



Performance of Various Support Vector Machine Kernels

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Abstract - The stock market prediction has long been a captivating area of study, especially with the evolution of prediction methodologies. With the proliferation of data available online over the years, predicting stock prices has become increasingly feasible through various techniques. Machine Learning and Data Mining concepts have played a pivotal role in the development of numerous prediction and analysis models, each with its unique advantages and limitations. Additionally, stock prices exhibit volatility due to a multitude of factors such as national policies and industry-related political news. While some advanced analysis and prediction models account for these factors, simpler models may overlook them. This paper focuses on analyzing and evaluating stock prices using real-time data, employing Support Vector Regression concepts. Furthermore, it compares the predicted stock prices with the actual ones to gauge the accuracy of this technique.

• INTRODUCTION

• *Stock Price*

The stock price represents the highest or lowest amount at which an individual can purchase shares of a company. These prices fluctuate daily, typically characterized by four values: the opening price, closing price, highest price, and lowest price of a stock on a given day. Our analysis focuses on past data concerning the opening price of Apple company's stock for July 2017. Furthermore, we have conducted predictive modeling to anticipate the opening price for future dates.

• *How prediction can be done*

The efficient market hypothesis(EMH) states that stock prices can't be predicted[14].But nowadays there are many approaches for forecasting stock price. In this paper, machine learning method is used. Machine learning is a very vast area. Machine learning is divided into 2 types- Supervised learning and Unsupervised learning [13]. In supervised learning, we



are basically guiding the machine how to approach the task. While unsupervised machine learning is clustering where a bunch of random data is thrown to the machine and asked to form groups which fit best. We used supervised learning for our analysis for stock market prediction.

One such method of supervised machine learning is Support Vector Machine(SVM)[13]. SVM is mainly used for classification and regression. We have used the approach of regression in this paper. In simple language, regression means traveling back in time. Technically regression is an analytic method used to find the relationship between one or more independent variables and a dependent variable. Therefore, here the prediction of the stock market is done using this concept.

- *Support Vector Machine(SVM)*

There are many methods which are effective as SVM like Artificial Neural Network(ANN). But there are few advantages of SVM over others[15]:

- When high-dimensional spaces are there, then SVM is effective.
- SVM has a simple geometric interpretation.
- SVM always finds a global minimum meaning does not miss the bigger picture.
- SVM are non-parametric thus their size is not fixed.
- SVM is memory efficient.

SVM consists of SVR (it is the method) which has many kernels included in it. Thus various kernel functions make SVM versatile.

- **LITERATURE SURVEY**

In the past few years, many theories, as well as models, have been proposed and developed for Stock Market prediction.

Social media sites like Facebook, Twitter and even articles in newspapers and blogs have an effect on the fluctuation of stock market prices [8]. Many papers have extensively written regarding the impact of information available on Web using different data and text mining techniques. R.P. Schumaker and H.Chen [8] predicted stock prices and analysed various representation of the text written in newspapers and later compared them to Linear Regression. J.Bollen et al. [9] collected states of mood from Twitter feeds and analysed its



text content using mood tracking tools. They found an accuracy of 87.6% in predictions of the stock market from the data collected.

Artificial Neural Network (ANN) model is another popular technique to predict the closing prices of stocks.

J. T. Yao and C. L. Tan [10] wrote about a neural network prediction model built on seven steps which classify and predict data. T. Hui-Kuang and K. Huarng [11] implemented a time series model to forecast stock prices of Taiwan. Neural networks can handle nonlinear relationships between numerical observations.

Md. R. Hassan and B. Nath [16] used Hidden Markov Model (HMM) to forecast stock prices. HMM is best suited to model dynamic systems and hence it is majorly used for pattern recognition and classification queries. The model that is chosen is trained on the past datasets yet the prediction is not entirely accurate and straightforward.

- **METHODOLOGY**

When SVM is applied for just regression problem then it is termed as Support Vector Regression (SVR). The fact that SVR just minimizes the training error is a myth. It actually takes a stab at minimizing the generalization error.

SVR is a method of python for predicting stock prices. SVR is a method of library SVM. SVR method has many parameters. One such parameter is the kernel. The kernel in this method means the type of algorithm which is used to forecast the prices. SVR method in python has 5 types of kernels which mean 5 types of algorithms [16]. The various types are: Radial Basis Function (RBF), Polynomial, Linear, Sigmoid, precomputed or callable. Further, we have performed a comparison among RBF, Polynomial and Linear method.

- *Radial Basis Function*

Radial basis function kernel is most common kernel function. It is the default function for SVR method in python. It is a non-linear regression. This means that data cannot be classified linearly. RBF is also known as the Gaussian kernel. RBF kernels are general purpose it should only be used when not using for text.

- *Polynomial*



Polynomial is a kernel function used for support vector machines. The polynomial kernel is a non-linear regression. This regression is used only when data points are non-linearly separable. As the name suggests this kernel will have a polynomial equation. In python when we use polynomial kernel then another parameter needs to be set i.e. degree. This parameter specifies that how many degrees of the equation will be. By default, the 3- degree polynomial equation would be used if not mention. The space of polynomial kernel is same as polynomial regression. Polynomial regression is a type of regression analysis which is quite same as a linear regression but is modeled as nth degree instead of just 1 degree. It is also considered to be a variety of multiple linear regressions.

- *Linear*

The Linear kernel is most commonly used for text. The Linear kernel is basically an equation which is defined as:

$$y = ax + b$$

where,

y = dependent

variable a = slope intercept

x = independent

variable b = constant

Here 'x' is variable which represents date and 'y' means stock price. Using x and y for past data 'a' and 'b' are obtained. After generating the equation, prediction can be made for any date by changing the value of 'x'.

Linear regression is concerned with only one independent variable. As the value of 'x' changes, we will get our value for 'y'.

- *Comparison*

Fig. 1 represents comparison for 3 different types of kernels of Support Vector Regression. The graph is for the opening price of Apple Company. The black dots represent the opening stock price of Apple Company for different dates of July 2017. The red line represents the RBF kernel line used for prediction while green line represents linear kernel of SVR and lastly, the blue line represents polynomial kernel line. The red, green, blue dots represent the

prediction made for 28th July using RBF, linear, polynomial kernel respectively for opening stock price.

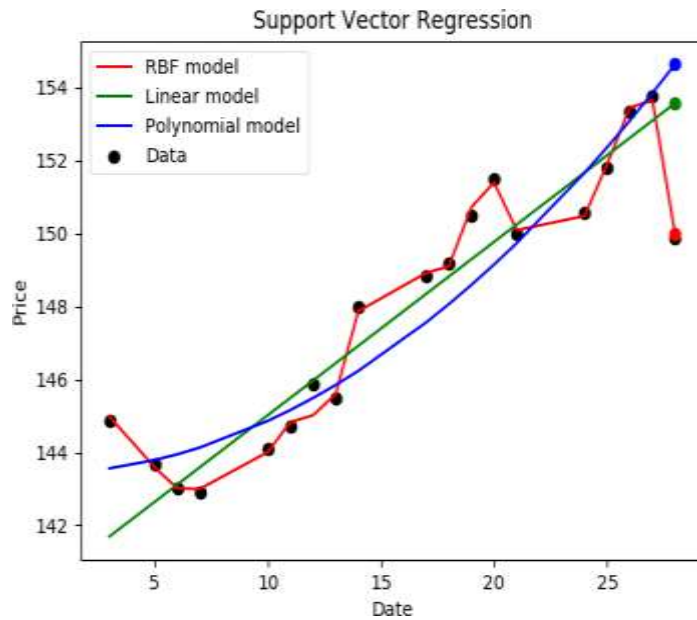


Fig. 1. Graph comparing 3 different methods on a single set of data.

It can be concluded from the graph(Fig. 1) that the prediction made for 28th July 2017 is more accurate to actual data for RBF kernel. The stock price for 28th July 2017 using RBF kernel is 149 which is very near to actual price which is 149.89(opening price). While using linear and polynomial the opening stock price is approximately 153 and 154 respectively.

To conclude, as RBF kernel is non-linear this means that it is non-parametric. Hence the complexity of the model is infinite. This means that more data used better and complex relationships could be determined. RBF is generally more flexible. Now as seen from the graph that data is not linearly separable thus higher accuracy could not be achieved. Despite being the simplest classifiers, linear kernels are better and faster in training and testing datasets as compared to RBF kernel. According to research linear kernel is mostly used when we want to optimize stock market prediction problem.

• CONCLUSION

Predicting stock prices garners significant attention from both researchers and investors due to the inherent financial risks involved. Our findings suggest that for novice analysts and



brokers, support vector regression serves as an effective method for stock price prediction. However, it's essential to acknowledge the dynamic nature of the stock market. Achieving advanced-level accuracy in prediction requires considering external parameters such as natural disasters, political climate, socioeconomic conditions, and more. Extensive research and development efforts have led to the implementation of various techniques including Artificial Neural Network, Autoregressive Models, and leveraging social media and news stories for stock price prediction. Nevertheless, uncertainty and ambiguity persist in every case, as no technique can accurately forecast stock price movements with certainty. While these techniques may mitigate losses in stock market investments, none can guarantee substantial profits consistently.

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