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***Research paper***

# Stock Market Price Forecasting by Using Deep Learning

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## Abstract

Stock market forecasts are an attempt to determine the future value of corporate capital or other financial products consumed in the stock market. If the future stock price forecast succeeds, you can gain great profit. The efficient market presents all the current stock price information, which shows that price fluctuations are not the basis for unnecessary new information. Others disagree that people who have these ideas have many methods and techniques to help them get future information. [1]

***Keywords:*** *stock market; prediction;*

## 1. Introduction

Forecasting the stock price is one of the most important topics in the financial sector. Many researchers have considered how to use technical analysis, statistical analysis and various methods to profit from market prices using a variety of methods. .ANN is one of data mining techn¨ıques for learning human brain function¸. [7] The current artificial neural network (ANN) is used to forecast the substitution index. ANN is one of data mining techniques that are learning capability of the human brain [8].Because sophisticated financial data is used, data patterns are unpredictable that can make dynamic changes.A number of studies have been conducted to improve the efficiency of stock value. . Kimoto used ANN's methods to use one of the first projects to predict the TOPIX [9]

## 2. Prediction methods

,Forecast methods are divided into three main categories that can (and often do) interact. They are (i)fundamental analysis, (ii)technical analysis (chart) and (iii)technological techniques. [30]

### A. Fundamental Analysis

This analysis deals with a company that manages its own stock. They evaluate the corporation's past performance and reliability of its accounts. Many performance ratios have been created to help basic analysts evaluate the validity of such stocks such as p/e ratio. [30]

### B. Technical Analysis:

Technical analysts and chartists are not interested in the company's basic principles. They are looking for the current (potential) price based on the original price that determines the future stock price(using time series analysis).

These days people are relied on technical analysts, who determine the company's future. Thus, here have been introduced a lot of techniques to predict the market commodities. [30]

### C. Technological Methods

Data Mining Technologies: With the advent of digital computers, stock market forecasts have entered the technical field. The most important method involves the use of artificial neural networks (ANNs) and transmissible processes. The researchers found that the method of improving bacterial chemotherapy may be much better than GA. [30] [1]

## 3. Artificial Neural Network (ANN)

Artificial neural network(ANNs) information processing systems were originally inspired by mathematical generalization of human neurons. ANNS are approximations to mathematical functions.The most common form of ANN used for stock market forecasting is a feedforward network that updates network weights using error rogue algorithms.Unfortunately, stock market is essentially complicated, non-linear,dynamic,non parametric, and chaotic in nature [3] . The time series are random,noisy,multi-stationary, and has frequent structural breaks [6]. In addition, stock market's movements are affected by many macro-economical factors [5] such as movements of other stock market,general economic conditions, firms' policies, bank rate, commodity price index, political events, bank exchange rate, investors' expectations,general economic conditions, institutional investors' choices, psychology of investors, etc. [1] Historical and present stock index data to predict future prices are used to model the most artificial neural network,Due to Inherent capabilities to approximate any non-linear function to a high level of accuracy, ANN has gained a lot of popularity. [4]. However, ANN is particularly pre-dispersed with a lot of noise and ignorance Characteristics of stock market volatility in backpropagation. [13]

Tsoi,Lawrence and Giles pointed [1] out that, When data noise makes BP formation difficult, such a network will always be a naive solution for predicting the most common result. [5] Miao et al. believes that BP solutions are generally ,The gradient descent algorithm is used to obtain connection weights.. [1]

# 4. Linear Regression

In statistics, linear regression is a linear method of modeling the relationship between a scalar dependent variable y and one or more explanatory variables (or independent variables) labeled with X.The relationship in the linear regression is modeled using a linear prediction function, and the model parameters that cannot be known from the data are estimated in the linear prediction function. These models are called linear models.The purpose of our linear regression is to predict the target y value in the input value vector,from

$x \in \Re^n$

to find a function ,$y = h(x)$ so that we have

$y^{(i)} \approx h(x^{(i)})$

,for each training example.To find a function h(x).we use the the equation

$$Index(x) = (Index(x) - Min(Index))/(Max(Index) - Min(Index))$$

$$h_\theta(x) = \sum_j \theta_j x_j = \theta^\top x$$

$h_\theta(x)$ represents a large family of functions parametrized by the choice of θ

Here the θ improves and minimizes the y ( i).so the function of θ is taken as

$$J(\theta) = \frac{1}{2}\sum_i \left(h_\theta(x^{(i)}) - y^{(i)}\right)^2 = \frac{1}{2}\sum_i \left(\theta^\top x^{(i)} - y^{(i)}\right)^2$$

There are many algorithms for minimizing the function.the most common used one is Gradient Descent.we use the gradient to optimize the output.to compute the gradient we use

$$\frac{\partial J(\theta)}{\partial \theta_j} = \sum_i x_j^{(i)} \left(h_\theta(x^{(i)}) - y^{(i)}\right)$$

j(θ) is called the cost function.

# 5. Methodology

The project can be divided into three main parts
(1) Training process
(2) Testing process
(3) Comparison

## A. Training Process

Training process are used as pre-parameters for the weights and optimal values of the network. The learning model used in MLP is characterized by changes in specific input patterns and connection weights. This model assigns the input signal to the optimal value of the network. The connection weight passes the signal. The hidden and output layers contain vectors of processing elements that have activation capabilities. Either weight or bias network is ready to be trained. Compare the deliverables and goals in the process of education and coordinate the network.

The training process requires an example of proper network behavior and target output. weights and biased networks are repeated during training to minimize network performance. Mean squared error (MSE) is a performance function used when learning feedforward neural networks. MSE is the mean square error between the network output and the target output. training is the process of backpropagation errors to the system via the output layer. Backpropagation is an important way of the training process. Because hidden units do not have training to use target values, they need to be trained based on previous layer mistakes.

## B. Testing Process

Training continues until all differences between the updated weight and the old weight of the previous epoch are below the threshold. MLP (Multilayer Perception) is the most common feedforward network In this setting, the input vector and the target vector are randomly divided into two groups, 80% learning. 20% will be used to confirm that the network has generalized and completed before the training is over. This last 20% is also used as a completely independent network standardization test.

## C. Comparison

Exchange statistics were collected by the Standard & Poor's 500 (S & P 500). The sample size of each stock index is 5 years. In each sample, the closing price, the starting price, the lowest price, the highest price, the total number of shares traded

One of the most important problems is to improve the artificial neural network. Each input variable should be preprocessed. Mean value, average of the training set is small compared to its standard deviation. Index rage is between -1 and +1 . We are able to use simple formula which is

It can be clearly seen the regression plot of the training set. Each of the figures corresponds to the target from the output array. Regression values (correlation coefficients) are very close to 1. It means that the correlation between the outputs and the target is very high.

# 6. Conclusion

In this document we have developed a new Framework for predicting stock market values .This Framework is able to learn structural representation from training data support all types of stocks efficiently computes all values i.e it can predicts the stock values.This implementation process consists of different steps like data collection, data preprocessing, classification and model evaluation. Each approach to stock prediction.is used back propagation with feed forward network

**Table 1:** Source From S& P 500, 2013

| date | open | high | low | close | volume |
|---|---|---|---|---|---|
| 08-02-2013 | 15.07 | 15.12 | 14.63 | 14.75 | 8407500 |
| 11-02-2013 | 14.89 | 15.01 | 14.26 | 14.46 | 8882000 |
| 12-02-2013 | 14.45 | 14.51 | 14.1 | 14.27 | 8126000 |
| 13-02-2013 | 14.3 | 14.94 | 14.25 | 14.66 | 10259500 |
| 14-02-2013 | 14.94 | 14.96 | 13.16 | 13.99 | 31879900 |
| 15-02-2013 | 13.93 | 14.61 | 13.93 | 14.5 | 15628000 |
| 19-02-2013 | 14.33 | 14.56 | 14.08 | 14.26 | 11354400 |
| 20-02-2013 | 14.17 | 14.26 | 13.15 | 13.33 | 14725200 |
| 21-02-2013 | 13.62 | 13.95 | 12.9 | 13.37 | 11922100 |
| 22-02-2013 | 13.57 | 13.6 | 13.21 | 13.57 | 6071400 |
| 25-02-2013 | 13.6 | 13.76 | 13 | 13.02 | 7186400 |
| 26-02-2013 | 13.14 | 13.42 | 12.7 | 13.26 | 9419000 |
| 27-02-2013 | 13.28 | 13.62 | 13.18 | 13.41 | 7390500 |
| 28-02-2013 | 13.49 | 13.63 | 13.39 | 13.43 | 6143600 |
| 01-03-2013 | 13.37 | 13.95 | 13.32 | 13.61 | 7376800 |
| 04-03-2013 | 13.5 | 14.07 | 13.47 | 13.9 | 8174800 |
| 05-03-2013 | 14.01 | 14.05 | 13.71 | 14.05 | 7676100 |
| 06-03-2013 | 14.52 | 14.68 | 14.25 | 14.57 | 13243200 |
| 07-03-2013 | 14.7 | 14.93 | 14.5 | 14.82 | 9125300 |
| 08-03-2013 | 14.99 | 15.2 | 14.84 | 14.92 | 10593700 |
| 11-03-2013 | 14.85 | 15.15 | 14.71 | 15.13 | 6961800 |
| 12-03-2013 | 15.14 | 15.6 | 14.95 | 15.5 | 8999100 |
| 13-03-2013 | 15.54 | 16.2 | 15.48 | 15.91 | 11380000 |
| 14-03-2013 | 15.98 | 16.36 | 15.93 | 16.25 | 8383300 |
| 15-03-2013 | 16.45 | 16.54 | 15.88 | 15.98 | 17667700 |
| 18-03-2013 | 15.8 | 16.33 | 15.71 | 16.29 | 6514100 |
| 19-03-2013 | 16.48 | 16.85 | 16.41 | 16.78 | 11805300 |
| 20-03-2013 | 17.13 | 17.33 | 16.87 | 17.23 | 10819800 |
| 21-03-2013 | 17.21 | 17.43 | 16.87 | 17 | 10740800 |

**Table 2:** Stock High Value

| Actual High Value | Predicted High Value |
|---|---|
| | 920.5639038 |
| 924.9909734 | 929.7027588 |
| 937.1526831 | 932.8369751 |
| 937.7684709 | 947.2979126 |
| 937.8290402 | 947.932251 |
| 942.1395554 | 948.2165527 |
| 937.7280914 | 953.2165527 |
| 935.5779822 | 948.3103638 |
| 940.443615 | 946.3339233 |
| 941.9477526 | 952.3509521 |
| 950.2659364 | 954.0079346 |
| 930.6414834 | 963.432312 |
| 931.2572712 | 940.1343384 |
| 943.6235032 | 941.71521 |
| 947.6614565 | 956.4824219 |
| 955.3083306 | 960.9164429 |
| 962.2990373 | 969.0296631 |
| 968.3256826 | 976.0913086 |
| 977.976391 | 982.3723145 |
| 982.4787089 | 993.3452759 |
| 973.0803726 | 998.3088989 |
| 972.9087596 | 987.3178711 |
| 978.9555946 | 987.7561646 |
| 988.1419384 | 995.4026489 |
| 988.1823179 | 1006.27887 |
| 988.8182956 | 1005.864075 |
| 990.2618639 | 1006.126526 |
| 948.2974342 | 1007.628052 |
| 927.7066989 | 959.3088989 |
| 956.8377054 | 937.9016113 |
| 954.9802469 | 973.8860474 |
| 937.0012598 | 971.270752 |
| 944.2241488 | 949.2855835 |
| 961.8447675 | 956.9157104 |
| 962.8138763 | 976.6952515 |
| 963.5709925 | 977.2593994 |
| 967.3969533 | 977.6177368 |
| 967.0436324 | 981.4330444 |
| 963.6012772 | 981.0328369 |
| 939.4341267 | 977.5479126 |
| 928.4811783 | 950.0905762 |
| 923.0501311 | 938.9729614 |
| 920.7182131 | 934.1507568 |

**Table 3:** Stock Low Values

| Actual Low Value | Predicted Low Value |
|---|---|
| 909.4526 | 910.4526 |
| 912.5426 | 913.5426 |
| 924.59 | 925.59 |
| 925.2 | 926.2 |
| 925.26 | 926.26 |
| 929.53 | 930.53 |
| 925.16 | 926.16 |
| 923.0301 | 924.0301 |
| 927.85 | 928.85 |
| 929.34 | 930.34 |
| 937.58 | 938.58 |
| 918.14 | 919.14 |
| 918.75 | 919.75 |
| 931 | 932 |
| 935 | 936 |
| 942.575 | 943.575 |
| 949.5 | 950.5 |
| 955.47 | 956.47 |
| 965.03 | 966.03 |
| 969.49 | 970.49 |
| 960.18 | 961.18 |
| 960.01 | 961.01 |
| 966 | 967 |
| 975.1 | 976.1 |
| 975.14 | 976.14 |
| 975.77 | 976.77 |
| 977.2 | 978.2 |
| 935.63 | 936.63 |
| 915.2328 | 916.2328 |
| 944.09 | 945.09 |
| 942.25 | 943.25 |
| 924.44 | 925.44 |
| 931.595 | 932.595 |
| 949.05 | 950.05 |
| 950.01 | 951.01 |
| 950.76 | 951.76 |
| 954.55 | 955.55 |
| 954.2 | 955.2 |
| 950.79 | 951.79 |
| 926.85 | 927.85 |
| 916 | 917 |
| 910.62 | 911.62 |
| 908.31 | 909.31 |

**Table 4:** Stock Close Value

| Actual Close Value | Predicted Close Value |
|---|---|
| 913.7460414 | 912.4527588 |
| 916.8309397 | 921.4907837 |
| 928.8584491 | 924.5903931 |
| 929.4674419 | 938.8917236 |
| 929.5273429 | 939.519104 |
| 933.7902929 | 939.800293 |
| 929.427508 | 944.7450562 |
| 927.3011245 | 939.8930664 |
| 932.1130667 | 937.9384155 |
| 933.6006066 | 943.8890381 |
| 941.8270021 | 945.527771 |
| 922.4190982 | 954.8480835 |
| 923.0280911 | 931.807251 |
| 935.2578659 | 933.3706665 |
| 939.2512618 | 947.9749146 |
| 946.8137552 | 952.3599854 |
| 953.7273218 | 960.383667 |
| 959.6874652 | 967.3674316 |
| 969.2316813 | 973.5791626 |
| 973.6843177 | 984.4310303 |
| 964.3896888 | 989.3398438 |
| 964.2199695 | 978.4700928 |
| 970.2000798 | 978.9035645 |
| 979.2850554 | 986.4656372 |
| 979.3249893 | 997.2218628 |
| 979.9539492 | 996.8117065 |
| 981.3815882 | 997.071228 |
| 939.8802216 | 998.5562134 |
| 919.5166981 | 950.7702026 |
| 948.3262539 | 929.5991821 |
| 946.4892918 | 965.1864624 |
| 928.7086967 | 962.6000366 |
| 935.8518836 | 940.8574829 |
| 953.2780648 | 948.4034424 |
| 954.2364798 | 967.9647217 |
| 954.9852415 | 968.522644 |
| 958.7689841 | 968.8770142 |
| 958.419562 | 972.6502686 |
| 955.015192 | 972.2544556 |
| 931.1147177 | 968.8079224 |

**Table 5:** Stock Open Value

| Actual Open Value | Predicted Open Value |
|---|---|
| 915.470023 | 914.1778564 |
| 918.5521673 | 923.2078247 |
| 930.5689392 | 926.3046265 |
| 931.1773884 | 940.5932617 |
| 931.2372359 | 941.2200317 |
| 935.4963803 | 941.5009766 |
| 931.1374901 | 946.4413452 |
| 929.013005 | 941.593689 |
| 933.8206514 | 939.6407471 |
| 935.3068633 | 945.5861206 |
| 943.5259148 | 947.2233276 |
| 924.1353371 | 956.5353394 |
| 924.7437863 | 933.5150757 |
| 936.9626431 | 935.0770874 |
| 940.9524739 | 949.6682739 |

| | |
|---|---|
| 948.508216 | 954.0494995 |
| 955.4156106 | 962.065979 |
| 961.3704331 | 969.0435181 |
| 970.9061287 | 975.2496948 |
| 975.35479 | 986.0918579 |
| 966.0684588 | 990.9963379 |
| 965.898891 | 980.1362305 |
| 971.8736627 | 980.5693359 |
| 980.9505277 | 988.1246948 |
| 980.9904261 | 998.8713379 |
| 981.6188244 | 998.4614868 |
| 983.0451889 | 998.7207642 |
| 941.5808723 | 1000.204407 |
| 921.235528 | 952.4610596 |
| 950.0193644 | 931.30896 |
| 948.1840423 | 966.864502 |
| 930.4193206 | 964.2803955 |
| 937.5561304 | 942.557251 |
| 954.9667546 | 950.0964355 |
| 955.924314 | 969.6402588 |
| 956.6724073 | 970.1976318 |
| 960.452772 | 970.5517578 |
| 960.1036618 | 974.3215942 |
| 956.702331 | 973.9261475 |
| 932.8231937 | 970.4827271 |
| 922.0007776 | 943.3526611 |

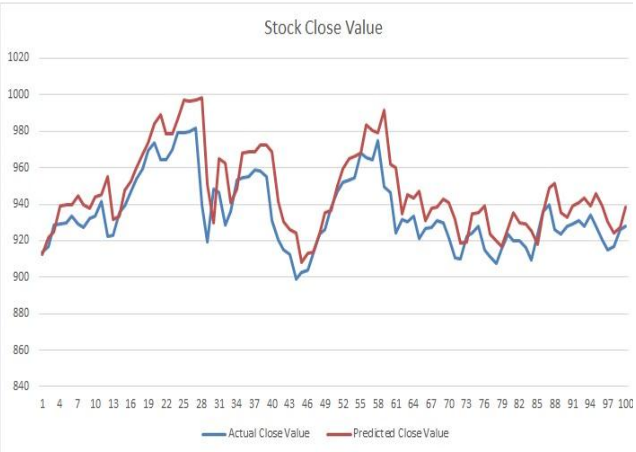


**Fig. 1:** Stock Close values comparison

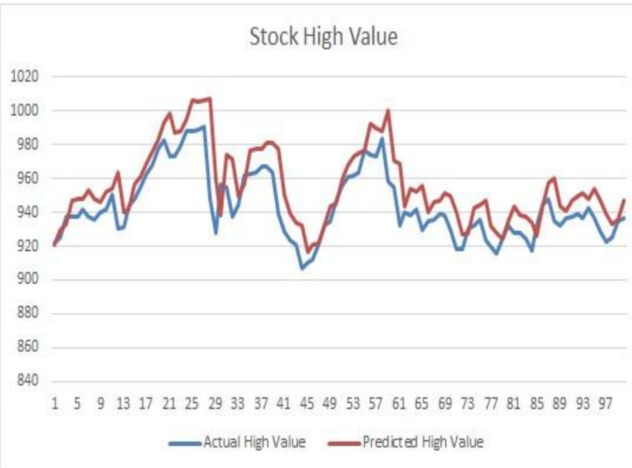


**Fig. 2:** Stock High values comparison

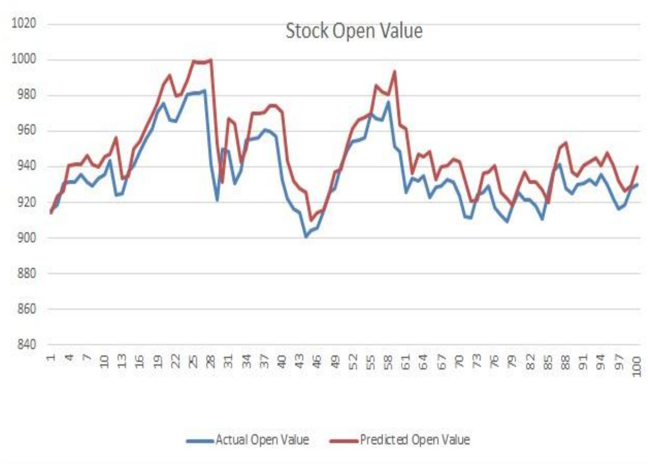


**Fig. 3:** Stock Open values comparison.

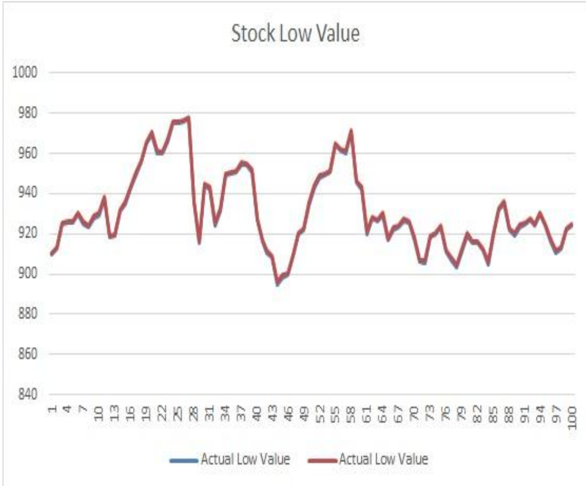


**Fig. 4:** Stock Low values comparison

The model can be very beneficial for financial analysis and corporate investors and uses for financial media . They can provide a futuristic plan our behaviour and moment and that properly in their trading.This act properly is for trading to profit and prevent loss. In future work, We intend to optimise the impact of fundamental analysis in predict the quality of the stock prediction.We also would like to predict the stock not only using the data stock but all so newsfeed from online or other social media

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