Report on stock market prediction

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***Abstract*—Stock market prediction is an area of extreme importance to an entire industry. Stock price is determined by the behavior of human investors, and the investors determine stock prices by using publicly available information to predict how the market will act or react.In this work we present an Neural Network approach to predict stock market indices.**

I. Introduction

NEURAL Networks have seen an explosion of interest over the last few years, and are being successfully applied across an extraordinary range of problem domains.We predict the closing price of next day's sensex based on previous day's high.low,opening and closing prices. http://www.sharelatex.com

II. Neural Networks

In this section we describe the structure of Artificial Neurons and how they are connected to construct Artificial Neural Network.

A. Artificial neuron

Artificial neurons are inspired from biological neuronal structure. The transmission of a signal from one neuron to another through synapses.The neuron fires if the value attains certain threshold.

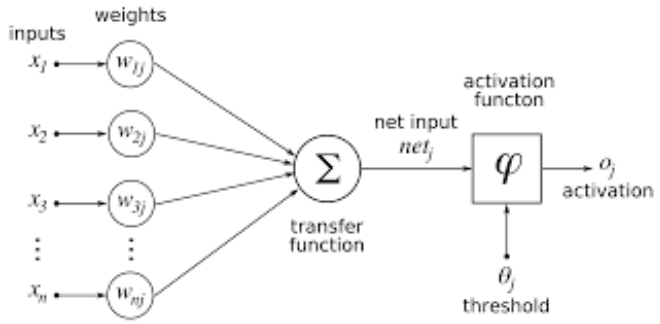


Fig. 1. Representation of neuron

B. Neural networks

While a single artificial neuron is not able to implement some boolean functions, the problem is overcome by connecting the outputs of some neurons as input to the others, so constituting a neural network.Neurons are organised in the form of layers.The neurons in a layer get input from the previous layer and feed their output to the next layer.There are many types of neural networks some of them are feedforward neural networks and recurrent neural networks.

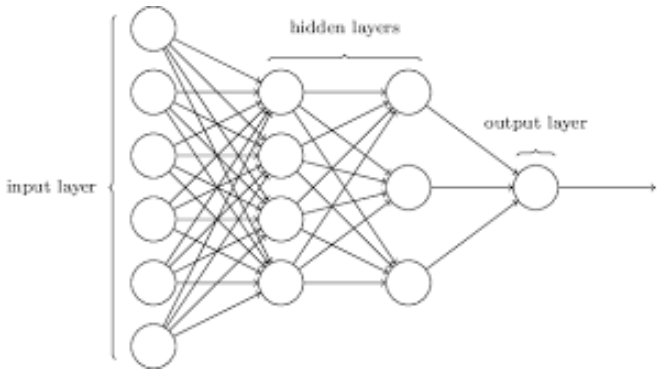
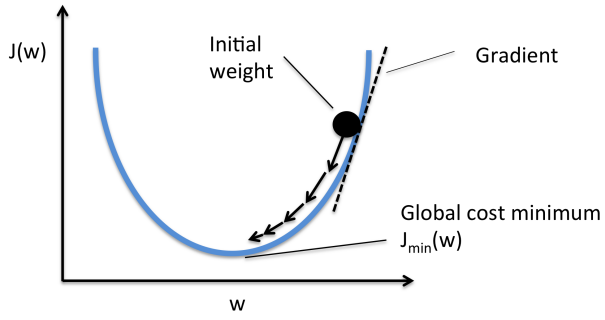


Fig. 2. Representation of neural network

III. Gradient descent

Gradient descent is a first-order iterative optimization algorithm for finding the minimum of a function. To find a local minimum of a function using gradient descent, one takes steps proportional to the negative of the gradient of the function at the current point.We have full batch gradient descent and stochastic gradient descent algorithm.One iteration of inputting all the training samples is called one epoch.We have used SGD in this problem with a batch size of 20.

Below is a picture of how we attain minimum cost function by continuosly derivating the function and substracting it from previous value



IV. Preprocessing data

Since,sensex ranges in multiples of thousands and activation functions we have used gives output from 0 to 1.We have preprocessed data by mapping it into [0,1].

We have given total of 11 inputs to the network.Previous day's high,Low and past 5 day's closing price and 5th,10th,15th and 20th moving averages of closing prices.The data was further divided into 80 percent and 20 percent to train and test data.

We can also have validation set from training set so as to test the model before testing on the final data.

A. Error Calculation

The error for convergence is calculated as the rms error between the target values and the actual outputs. We use the same error to report the performance of the algorithm on the test set.

V. Results and Simulation

Data taken from BSE INDIA website The variables that are to be decided by the user are • Inputs (Open, Low, High, Close)

- Outputs (Close value)
- Percentage of training data (60)
- Percentage of testing data (40)
- Number of previous data points considered for training (5)
- Learning rate, (0.002)
- Number of hidden layers, nH (2)
- Number of nodes in each hidden layer, n (121,16)
- Maximum number of epochs (15)
- Activation function (Unipolar Sigmoid,relu)

A. Result

Average error = actual value - Predicted value ;over entire testing dataset.

Average error we have got is **250**. The various parameters to be varied by the user were systematically varied by the user, one by one to get the ideal set of parameters so as to obtain the maximum efficiency in the data prediction.

The prediction was carried out using different activation functions such as sigmoid for input layer and tanh for 1st hidden layer and rectified linear units for 2nd hidden and output layers

Below is the graph shown over testing data (800 points) with 2 hidden layers

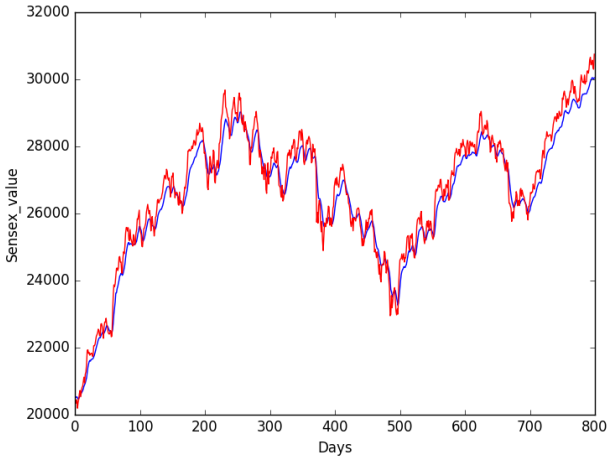


Fig. 3. Red line represents actual value and Blue line represents predicted value.

Below graph shows predicted vs actual values with 1 hidden layer.

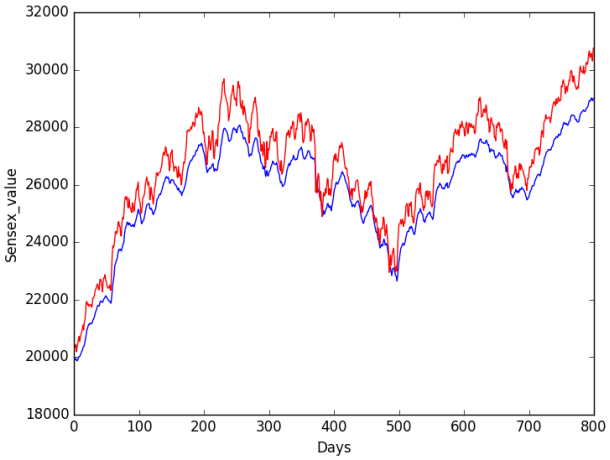


Fig. 4. Red line represents actual value and Blue line represents predicted value.

Error plot shows the difference between the actual and predicted value on that particular day

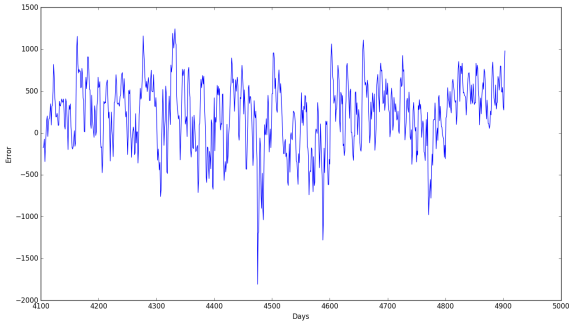


Fig. 5. Plot shows the error vs no of day's

VI. Conclusion

In this paper, we described the application of Artificial Neural Networks to the task of stock index prediction. We described the theory behind ANNs and our Neural Network model and its salient features.

The results obtained are accurate and we can practically use them in deciding to invest or not.As we see the average error is 250 which is good in markets because the downfall in markets can lead in thousands of points.

Thus we can see that Neural Networks are an effective tool for stock market prediction and can be used on real world datasets.