or some information from the previous output, so as to infer the new output.

How to overcome this challenge?

Consider the following diagram:

We have input at ' $t-1$ ', which we will feed to the network, and then we will get the output at ' $t-1$ '. Then at the next timestamp that is at a time ' t ', we have an input at a time ' t ', which will be again given to the network along with the information from the previous timestamp, i.e., ' $t-1$ ' and that will further help us to get the output at ' t '. Similarly, at the output for ' $t+1$ ', we have two inputs; one is the new input that we give, and the other is the information coming from the previous timestamps, i.e., ' t ' in order to get the output at a time ' $t+1$ '. In the same way, it will go on further like this. Here we have embodied in a more

generalized way to represent it. There is a loop where the information from the previous timestamp is flowing, and this is how we can solve a particular challenge.

What are Recurrent Neural Networks?

"Recurrent Networks are one such kind of artificial neural network that are mainly intended to identify patterns in data sequences, such as text, genomes, handwriting, the spoken word, numerical times series data emanating from sensors, stock markets, and government agencies".

In order to understand the concept of Recurrent Neural Networks, let's consider the following analogy.

Training a Recurrent Neural Network

A recurrent neural network uses a backpropagation algorithm for training, but backpropagation happens for every timestamp, which is why it is commonly called as backpropagation through time. With backpropagations, there are certain issues, namely vanishing and exploding gradients, that we will see one by one.

Vanishing Gradient

Consider the following diagram:

In vanishing gradient when we use backpropagation, we tend to calculate the error which is nothing but the actual output that we already know subtracted by the model output that we got through the model and the square of that, so we can figure out the error, and with the help of that error, we tend to find out the change in error with respect to change in weight or any variable, which is here called as weight.

So, the change of error with respect to change in weight multiplied by learning rate will give us the change in rate. And then we will add this change in weight to the old weight to get a new weight. Basically, here we are trying to reduce the error, and for that, we need to figure out what will be the change in error if variables get changed, by which we can get the change in the variable and add it to our old variable to get the new variable.

Now over here what can happen if the value $\frac{de}{dw}$, i.e., gradient or simply we can say the rate of change of error with respect to weight variable becomes very smaller than 1 and if we multiply that with the learning rate, which is the definitely smaller than 1, then, in that case, we will get the change in weight, which is negligible.

Consider a scenario where you need to predict the next word in the sentence, and your sentence is something like "I have been to USA". Then are a lot of words after that few people speak, and then you need to predict what comes after speak. Now, if you need to do that, then you will have to go back and understand the context of what it is talking about, which is nothing but our long-term dependencies. During the long-term dependencies, $\frac{de}{dw}$ becomes very small, and then when you multiply it with η , which is again smaller than 1, you get Δw , which will be very small or simply negligible. So, the new weight that you will get here will be almost equal to your old weight, such that the weight will not get updated further. Also, there will be no learning here, which is nothing but the problem of vanishing gradient.

Similarly, if we talk about the exploding gradient, it is actually opposite to that of the vanishing gradient. Consider the below diagram to have a better understanding of it.

If $\frac{de}{dw}$ becomes very large or greater than 1 and we have some long-term dependencies, then, in that case, $\frac{de}{dw}$ will keep on increasing, and Δw will

become very large that will make the new weight different than that of the old weights. So, these were the two problems with backpropagation, and now we will see how to solve these problems.

CHAPTER 4

RESULTS AND DISCUSSIONS

Based on data science approach, we can have insight Example of Stock Prices of PT Bank Central Asia Tbk (BBCA.JK) and PT Bank Mandiri from Indonesia at Yahoo finance are shown in Figs. [6](#) and [7](#). The first Covid-19 confirmed case in Indonesia is on 2 March 2020. After that, the composite stock price index has plunged 28% since the start of the year 2020, the share prices of cigarette producers and banks in the midst of the corona pandemic reached their lowest value on March 24, 2020 easily can be seen from data visualization. Epoch is one of the best methods to compare various data for forecasting. For analyzing the efficiency of the system we are used the Root Mean Square

CHAPTER 5

5.1 CONCLUSION

By measuring the accuracy of the different algorithms, we found that the most suitable algorithm for predicting the market price of a stock based on various data points from the historical data is the random forest algorithm. The algorithm will be a great asset for brokers and investors for investing money in the stock market since it is trained on a huge collection of historical data and has been chosen after being tested on a sample data. The project demonstrates the machine learning model to predict the stock value with IT. This paper

develops a model and program for stock prices prediction using data from Yahoo finance. Efficient and accurate prediction systems for stock prices help traders, investors, and analyst by providing supportive information like the future direction of the stock market. use short term historical data for the best accuracy. Historical data using 1 year is the best compared with 3 years and 5 years data. Data science approach proved to be used easily for decision maker and companies to get better view of stock prices or their financial health condition. For future work, we will improve our method using recent deep learning methods. At the end of 2020, amid the COVID-19 Pandemic, the number of Indonesia Capital Market investors continues to increase rapidly. The number of Indonesia Capital Market investors, according to data recorded in KSEI as of December 29, 2020, increased by more than 50% to 3,871,248 from the previous 2,484,354 at the end of 2019. So, we have to optimize to solve the pandemic with empowering the business at all sectors.

5.2 FUTURE WORK

In this work, we proposed an end-to-end attention based classification model architecture that predicts the stock price movements based on the linguistic features extracted from 8-K documents. The overall results suggest that the proposed models successfully extract the relevant linguistic signals from the report that help with the stock dynamic predictions. The analysis highlights the strengths and the limitations of the models and how important to combine the linguistic features and non-linguistic feature to the performance of the model predictions.

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