

Department of Computer Engineering**MET,BKC,Adgaon,Nashik****Group 1****Assignment No. 4**

Title: Recurrent neural network (RNN).

Objective:

Design and develop Recurrent Neural Network (RNN) for prediction of Google Stock Price.

Problem Statement:

Use the Google stock prices dataset and design a time series analysis and prediction system using RNN

Software and Hardware Requirements:

- Python TensorFlow library.
- Numpy, Keras and Matplotlib library

Theory:

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.

The stock market plays a remarkable role in our daily lives. It is a significant factor in a country's GDP growth. Stock price analysis has been a critical area of research and is one of the top applications of machine learning. In this practical we learn how to perform stock price prediction using deep learning techniques. Here, we have use 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

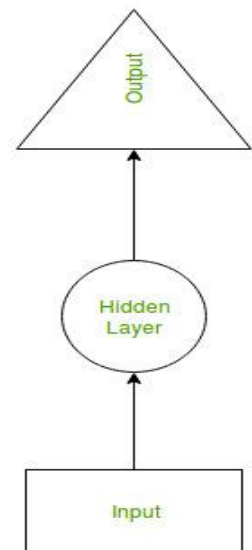
Stock Price Prediction using machine learning helps you discover the future value of company stock and other financial assets traded on an exchange. The entire idea of predicting stock prices is to gain significant profits. Predicting how the stock market will perform is a hard task to do. There are 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.

Recurrent Neural Network(RNN)

It is a type of Neural Network where the **output from the previous step are fed as input to the current step**. In traditional neural networks, all the inputs and outputs are independent of each other, but in cases like when it is required to predict the next word of a sentence, the previous words are required and hence there is a need to remember the previous words. Thus RNN came into existence, which solved this issue with the help of a Hidden Layer. The main and most important feature of RNN is **Hidden state**, which remembers some information about a sequence

RNN have a “**memory**” which remembers all information about what has been calculated. It uses the same parameters for each input as it performs the same task on all the inputs or hidden layers to produce the output. This reduces the complexity of parameters, unlike other neural networks.

Recurrent neural networks are a form of deep learning method that uses a sequential approach. We always assume that each input and output in a neural network is reliant on all other levels. Recurrent neural networks are so named because they perform mathematical computations in consecutive order.



Advantages of RNN

1. An RNN remembers each and every piece of information through time. It is useful in time series prediction only because of the feature to remember previous inputs as well. This is called Long Short Term Memory.
2. Recurrent neural networks are even used with convolutional layers to extend the effective pixel neighborhood.
3. Model size does not grow with input size.

Disadvantages of RNN

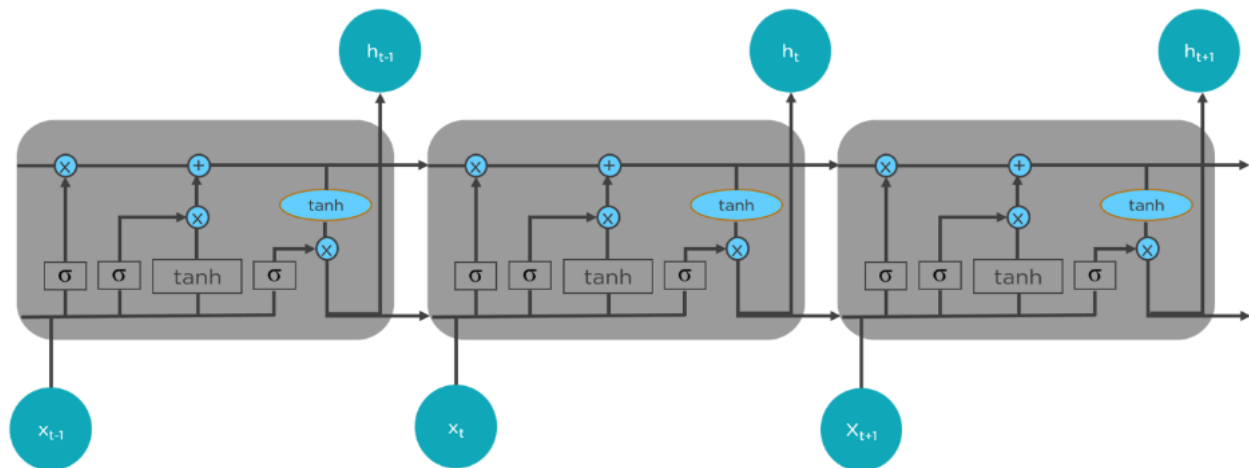
1. Gradient vanishing and exploding problems.

2. They are slow because they processed sequentially. TO calculate current state we must know previous state. So, Training an RNN is a very difficult task.
3. It cannot process very long sequences if using tanh or relu as an activation function.
- 4.

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.

Algorithm for Google Stock Price Prediction Using LSTM

1. Import the Libraries.
2. Load the Training Dataset.
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.

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.

Conclusion: In this way, we learned the basics of the stock market and how to perform stock price prediction using RNN.

Assignment Questions

1. Which are the Types of RNN? Also give Applications of RNN.
2. What is the difference between RNN and LSTM?
3. What Are Vanishing and Exploding Gradients?
4. How does RNN work?
5. How does LSTM work?(<https://www.shiksha.com/online-courses/articles/rnn-vs-gru-vs-lstm/>)
6. What is difference between Recursive Neural Network and Recurrent Neural Network?