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Stock Prediction using Support Vector Regression and Neural Networks

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ABSTRACT

The purpose of this project is to compare two very widely used methods for stock prediction and see which one is a more accurate method. With the advent of machine learning, soft computing techniques are being used more frequently for various purposes, especially where mathematical models can be used and juxtaposed onto real life situations. Here in this report, we have compared the prediction of the stock market using artificial Neural Networks versus a prediction of stock market using support vector regression. Testing has been done only in one language, python and hence it cannot exactly be determined if other languages or software's such as R or Matlab may give better results. The system is built completely on numbers and does not depend on popular emotions or gut feeling.

Keywords: Support Vector Regression, Neural Networks, Stocks.

1. INTRODUCTION

There are two prices that are critical for any investor to know: the current price of the investment he or she owns or plans to own, and its future selling price. Despite this, investors are constantly reviewing past pricing history and using it to influence their future investment decisions. Some investors won't buy a stock or index that has risen too sharply because they assume that it's due for a correction, while other investors avoid a falling stock, because they fear that it will continue to deterioration.

The basic tool used for predictions is spotting market trends. Technical Analysis- a science of predicting future prices from historical price data has helped investors increase their accuracy regarding predictions. The Algorithms used are able to predict the right time to invest and to some extent, right quantity and right rice to invest. Traders use these graphs to forecast favourable time to invest or drop stocks. Short term changes are studied and generally, patterns upto the previous 6 months are examined. The Efficient Market Hypothesis (EMH) also states that it is practically impossible to outperform the overall market. Proper and trained stock selection along with experienced and proper timing is the only way an investor can obtain higher returns if buying risky investments.

However, with whatever tool we use for prediction, technical or not, one supposition remains constant. We assume that trends and trajectories will repeat itself in the future, and that share prices will also fluctuate based on demand and supply.

2. LITERATURE REVIEW

Various computational and mathematical algorithms have been used over the years to acquire accurate prediction of the volatile stock market, some of the methodologies are:

Here we present to you a literature survey on all methods used for stock prediction.

2.1. Neuro-Fuzzy Based Methodology

Forecasting stock market short-term trends using a neuro-fuzzy based methodology

Authors: George S Atsalakis, Kimon P Valavanis

The Neuro Fuzzy based methodology works around the concept of the ANFIS which is an abbreviated form of Adaptive Neuro Fuzzy Inference System. This paper shows how it is used to control the stock market process model. The paper has tested and evaluated this on a variety of stocks. One important aspect it focuses on is long term market trends, the results for which are obtained with accuracy much greater than that of short term market trends. 15 combinations of stocks have been used to test the model and the best stock for the next day is determined.

2.2. Stock Prediction using the WASP System

Elliott Wave Theory and neuro-fuzzy systems, in stock market prediction: The WASP system

Authors: George S Atsalakis, Emmanouil M Dimitrakakis, Constantinos D Zopounidis

This paper presents the WASP (Wave Analysis Stock Prediction) system, a system based on the neuro-fuzzy architecture, which utilizes aspects of the Elliott Wave Theory, presented by Ralph Nelson Elliott. The Elliot Wave principle hypothesises that the psychology of a bunch of investors oscillates between optimistic to pessimistic based on the mood of the people around them, this, in turn, affects market trends and stock patterns. A hybridified system of the Neuro Fuzzy and Elliott wave helps predict stock patterns fairly accurately.

2.3. HMM, ANN and GA Method

A fusion model of HMM, ANN, and GA for stock market forecasting

Authors: Md. Rafiul Hassan, Baikunth Nath, Michael Kirley

Represented as the simplest Bayesian network, the Hidden Markov Model is combined with Artificial Neural Network and Genetic Algorithm to forecast the fiscal market behaviour. ANN is used to convert the daily stock values to a set of input arrays which are fed into the Markov Model. Genetic Algorithm is used to primarily optimize the first set of parameters. HMM is used to scoop out comparable patterns from previous data. The price difference for two successive days at each critical point is calculated in order to find out a weighted average. This value is used to prepare the forecast

2.4. Support Vector Machines

Financial time series forecasting using support vector machines

Authors: Kyoung Jae Kim

Support Vector Machines are the methodologies with greatest results when it comes to financial time series. This paper compares Back propagation neural networks as well to show how promising an alternative SVM is turning out to be. A structural Risk minimization principle is developed in order to minimize classification error or atleast try to revert deviation from the actual linear stock prices. One huge advantage of SVM is that it provides a globally optimized solution. This paper also compares Case Based reasoning and ANN with SVM.

2.5. Neural Networks

Predicting Stock Market Trends by Recurrent Deep Neural Networks

Authors: Akira Yoshihara, Kazuki Fujikawa, Kazuhiro Seki, Kuniaki Uehara

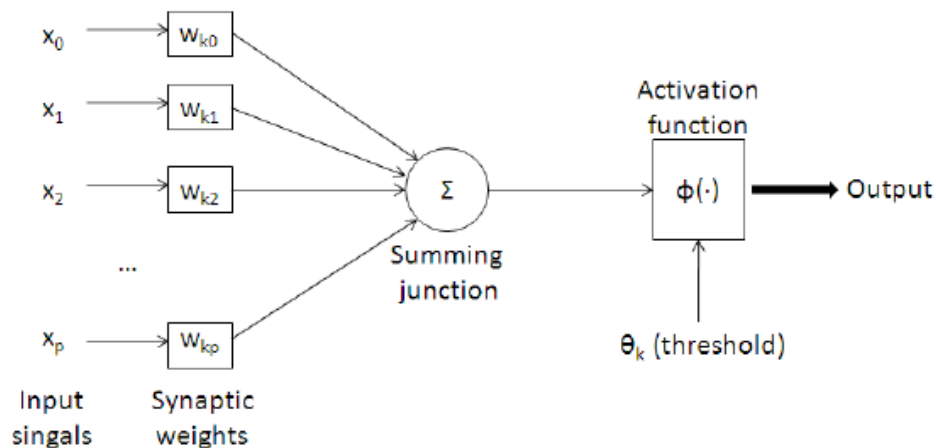
There are various factors which influence the decision of investors, among these also includes CPI, price earnings ratio, newspaper opinions and also tips by brokers. Despite psychological information also widely impacting the trends, utmost effort and care have been taken that only numerical information be used to predict patterns and trends. The most recent Neural Network, the Deep Belief Neural Network has risen to be used extensively in pattern mining. It is able to construct useful information from huge amounts of data which almost precisely what is needed for stock and market predictions

3. PROPOSED METHOD

Out of the given methods, we have compared Neural Networks and Support Vector Regression.

These are both supervised learning methods, and theoretically, they are not too different from each other. In simplest manner, Support Vector Machine without a kernel is a single neural network neuron but with a separate cost function. If you add a kernel function, then it is comparable to 2 layer neural nets. The two layers are used for projection and classification respectively.

Mathematical Model for Neural Networks



A Neuron's Mathematical function is given as $f(x)$. It is a composition of other functions as seen in the above figure.

$$F(x) = f_1(x) + f_2(x) + f_3(x) \dots$$

This is portrayed as a structure of networks, the arrows in the figure show the dependencies. Below shown is a dependency graph.

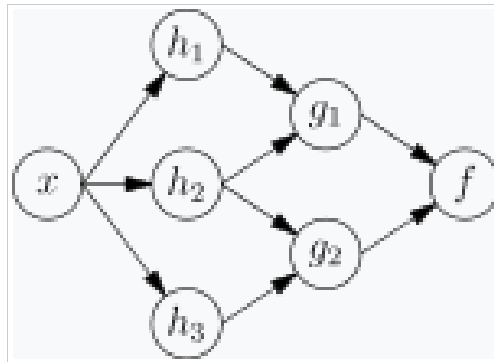


Fig: Dependency Graph

SVM Regression Formula

To find the Linear function of a given training data set of N observations we use the formula

$$f(x) = x'β + b$$

Where $(β', β)$ is the norm value.

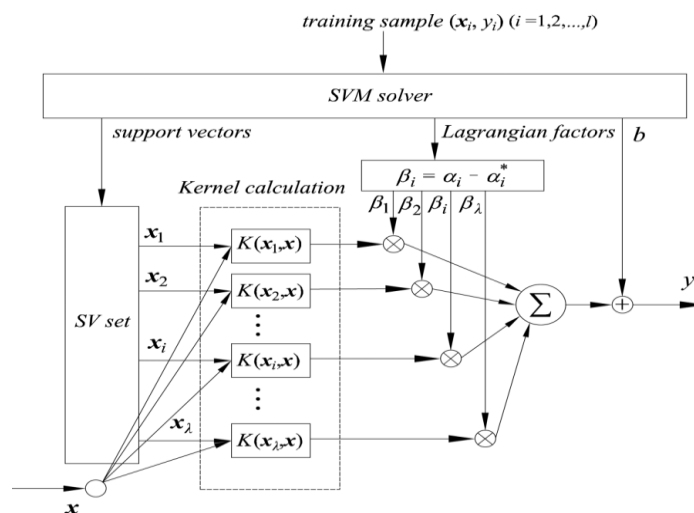


Fig: Shows how SVM is used to Solve Mathematical Models without Regression Libraries

The basic equation for linear regression is:

$$Y = a + bX$$

$$b = \frac{N\sum XY - (\sum X)(\sum Y)}{N\sum X^2 - (\sum X)^2}$$

N = Number of Years

X= Year

Y = Stock Price

Nonlinear SVM regression is represented by the formula

$$L(\alpha) = \frac{1}{2} \sum_{i=1}^N \sum_{j=1}^N (\alpha_i - \alpha_i^*) (\alpha_j - \alpha_j^*) G(x_i, x_j) + \epsilon \sum_{i=1}^N (\alpha_i + \alpha_i^*) - \sum_{i=1}^N y_i (\alpha_i - \alpha_i^*)$$

Where, $G(x_1, x_2)$ is the kernel function and α is a non-negative multiplier

The function used to predict new values is,

$$f(x) = \sum_{n=1}^N (\alpha_n - \alpha_n^*) G(x_n, x) + b.$$

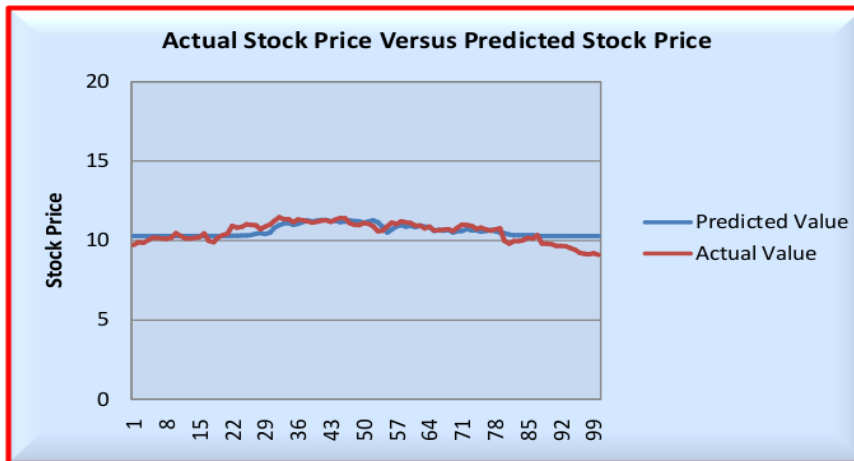
Where b is a specified constant

Here we compare the Neural Network methodology and the Support Vector Regression methodology for Stock price prediction. In both methods, we divide the data set into three groups. We perform testing on the first group, training on the second set and perform prediction-output on the third data-set. Artificial Neural Networks and Support Vector Regression have the highest accuracy amongst most methodologies used in Stock Prediction.

4. OUTPUTS

4.1 Artificial Neural Networks

On the basis of the charts, we can say that ANN-based systems perform quite well as the prediction accuracy is quite satisfactory. Although, there are possibilities for improvement. This system is still at a preliminary stage and many of the parameters which affect ANN have not been fully explored.



Fog: This graph shows the Actual vs. Predicted Stock prices for Apple

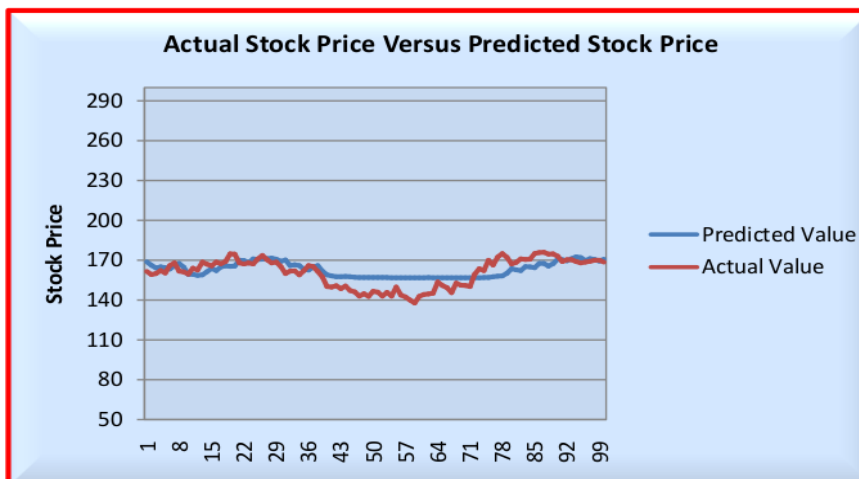


Fig: This graph shows the Actual vs. Predicted Stock prices for a particular IT company (Apple Software) using ANN

4.2 Support Vector Regression

Support Vector Machine can also be used as a regression method, maintaining all the main features that characterize the algorithm (maximal margin). The Support Vector Regression (SVR) uses the same principles as the SVM for classification, with only a few minor differences. Regression means estimating the relation between two variables, which is exactly what is seen in this particular method. Time vs Price graphs are estimated almost accurately using SVR

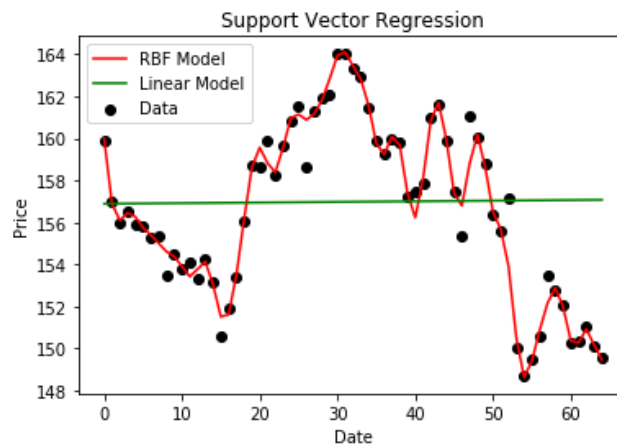


Fig: Graph Obtained through SVR

The methodology has been implemented in python. The libraries used are scikit-learn, matplotlib, numpy, and panda. These are all mathematical libraries in python used for various regression and prediction outcomes.

We have used a compiled .csv file from the NASDAQ site which contains all past stock values of Apple. For the sake of training, we have performed one set of training on the Apple Stock and resiction on the next set.

I have coded the entire program in the jupyter notebook to see live output while writing the code. The rbf model has helped us understand the stocks better with respect to current data better

Apple Stocks: <http://www.nasdaq.com/symbol/aapl>

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Scikit Learn - SVR Support Vector Regression

In [1]: import numpy as np
import pandas as pd
from sklearn.svm import SVR
import matplotlib.pyplot as plt

In [2]: def predict_prices(dates, prices, x):
dates = np.reshape(dates, (len(dates), 1))

svr_lin = SVR(kernel='linear', C=1e3)
svr_poly = SVR(kernel='poly', C=1e3, degree=2)
svr_rbf = SVR(kernel='rbf', C=1e3, gamma=0.1)
svr_lin.fit(dates, prices)
svr_poly.fit(dates, prices)
svr_rbf.fit(dates, prices)

plt.scatter(dates, prices, color='black', label='Data')
plt.plot(dates, svr_rbf.predict(dates), color='red', label='RBF Model')
plt.plot(dates, svr_lin.predict(dates), color='green', label='Linear Model')
plt.plot(dates, svr_poly.predict(dates), color='blue', label='Polynomial Model')
plt.xlabel('Date')
plt.ylabel('Price')
plt.title('Support Vector Regression')
plt.legend()
    
```

Fig: Part of implementation carried out on Jupyter Notebook

5. CONCLUSION

ANN seems to be a better option since the predictions run close by and according to the RBF model comparing it to the linear model on SVR, we see there is a huge drop in the prices which does not seem plausible. Hence of the two methods, Artificial Neural Networks is a better and more accurate methodology.

6. REFERENCES

- [1] Predicting Stock Market Trends by Recurrent Deep Neural Networks Authors: Akira Yoshihara, Kazuki Fujikawa, Kazuhiro Seki, Kuniaki Uehara Link to paper: https://link.springer.com/chapter/10.1007/978-3-319-13560-1_60
- [2] Financial time series forecasting using support vector machines Authors: Kyoung Jae Kim Link to paper: <http://www.sciencedirect.com/science/article/pii/S0925231203003722>
- [3] Stock Market Prediction System with Modular Neural Network <https://pdfs.semanticscholar.org/25b0/d0316ece493899d74cfb98ce7b77dca8352e.pdf>
- [4] Scikit-learn http://scikit-learn.org/stable/auto_examples/svm/plot_svm_regression.html
- [5] Artificial Neural Network Models https://www.researchgate.net/figure/284516167_fig2_Figure-4-Mathematical-model-of-an-artificial-neural-network-ANN
- [6] Fusion Model of HNN, Markov <http://www.sciencedirect.com/science/article/pii/S0957417409001948>
- [7] Elliott Wave Theory and neuro-fuzzy systems, in stock market prediction: The WASP system <http://www.sciencedirect.com/science/article/pii/S0957417411000881>