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STOCK PRICE PREDICTION BY USING MACHINE LEARNING APPROACH

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Abstract

In this research paper, we will see the application of machine learning techniques for predicting stock prices. Here we will use the one-week historical data of Microsoft company. We will test and train that data by using different algorithms of machine learning. Such algorithm will include LSTM or Long Short Term Memory, RNN or Recurrent Neural Network and Linear Regression. We are using LSTM here as its MSE is 0.0005 which is better than other algorithms. Our task is to predict future stock price and predicting future stock price is very challenging process. So, our research paper will show the potential of machine learning by predicting stock prices.

Keywords: Machine Learning, Recurrent Neural Network, LSTM, Linear Regression.

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1. INTRODUCTION

Predicting stock prices is a very challenging task for anyone. Nowadays many people invest money on stocks of different companies and every investor wants to be in profit by buying stock of a company. By predictions we can help the investors to make the right decision, minimize risks and maximize the profit. We can take the benefit of the technology to predict such a large amount of data. Data present online is huge and to predict this huge data we need advance technology like Hadoop, Cloudera and many more. These applications help to analyse the large amount of data in less time. Machine Learning is one of the best technologies presents to get future outcome accurately. We will use Machine Learning technology to analyse our data and will predict the meaningful outcome.

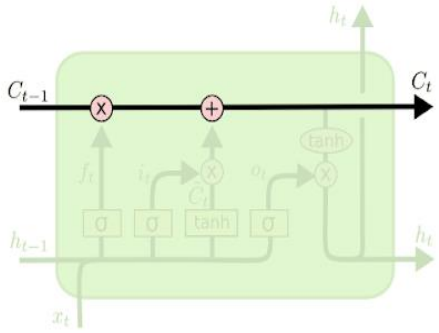
LSTM is a neural network architecture which is used for processing sequences of data. LSTM we can say the special version of Recurrent Neural Network. LSTM hence solves the short term memory problem which RNN fails to do. LSTM is also capable of selectively maintaining or erasing data from last time steps in the sequence which makes it to fit for time series analysis. We can also use LSTM in stock price prediction.

2 IDEA OF LSTM

1. In an LSTM network, there's a cell state which is a very important element is LSTM. It runs horizontally at the top of the diagram which can be thought as the conveyor belt that extends to the whole network. It carries data from one end of the network to other very easily without any changes.

The information pass from one cell state to other cell state neither distorted nor modified, it will pass as it is. This allows the LSTM network to control and maintain the flow of data, which make it an effective tool for many applications in ML and NLP that is natural language processing. Below is the diagram which shows the Cell State which runs horizontally through the network.

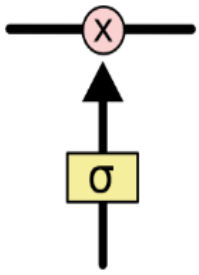
We can take the benefit of the technology to predict such a large amount of data. Data present online is huge and to predict this huge data we need advance technology like Hadoop, Cloudera and many more. These applications help to analyse the large amount of data in less time. Machine Learning is one of the best technologies presents to get future outcome accurately



2. In LSTM networks, we have structures called GATES. GATES are the structure which allow the addition and deletion of the selected data from the cell state. These gates have two components: A point wise multiplication operation a sigmoid neural network layer and a sigmoid layer is used to determine which data to allow through gate. The elements which have data have some weighs through which the sigmoid layer identifies the data to allow. After the sigmoid layer allows the input data then the point wise multiplication operation sequences the input data through their given weighs. It allows the most relevant information to pass through the gates.

These regulating gates help the LSTM network to maintain and manage the flow of information through the network and help to learn complex pattern of data and

relationship between them below is the diagram which depicts the sigmoid layer gate.

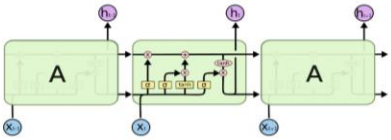


3. In an LSTM network, the sigmoid layer plays an important role in regulating the flow of data through the network. This layer works on binary digits that is 1 and 0. These number helps the layer to allow or deny of data to pass through. A value 1 means that all the data having value 1 will pass through the gate and the value 0 means that all the data having value 0 cannot pass through gate.

The LSTM has 3 gates that is forget gate, input gate and output gate. These gates are responsible for the flow and controlling of data throughout the network. By giving the weighs to the data, these gates can easily identify the information and accordingly deny or allow the data to pass through these gates.

3 STRUCTURE OF LSTM

LSTM depicts a structure shaped like chain which basically comprise of four neural network and dissimilar memory blocks which are known as cells.

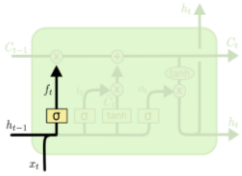


Information is generally maintained by cells and memory operations are executed by gates.

There are basically 3 gates: Forget gate, Input gate, Output gate.

4 FORGET GATE

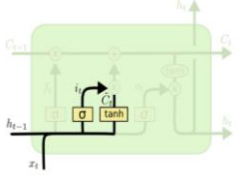
In an LSTM, the first step is to find which information to get rid of it from the cell state. This decision is made by a gate which is known as the forget gate layer, by using a sigmoid function. The forget gate layer inspect the old hidden state (h_{t-1}) and the new input (x_t), and provide output a value lying between 0 and 1 for each element present in the cell state (C_{t-1}). A value of 1 describes that the information should be retained, whereas a value of 0 shows that the information should be taken out completely.



$$f_t = \sigma\left(W_f \cdot [h_{t-1}, x_t] \; + \; b_f\right)$$

5 INPUT GATE

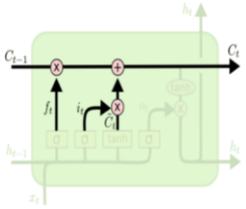
To enhance the cell state in a LSTM (Long Short-Term Memory)network, there are two steps. The initial step is called the “input gate layer” which determines which current state values will be updated. This is completed by using a sigmoid layer, which provides an output value between 0 and 1 for each element in the state, specifying how much it should be updated. The next step is to generate a vector of new candidate values, represented by Ct , using a tanh layer. This vector holds new possible values that could be added to the state. In the next step, these two pieces of information are integrated to generate an update to the state.



$$i_t = \sigma\left(W_i \cdot [h_{t-1}, x_t] \; + \; b_i\right)$$
$$\tilde{C}_t = \tanh(W_C \cdot [h_{t-1}, x_t] \; + \; b_C)$$

The LSTM network now needs to update the previous cell state (Ct-1) to the new cell state (Ct) using the information from the previous step. It this way, the network

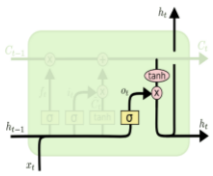
multiplies the state of the previous cell state by a value called "ft" which represents the information that the network has decided to forget. Next, the network adds the product of "it" (representing the value of each element to update the cell's state) with the new candidate values represented by Ct . This results in a new cell state containing the original state but with update values based on the value of the new candidate values and the update value the network decided to perform.



$$C_t = f_t * C_{t-1} + i_t * \tilde{C}_t$$

6. OUTPUT GATE

The last part in the LSTM network is to know what type of information to output depending on the ongoing cell state. To apply this concept, the network uses the sigmoid layer for deciding which part of the cell state should be in the output. Then the cell state is passed by a tanh function to make sure that all the output values lie between -1 and 1. Then the output of sigmoid gate is get multiplied by the values that have been passed by the tanh function, due to which the output shows only the parts of the cell state those were get selected by sigmoid gate. Then is generated output will be the last output of the LSTM network.

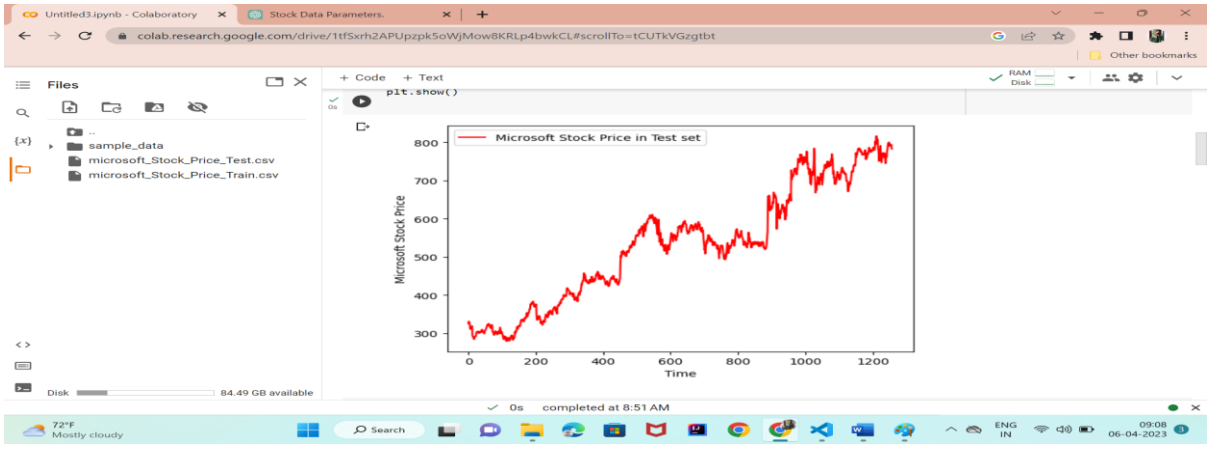


$$o_t = \sigma(W_o\,[h_{t-1}, x_t] + b_o)$$
$$h_t = o_t * \tanh(C_t)$$

7 DATA AND METHODOLOGY

To predict the price of stock we collected the Microsoft data. It contains one week of data. The data represent the date which is the combination of five parameters. The 1st parameter is Open which shows the initial price of the stock for that date. The 2nd parameter is High which represents the maximum price the stock reached during that particular date. The 3rd parameter is Low which represents the minimum price the stock reached during that particular date. The 4th parameter for the remaining days is High which represents the final price of the stock for that particular date. The 5th and the last parameter is Volume which shows the total amount of stock that was traded during that day.

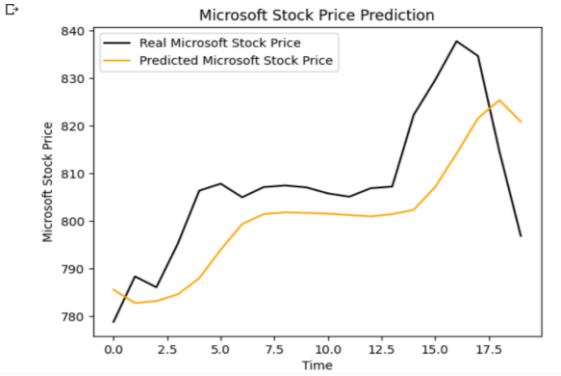
	Date	Open	High	Low	Close	Volume
0	1/3/2012	325.25	332.83	324.97	663.59	7,380,500
1	1/4/2012	331.27	333.87	329.08	666.45	5,749,400
2	1/5/2012	329.83	330.75	326.89	657.21	6,590,300
3	1/6/2012	328.34	328.77	323.68	648.24	5,405,900
4	1/9/2012	322.04	322.29	309.46	620.76	11,688,800



The figure shows the training set of data

RESULT

#predicting the output



The figure shows the output of the stock price of the data we trained and tested. The orange line shows the predict Microsoft stock price and The black line shows the actual stock price.

8 CONCLUSION

The application of machine learning such as LSTM, RNN, Linear Regression here can be used in predicting, analysing and getting the future stocks price visualization of any company which is listed in stocks . These same algorithms can be applied to any company stock dataset to get the output. This method is applicable on many platforms which also includes cloud systems. The method we are using is far quite more advanced than the previous one. The previous method uses the RNN technique which is slower and the memorising power of RNN is low in comparison of LSTM. Whereas the memorising power of LSTM is for more time and we can easily update and train the LSTM easily and more efficiently. It can process large data and give more accurate and precise output than RNN. In the future it may be enhanced in such a way to give better and more accurate results by using different machine learning techniques, tools and Algorithms.

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