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Stock Price Prediction using Machine Learning

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Abstract: Nowadays, a large amount of data is available everywhere. Therefore, it is very important to analyze this data to extract some useful information and develop an algorithm based on this analysis. This can be achieved through data mining and machine learning. Machine learning is an integral part of artificial intelligence, which is used to design algorithms based on data trends and historical relationships between data. ML is used in various fields such as bioinformatics, intrusion detection, Information retrieval, game playing, marketing, malware detection, image deconvolution, and so on.

1. Introduction

A stock market, equity market, or share market is the aggregation of buyers and sellers (a loose network of economic transactions, not a physical facility or discrete entity) of stocks (also called shares), which represent ownership claims on businesses; these may include securities listed on a public stock exchange as well as those only traded privately. Examples of the latter include shares of private companies which are sold to investors through equity crowdfunding platforms. Stock exchanges list shares of common equity as well as other security types, e.g., corporate bonds and convertible bonds.

2. Literature Survey

Literature about effective stock price prediction methods is extensive. This is partly driven by the problem's dynamic character and the desire for better outcomes. Based on modelling accuracy, practicality, and computational time, compared to the performance of linear optimization, [1] ANNs, and [2] genetic algorithms (GAs) in modelling time series data. According to the study, linear optimization approaches produced the best results, with GAs producing comparable outcomes if the parameter and resolution boundaries were carefully chosen. NNs produced the worst results. To forecast the Korean Stock Price Index, the work reported also compared the forecasting abilities of [3] ARIMA and ANN models. The ARIMA model outperformed the [4] back-propagation neural network (BPNN) model in terms of forecast accuracy. Also, role of ML and ESP becoming important nowadays in latest applications and control [5-59].

3. Proposed System and Interpretation

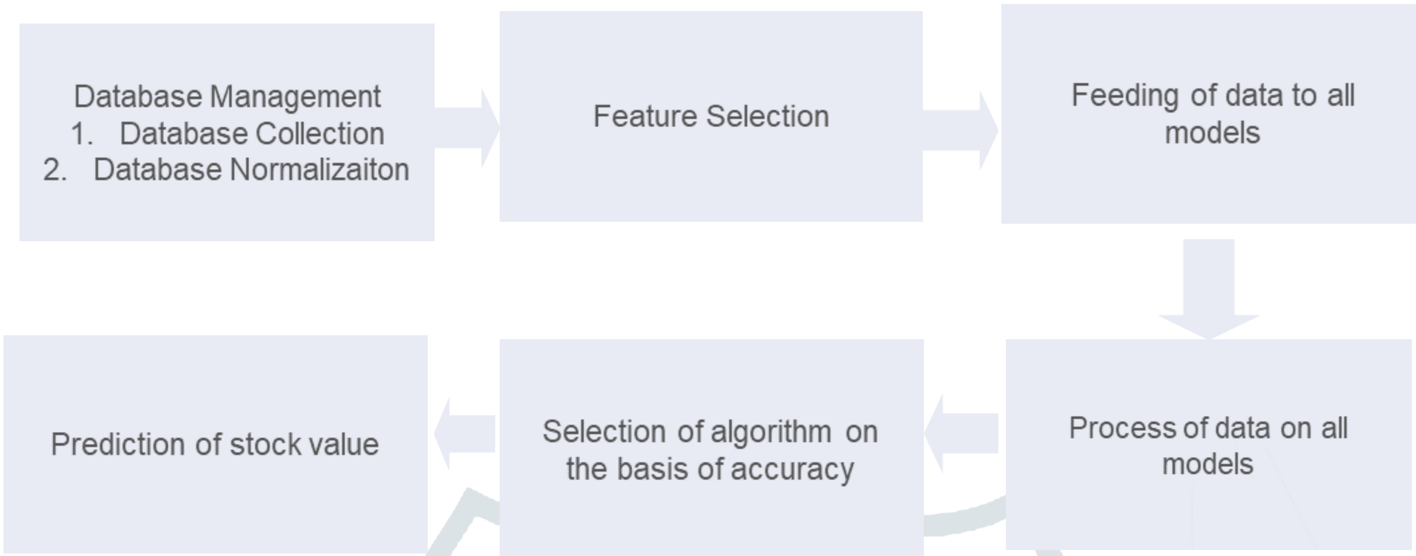

Fig.1. Block diagram of stock value prediction system

3.1.1 We collected a database from a source called Kaggle which is the largest community of data scientists and machine learners.

3.1.2 After collecting data from all sources, we will have to combine it and normalize it using different functions.

3.2 Feature Extraction

- We considered various independent features relating to Stock Market. Of these, we will select some features to use in our initial algorithm with daily data. These features will be selected manually based on our research of their significance to the problem we are trying to solve.

3.3 Feeding database to our models:

- The selected features will be fed to our models for processing using various algorithms, mentioned later.

3.4 Processing of data on models:

- The dataset will be used for training purposes for a particular amount of time. After the training is complete, a part of the dataset will be removed from the training set and will be used for cross-validation.
- After this, to check the accuracy, a testing procedure will be done.

3.5 Selection of algorithm based on accuracy:

- After all the algorithms are implemented, the one with the higher accuracy will be used for predicting the correct Stock market value.

3.6 Predicting the price of the stock:

- After the correct model is selected, the historical close price of the stock is given as input and the output obtained is the predicted price of the stock.

4. Steps and Working of the model

4.1 The starting date for the historical price data for the stock is 2015-01-01 and the stock is taken as a sample is that of Apple Inc whose ticker is AAPL (data source: yahoo finance)

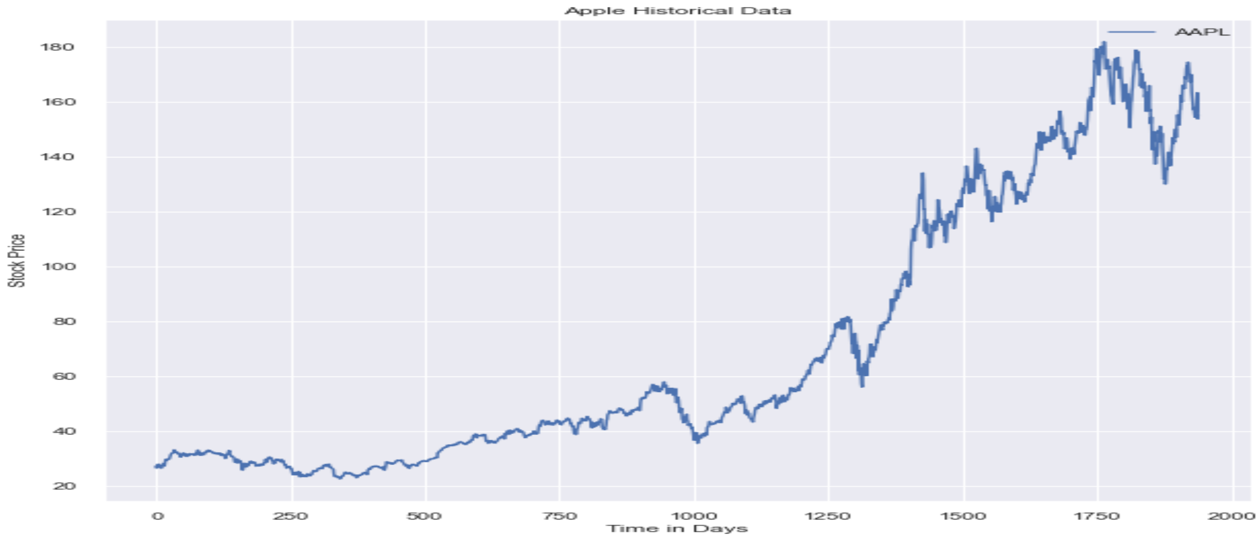

Fig.2. Working of the proposed model

4.2 The ARIMA model has been chosen for time-series analysis. Make sure that your data is stationary before applying this model. To have stationary data:

1) The series' mean should not depend on the passage of time.
2) The series' variance should not depend on the passage of time
3) There should be no time dependence in the covariance of the ith term and the I + m)th term.

There are two ways to determine whether a time series is stationary. The first is through studying the information. It should be simple to spot a changing mean or variation in the data by visualizing it. The Dickey-Fuller test offers a more precise evaluation.

Our adf_test_stationarity function supports our observation that the time series is not stationary, which is obvious to us.

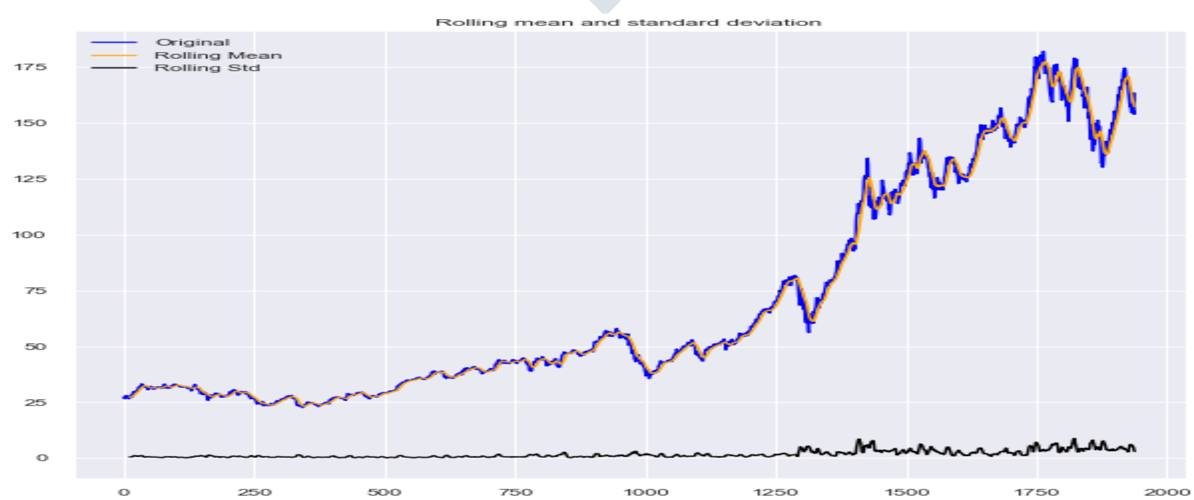

Fig.3. Rolling mean and rolling standard calculations

4.3 Once we confirm that the time series is non-stationary, we convert the series into stationary data by taking using the first-differencing method.

- This means we take the value at a time (t) and subtract the value at a time (t-1) to get the difference. This difference is also the calculated return over that period. Since our time steps are in days this differencing is the daily return
- In time series analysis and forecasting, autocorrelation and partial autocorrelation plots are frequently employed.

Fig.4. Rolling mean and rolling standard deviation calculations of first order differences

- The p-value obtained is less than the significance level of 0.05 and the ADF statistic is lower than any of the critical values. We reject the null hypothesis. So, the time series is stationary.

4.4 These plots show the strength of a relationship between an observation and an observation in a time series containing observations at earlier time steps.

- For those new to time series forecasting, understanding the distinction between autocorrelation and partial autocorrelation can be challenging and perplexing.
- Autocorrelation is the correlation between points at time t (P_t) and the point at(P_{t-1})

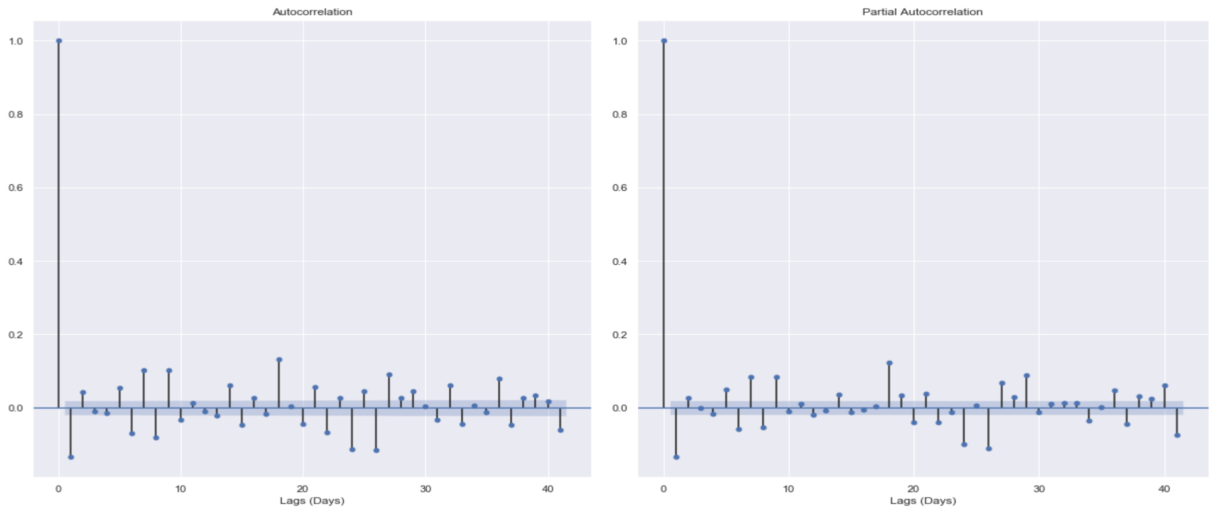

Fig.5. Autocorrelation and partial Autocorrelation calculations

The chart above provides a brief guide on how to read the autocorrelation and partial autocorrelation graphs to select the proper terms. The big issue as with all models is that you don't want to overfit your model to the data by using too many terms.

Once we generate the autocorrelation and partial correlation, based on these experiments we found our preferred model order of (4,2,0) and used this to generate the following forecast.

5. Results and discussion

We Fit the model on the univariate series of lagged differenced values. Then predictions are made on the testing data.

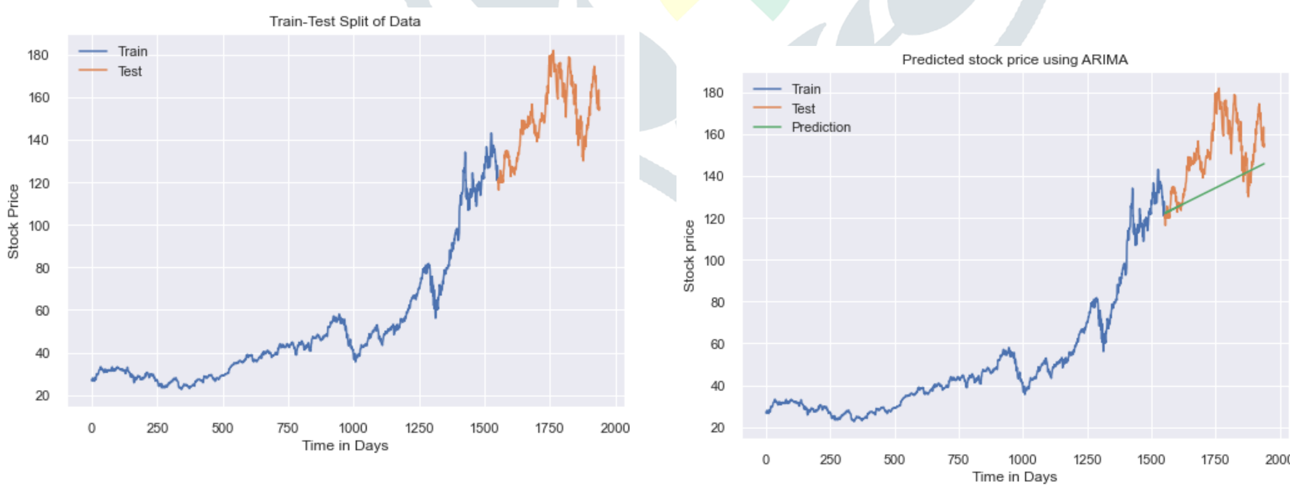

Fig.6. Training, Testing of data and Prediction analysis

The chart on the left above shows the train and test split of the data in the ratio of (80:20). The training data starts from inception date till the cutoff date which is 2021-03-03 and the test data starts from 2021-03-04 till the most recent date for which the price of the stock is available.

The chart on the right above depicts the final output using the ARIMA model, in which the green line gives us the predicted values on the testing data set.

6. Conclusion

We experimented with different parameters of autoregressive (AR) and moving average (MA)models to determine the best model that will give the best forecast as indicated in.

We found ARIMA (Autoregressive moving average) model as a tool for understanding and predicting future values in a time series. The model used of the order (4,2,0) had a Standard Deviation of innovations ~0.139 and could predict the output price with the accuracy of more than 80%. We also observed that in a time series which is showing non-stationarity, the ARIMA is used because it generalizes both models and integrates both. For data showing non-stationarity, we can apply the differencing step to eliminate the non-stationarity in data.

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