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# Stock Market Prediction Using Neural Networks

Time Series Prediction-Stock Markets

Aquib Shaikh[1], Prasenjt Banik[2], Harpreet Tarhen[3] ,Alestair Varghese,Ashish Ramdasi

[1]*Computer Engineering, Sinhgad Academy of Engineering*
[2] *Computer Engineering, Sinhgad Academy of Engineering*
[3] *Computer Engineering, Sinhgad Academy of Engineering*
[4]*Computer Engineering, Sinhgad Academy of Engineering*
[4]*Computer Engineering, Sinhgad Academy of Engineering*

**Abstract** —*A stock market is a public market for the trading of company stock. It is an organized set-up with a regulatory body and the members who trade in shares are registered with the stock market and regulatory body SEBI. Since stock market data are highly time-variant and are normally in a nonlinear pattern, predicting the future price of a stock is highly challenging. Prediction provides knowledgeable information regarding the current status of the stock price movement. Thus this can be utilized in decision making for customers in finalizing whether to buy or sell the particular shares of a given stock. Many researchers have been carried out for predicting stock market price using various data mining techniques. The past data of the selected stock will be used for building and training the models. The results from the model will be used for comparison with the real data to ascertain the accuracy of the model.*

*Keywords-Stock Market, Artificial Neural Networks, Arma*

## I. INTRODUCTION

From the beginning of time it has been man's common goal to make his life easier. The prevailing notion in society is that wealth brings comfort and luxury, so it is not surprising that there has been so much work done on ways to predict the markets. Various technical, fundamental, and statistical indicators have been proposed and used with varying results. However, no one technique or combination of techniques has been successful enough. With the development of neural networks, researchers and investors are hoping that the market mysteries can be unraveled. A stock market is a public market for the trading of company stock and derivatives at an agreed price; these are securities listed on a stock exchange as well as those only traded privately. It is an organized set-up with a regulatory body and the members who trade in shares are registered with the stock market and regulatory body SEBI. The stock market is also called the secondary market as it involves trading between two investors. Stock market gets investors together to buy and sell their shares. Share market sets prices according to supply and demand. Stocks that are in demand will increase their price, whereas as stocks that are being heavily sold will decrease their price. Companies that are permitted to be traded in this market place are called "listed companies".

Investors in stock market want to maximize their returns by buying or selling their investments at an appropriate time. Since stock market data are highly time-variant and are normally in a nonlinear pattern, predicting the future price of a stock is highly challenging. With the increase of economic globalization and evolution of information technology, analyzing stock market data for predicting the future of the stock has become increasingly challenging, important and rewarding. Prediction provides knowledgeable information regarding the current status of the stock price movement. Thus this can be utilized in decision making for customers in finalizing whether to buy or sell the particular shares of a given stock.

## II. NEURAL NETWORKS

An artificial neural network is an information processing system that tries to simulate biological neural networks or also known as information processing paradigm that is inspired by the way biological nervous system. Artificial neural network (ANN) is distributed, adaptive, generally nonlinear learning machines built from many different processing elements (PE). Each PE receives connections from other PE and/or itself. The interconnectivity defines the topology. Neural networks are typically arranged in layers. Each layer in a layered network is an array of processing elements or neurons. Information flows through each element in an input-output manner. An artificial neural network (ANN) is configured for a specific application, such as pattern recognition or data classification through learning processing. The most commonly used structure of neural network is shown in Figure 1.1. This neural network is formed in three layers, called the input layer, hidden layer, and output layer. Each layer consists of one or more nodes, represented in this diagram by the small circles. The lines between the nodes indicate the flow of information from one node to the next. Neural networks process information in a similar way the human brain does. The network is composed of a large number of highly interconnected processing elements (neurons) working in parallel to solve a specific problem. Neural networks learn by example. They cannot be programmed to perform a specific task.

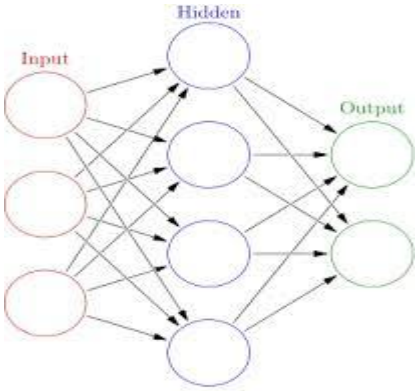



Figure 1,1

There are many different applications and advantages of neural networks are character recognition, Image compression, travelling salesman's problem, stock market prediction.

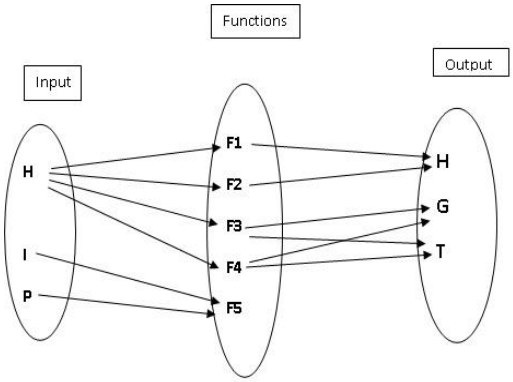
## III. LITERATURE REVIEW

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 traits of share costs area unit unpredictable and unsure. to create some style of sense of this chaotic behavior, 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 varied applied math models, Artificial Neural Networks area unit analogous to non-parametric, nonlinear, regression models. So, Artificial Neural Networks (ANN) actually has the potential to tell apart unknown and hidden patterns in information which may be terribly 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. The securities market reflects the fluctuation of the economy, and receives 10 million investors' attention since its initial development. The securities market is characterized by bad, high-yield, thus investors are involved concerning the analysis of the securities market and making an attempt to forecast the trend of the securities market. However, securities market is wedged by the politics, economy and plenty of different factors, let alone the quality of its internal law, like value (stock index) changes within the non-linear, and shares knowledge with high noise characteristics, so the normal mathematical applied mathematics techniques to forecast the securities market has not yielded satisfactory results. Neural networks will approximate any advanced non-linear relations and has hardiness and fault-tolerant options. Therefore, it's terribly appropriate for the analysis of stock knowledge. In dozens of neural network models that were suggests, researchers usually use the hop garden network. hop garden network is that the commonest feedback network model, it's one among the models that almost typically studied currently. The hop garden network is that the mono layer recognized by an equivalent vegetative cell, and is additionally a symmetrically connected associative network while not learning operates.

## IV. MATHEMATICAL MODEL

Set Theory Analysis:
Let 'S' be the | Stock market prediction as the final set
S = {……
Identify the inputs as D , Q, I, P
S = {H, I, P, …
H = {H1, H2, H3,H4, …| 'H' given shares in the database }
I = {I1, I2, … |'I' gives user ID for login}
P= {P1, P2, … |'P' gives the respective password for login ID}
Identify the outputs as O
S = {H, I, P, G, S, …
H = {H1, H2, H3, H4, …| 'H' given shares in the database }
G = {G1, G2 …| 'G' gives the graphical analysis for prediction of share or shares that are selected }
T= {T1, T2 …| 'T' gives the statistical analysis for prediction of share or shares that are selected}




Identify the functions as 'F'
S = {H, I, P, G, S, F…
F = {F1(), F2(), F3(), F4(), F5()}
F1( H ) :: Show share records
F2 ( H) :: Select shares
F3 ( H ) :: Predict
F4 ( H) :: generate analysis
F5( P, I ) :: login

## V. ARMA MODEL

In the statistical analysis of time series, autoregressive–moving-average (ARMA) models provide a parsimonious description of a (weakly) stationary stochastic process in terms of two polynomials

The auto-regression
The moving average.

**--Autoregressive model**

The notation AR(p) refers to the autoregressive model of order p. The AR(p) model is written

$$X_t = c + \sum_{i=1}^{p} \varphi_i X_{t-i} + \varepsilon_t.$$

where φ are parameters, is a constant, and the c random variable Et is white noise.
Some constraints are necessary on the values of the parameters so that the model remains stationary

**--Moving-average model**

The notation MA(q) refers to the moving average model of order q:

$$X_t = \mu + \varepsilon_t + \sum_{i=1}^{q} \theta_i \varepsilon_{t-i}$$

where the θ1, ..., θq are the parameters of the model, μ is the expectation of (often assumed to equal 0), and the Et are white noise error terms.

## VI. ARMA ALGORITHM

1 Review: Time series modelling and forecasting
We want to estimate the parameters of an ARMA(p,q) model.
We will assume (for now) that:
1. The model order (p and q) is known, and
2. The data has zero mean.
If (2) is not a reasonable assumption, we can subtract the sample mean y bar,
fit a zero-mean ARMA model,
φ(B)Xt= θ(B)Wt,
to the mean-corrected time series Xt= Yt− y bar,
and then use Xt+ y bar as the model for Yt.
2. Parameter estimation
One approach:
Assume that {Xt} is Gaussian, that is, φ(B)Xt= θ(B)Wt, where Wtisi.i.d. Gaussian.
Choose φi, θjto maximize the *likelihood*:
L(φ, θ, σ2) = fφ,θ,σ2(X1, . . . , Xn),
where fφ,θ,σ2 is the joint (Gaussian) density for the given ARMA model.(c.f. choosing the parameters that maximize the probability of the data.)

3. Maximum likelihood estimator
Suppose that X1, X2, . . . ,Xnis drawn from a zero mean Gaussian ARMA(p,q) process. The likelihood of parameters φ ∈Rp, θ ∈Rq,σ2w ∈R+ is defined as the density of X = (X1, X2, . . . , Xn)′ under the Gaussian model with those parameters:
L(φ, θ, σw2 ) = 1 (2π)n/2 |Γn|1/2 exp−1 2X′Γ− n 1X,
where |A| denotes the determinant of a matrix A, and Γnis the variance/covariance matrix of X with the given parameter values.
The maximum likelihood estimator (MLE) of φ, θ, σw2 maximizes this
quantity.
4. Yule-Walker estimation

For a causal AR(p) model $\phi(B)X_t = W_t$, we have

$$\mathrm{E}\left(X_{t-i}\left(X_t - \sum_{j=1}^{p}\phi_j X_{t-j}\right)\right) = \mathrm{E}(X_{t-i}W_t) \quad \text{for } i = 0, \ldots, p$$

$$\Leftrightarrow \qquad \gamma(0) - \phi'\gamma_p = \sigma^2 \quad \text{and}$$

$$\gamma_p - \Gamma_p\phi = 0,$$

where $\phi = (\phi_1, \ldots, \phi_p)'$, and we've used the causal representation

$$X_t = W_t + \sum_{j=1}^{\infty}\psi_j W_{t-j}$$

to calculate the values $\mathrm{E}(X_{t-i}W_t)$.

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