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Stock Market Prediction using Machine Learning Techniques

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ABSTRACT

Prediction of Stock Market has been an area of interest for investors as well as researchers from a long time due to its intrinsic volatility, complex and regularly changing in nature makes it difficult to make reliable prediction. So, predicting daily behaviour of stock market is a serious challenge for investors and corporate stockholders. The objective of this paper is to predict the market performance by using Artificial Neural Network. These techniques are used to classify the stock in 3 categories – Buy, Hold and Sell, based on historical data while providing an in-depth understanding of the models being used. The Study shows that logistic regression model compared to Linear Regression can be used by the investors, individual as well as fund managers to predict "good or poor" stock. Because of the data being Non-Linear we will be using artificial neural network to classify Non-linear data using hidden layers.

Keywords : Stock Market, Linear Regression Model, Logistic Regression Model, Machine Learning, Artificial Neural Network, Hidden Layer

I. INTRODUCTION

Stock Market attracts thousands of Investors. The risk and profit of it has great effect and every stock investor wants to get some benefits from that, so the stock price forecasting is always a popular field of study. Predicting the future has always been an adventurous and attractive task for the probing individual. This kind of prediction becomes more fascinating when it involves money and risk like predicting the Stock Market. People use different methods to predict market volatility, such as fundamental analysis, technical analysis, Linear Regression Model , Logistic Regression Model, even coin tossing, fortune telling, and so on.

Previous Studies by experts shows that rarely demonstrated successful due to the existence of noise and nonlinearity in past and historical data. Machine Learning Techniques were found successful for the prediction because of predicting stock from a large historical data. Artificial Neural Network was used to demonstrate the Non-linear data and classify it.

Artificial Neural Networks have seen an increase of interest over the last few years, and are being successfully used across an extraordinary range of problem domains, in areas as diverse as finance, medicine, engineering, geology and physics. There have been made many trails define neural networks.

A neural network is a huge parallel distributed processor that has a natural tendency for storing experiential knowledge and making it available for use. It resembles the brain in two respects: 1. Knowledge is gained by the network through a learning process. 2. Interal neuron connection strengths known as synaptic weights are used to store the information." – Haykin (1994).

We have tried to consider some crucial input variables. By using the back propagation algorithm, it is possible to train the network by error correction and adjusting the weights based on these corrections. Neural Networks has the ability for arbitrary non-linear function approximation and information processing which other methods do not have. Artificial Neural Networks are well applied to the problems in which reproducing the relationships among data is really difficult provided that on the other hand there exists a large enough training data sets

II. LITERATURE SURVEY

In recent times, sentiment Analysis has been used in multiple areas such as blogging websites, review websites, online retail etc. Sentiment analysis has been very important social media analytics tool and has been effectively used by E-commerce websites like Snapdeal and Flipkart to filter irrelevant reviews. Sentiment analysis at present plays a vital role in customer service, management of brand reputation and business intelligence. It has also been influential in politics by helping political strategists determine the public opinion on the internet. It played a crucial role in Barack Obama's campaign in 2011 where sentiment analysis was used to predict the responses to campaign messages.

A share market could be a place of high interest to the investors because it presents them with a chance to learn financially by finance their resources on shares and derivatives of varied firms. it's a chaos system; that means the activity attribute of share costs area unit unpredictable and unsure. to define some style of sense of this unpredictable behavior, experts or researchers were forced to search out a way which may estimate the result of this uncertainty to the flow of share costs. From the analyses of different applied math models, Artificial Neural Networks area unit analogous to non-parametric, nonlinear, Linear and logistic regression models. So, Artificial Neural Networks (ANN) actually has the strength to tell apart unknown and hidden patterns in information which may have worse effective for share market prediction. If successful, will this will this could this may} be useful for investors and finances which can completely contribute to the economy. There are unit totally different strategies that are applied so as to predict Share Market returns.

III. PROPOSED SOLUTION

We propose a way to predict stock trends using machine learning techniques. This proposed method for developing the system mainly consists of four main steps. Firstly, data is collected and sorted for relevancy from various sources. Secondly, analysis is carried out on the collected data and features will be extracted. Then data representation will be carried out. , using suitable machine learning algorithm prediction of the stock trends would be done.At last Artificial Neural Network will be used to classify the data into three categories – Buy , Hold , Sell.

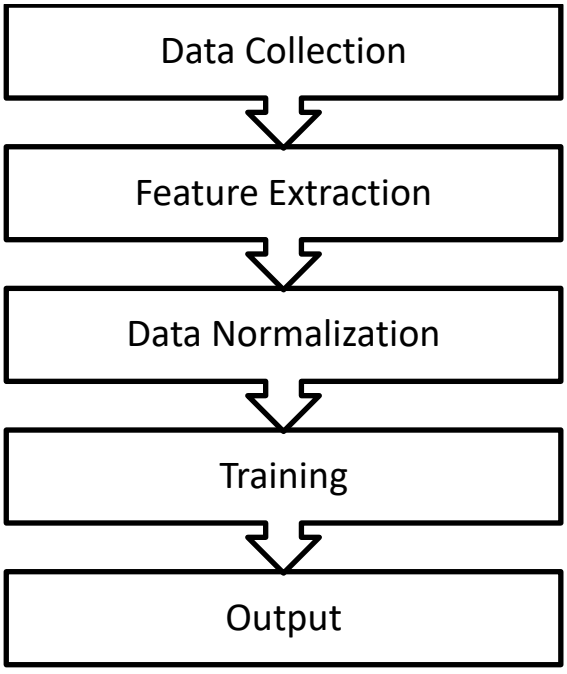

Figure 1 : Flow of proposed work

Artificial Neural Networks is a complex network. It is a system widely interconnected by a large number of simple processing units which is analogous to a neuron. It is an artificial construction of network which is capable of achieving some kind of function based on humans understanding of their brains neural networks [7]. It is a sort of a theoretical mathematical model of human biological neural networks and a kind of information processing system created by implementation and imitation of the biological neural networks structure. It is designed to do a lot of complex logic operations such as finding out patterns in nonlinear relationship by the help of numerous interconnected processing units.

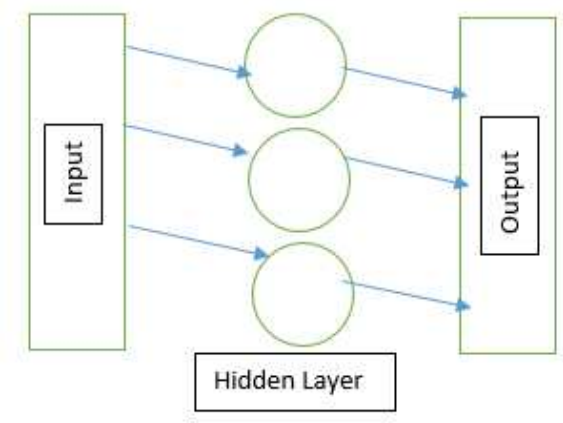

Figure 2 : Artificial Neural Network

Back Propagation Neural Network, which can alternatively be called Multilayer Feed-forward Neural Network, is composed of one input layer, one or more hidden layer and one output layer. It can be used to simulate nonlinear mapping model, solve some real world problems, such as classification, valuation, prediction, and so on. Three-layer Feed-forward Neural Network is a single hidden layer network generally used in the complex problem solving. The backpropagation algorithm falls into the general category of gradient descent algorithms, which intend to find the minima/maxima of a function by iteratively moving in the direction of the negative of the slope of the function to be minimized/maximized.

Back Propogation

To improve our model, we first have to quantify just how wrong our predictions are. Then, we adjust the weights accordingly so that the margin of errors are decreased.

Similar to forward propagation, back propagation calculations occur at each "layer". We begin by changing the weights between the hidden layer and the output layer.

Calculating the incremental change to these weights happens in two steps: 1) we find the margin of error of the output result (what we get after applying the activation function) to back out the necessary change in the output sum (we call this delta output sum) and 2) we extract the change in weights by multiplying delta output sum by the hidden layer results.

The output sum margin of error is the target output result minus the calculated output result:And doing the math:

Target = 0

Calculated = 0.77

Target - calculated = -0.77

To calculate the necessary change in the output sum, or delta output sum, we take the derivative of the activation function and apply it to the output sum. In our example, the activation function is the sigmoid function.

To refresh your memory, the activation function, sigmoid, takes the sum and returns the result:

So the derivative of sigmoid, also known as sigmoid prime, will give us the rate of change (or "slope") of the activation function at the output sum:

Since the output sum margin of error is the difference in the result, we can simply multiply that with the rate of change to give us the delta output sum:

Conceptually, this means that the change in the output sum is the same as the sigmoid prime of the output result. Doing the actual math, we get:

Delta output sum = S'(sum) * (output sum margin of error)

Delta output sum = S'(1.235) * (-0.77)

Delta output sum = -0.13439890643886018

Now that we have the proposed change in the output layer sum (-0.13), let's use this in the derivative of the output sum function to determine the new change in weights.

As a reminder, the mathematical definition of the output sum is the product of the hidden layer result and the weights between the hidden and output layer:

This relationship suggests that a greater change in output sum yields a greater change in the weights; input neurons with the biggest contribution (higher weight to output neuron) should experience more change in the connecting synapse.

Let's do the math:

To determine the change in the weights between the *input and hidden* layers, we perform the similar, but notably different, set of calculations. Note that in the following calculations, we use the initial weights instead of the recently adjusted weights from the first part of the backward propagation.

Remember that the relationship between the hidden result, the weights between the hidden and output layer, and the output sum is:

Instead of deriving for output sum, let's derive for hidden result as a function of output sum to ultimately find out delta hidden sum:

Also, remember that the change in the hidden result can also be defined as:

Let's multiply both sides by sigmoid prime of the hidden sum:

All of the pieces in the above equation can be calculated, so we can determine the delta hidden sum:

new w1 = 0.712
new w2 = 0.3548
new w3 = 0.2681
new w4 = 0.112
new w5 = 0.8548
new w6 = 0.4681

Here are the new weights, right next to the initial random starting weights as comparison:

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w1: 0.8 w1: 0.712
w2: 0.4 w2: 0.3548
w3: 0.3 w3: 0.2681
w4: 0.2 w4: 0.112
w5: 0.9 w5: 0.8548

w6: 0.5 w6: 0.4681
w7: 0.3 w7: 0.1162
w8: 0.5 w8: 0.329
w9: 0.9 w9: 0.708

Once we arrive at the adjusted weights, we start again with forward propagation. When training a neural network, it is common to repeat both these processes thousands of times (by default, Mind iterates 10,000 times).

And doing a quick forward propagation, we can see that the final output here is a little closer to the expected output:

IV. CONCLUSION

By testing different Stock predicting technologies, we come to the conclusion that Artificial Neural Networks are best suited for predicting the nearest value of stock prices With the help of an ANN with Back-Propagation algorithm it has been made possible to predict the stock prices of the future where Linear regression and Logistic regression were not able to predict the prices of much volatile stock. Thus we can understand that Artificial Neural Network is an Effective tool for predicting price.

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