

STOCK PRICE PREDICTION USING MACHINE LEARNING TECHNIQUES

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Stock price prediction is one of the most difficult tasks in the financial analysis. Large number of factors affecting pricing and big amount of data complicate this task. There are two main methods for solving this problem, the fundamental method, and the technical analysis method.

This paper discusses main methods of analyzing the stock market. Main algorithms of machine learning are studied. This paper considers the possibility of using machine learning methods in the process of technical analysis to predict the behavior of stocks in time. Proposed algorithm using machine learning method for predicting prices using historical data.

Keywords: machine learning, stock price prediction, technical analysis.

In our days, the study of the stock market is a highly promising area of economic research. The high interest is due to the significant dynamics in the development of modern stock markets. The modeling of the value of stocks is central to the theory of portfolio management and the valuation of financial instruments.

Due to the high instability in global financial markets, methods of studying and forecasting volatility have become particularly important and actual. The prices of financial assets are influenced by many internal and external factors, such as news, macroeconomic conditions, company reports on the results of their activities, company valuation, etc. It is also interesting to analyze the market for the influence of certain factors.

There are two main groups of methods: fundamental analysis methods and technical analysis methods. Fundamental analysis is usually used to study the financial and economic situation in a company and allows to answer two main questions: which issuer shares can bring the greatest income, and what is the “fair” (internal) price of the considered share. At the same time, fundamental analysis is abstracted from fluctuations in the stock price on the market. To form a holistic view, it is also necessary to perform technical analysis.

Fundamental analysis is the cornerstone of investing. The biggest part of fundamental analysis involves delving into the financial statements and performing a quantitative analysis, this involves looking at revenue, expenses, assets, liabilities and all the other financial aspects of a company to gain insight on a company's future performance. When talking about stocks, fundamental analysis is a technique that attempts to determine a security's value by focusing on underlying factors that affect a company's actual business and its future perspectives. On a broader scope, fundamental analysis can be performed on industries or the economy. One of the primary assumptions of fundamental analysis is that the price on the stock market does not fully reflect a stock's “real” value but in the

long run, the stock market will reflect the fundamentals. The biggest criticisms of fundamental analysis come primarily from two groups the proponents of technical analysis and believers of the “efficient market hypothesis” [1].

Usually, in practice, under the technical analysis are considered some methods for predicting financial asset prices based on a special mathematical calculation. Technical analysis assumes that knowledge of the history of prices in the past allows us to draw conclusions about a possible change in the future.

Technical analysis appraises equity securities by evaluating the statistics of preceding stock prices and volume caused by market activity. Technical analysts do not measure a stock's intrinsic value but alternatively use charts and other instruments to recognize patterns that can advocate perspective activity. Technicians can depend on chart patterns, technical indicators, and oscillators. Moreover, technical analysts' exclusive use of historical price and volume data is what separates them from fundamental analysts. The field of technical analysis is based on the three suppositions: “the market discounts everything”, “stock prices move in trends”, and “history of stocks tends to repeat itself” [2, 3].

Technical analysis uses technical indicators to gain insight into the supply and demand of securities and market psychology. Moving averages are primarily the most recognized technical indicators used to decide the direction of trading stocks. Every moving average model is the consequence of a statistical computation of an averaging number of preceding information plotted into a chart enabling traders to watch at smoothed data rather than focusing on daily price movements inherited in all financial markets. The relative strength index (RSI) is a momentum indicator used in technical analysis that measures the magnitude of recent price changes to evaluate overbought or oversold conditions in the price of a stock or other asset. The RSI is displayed as an oscillator (a line graph that moves between two extremes) and can have a reading from 0 to 100. The Aroon oscillator is a technical indicator used to measure whether a security is in a trend, and more specifically if the price is hitting new highs or lows over the calculation period. The indicator can also be used to identify when a new trend is set to begin [4].

Thanks to these concepts, in further work, the technical analysis method will be considered.

Machine learning (ML) methods

The development of ML methods makes it possible to use these methods in the field of analysis and forecasting of prices in the securities market too. This paper proposes the use of machine learning methods for predicting securities prices. Machine learning algorithms can be described as training of an objective function f that best matches the input variables X and the output variable Y : $Y = f(X)$. The most common task in machine learning is to predict Y values for new X values. This is called predictive modeling, and our goal is to make the prediction as accurate as possible.

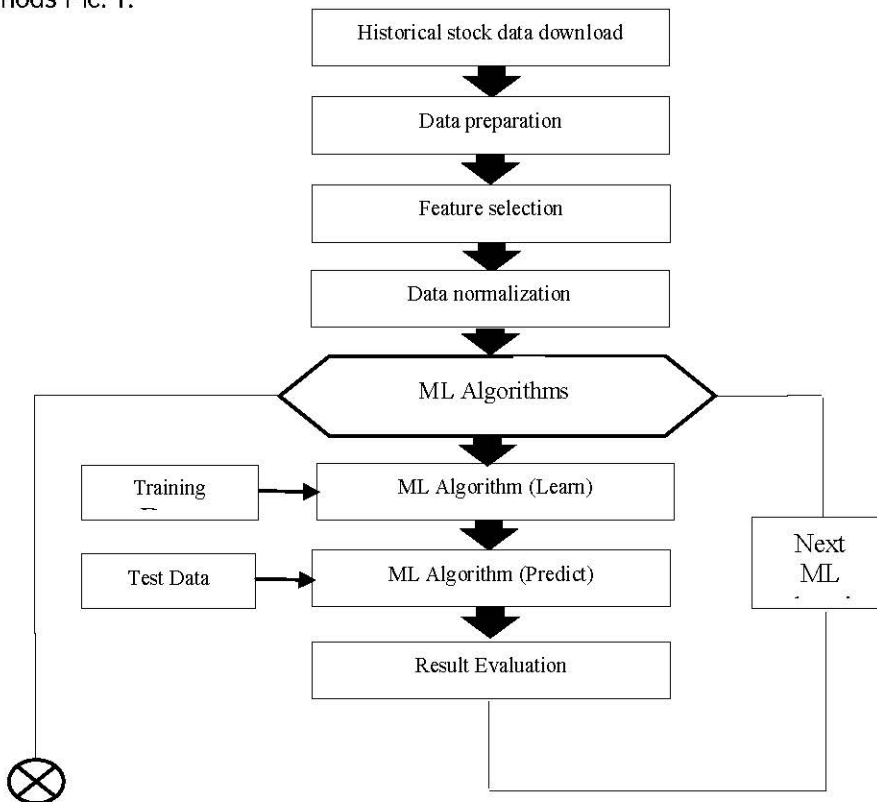
The first approach that we will discuss is linear regression. The use of linear regression model is important for the following reasons:

- a. Descriptive – It helps in analyzing the strength of the association between the outcome (dependent variable) and predictor variables
- b. Adjustment – It adjusts for the effect of covariates or the confounders
- c. Predictors – It helps in estimating the important risk factors that affect the dependent variable
- d. Extent of prediction – It helps in analyzing the extent of change in the independent variable by one “unit” would affect the dependent variable
- e. Prediction – It helps in quantifying the new case. [5]

The second approach is support vector machine (SVM). SVM is a novel small-sample learning method, because it is based on the principle of structural risk minimization, rather than the traditional empirical risk minimization principle. SVM fall into the category of supervised learning, which means that it creates a function that will map a given input to an output. It is superior to existing methods on many performances. SVM is a two-dimensional description of the optimal surface evolved from the linearly separable case. [6]

Proposed algorithm

Based on described studies, proposed algorithm for stock price prediction using ML methods Pic. 1.

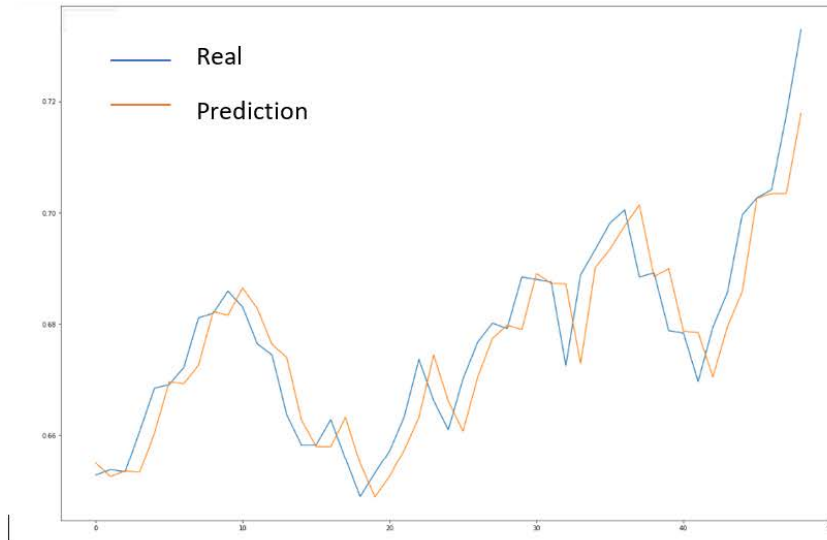


Pic. 1. algorithm for stock price prediction using ML methods

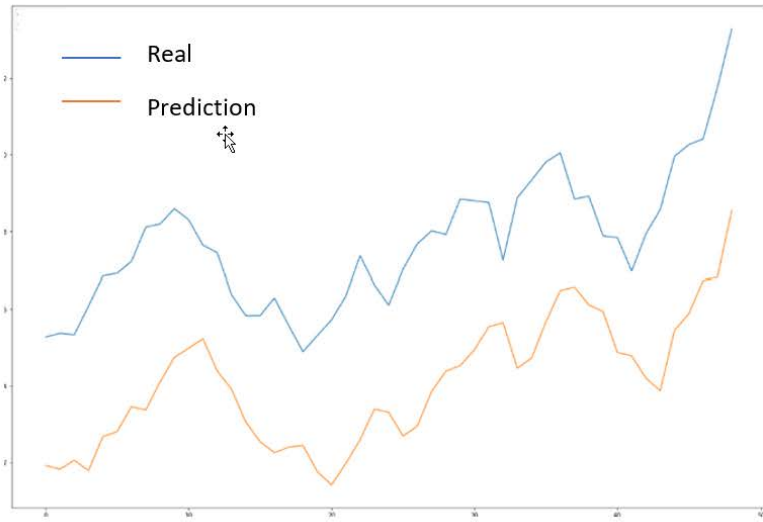
Algorithm description:

- a. Historical stock data download- for this step were used service called AlphaVantage. In that service is available history or prices for past 20 years. AlphaVantage provides public API for downloading data.
- b. Data preparation – Form AlphaVantage we can get data in different of formats (JSON, XML). On this stage we are converting data to appropriate format.
- c. Feature selection – On this stage from large number of columns we are selecting only necessary properties. In our case we will use open, high, low, close and volume of trades for each time.
- d. Data normalization – On this stage normalization in the data between 0 to 1 range are done. And data is divided into test and training parts.
- e. ML Algorithms - On this stage we are using two ML algorithms: linear regression and support-vector machines

During practical usage of proposed algorithm where used Google price date for July 2020. Interval between prices was 1 min. Algorithm as realized using Python Scikit-learn library.



Pic. 2. Linear regression



Pic. 3. Support-vector machines

As a prediction result, we consider two main indicators: root mean square error (RMSE) and mean absolute error (MAE). Results for both algorithms are presented in Table 1.

Table 1. Prediction results measurements

	Root mean square error (RMSE)	Mean absolute error (MAE)
Linear regression	0.007775	0.006063
SVM	0.037188	0.036222

Usage of proposed algorithm are giving opportunity to find better method of ML for current task. Our experimental study shows that linear regression has better results than SVM algorithm. For future work we expect to use more factors in model learning to improve prediction results. Such factors can be oil price, economical and political news etc.

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ՄԵՔԵՆԱՆԵՐԻ ՈՒՍՈՒՑՄԱՆ ՄԵԹՈԴՆԵՐԻ ԿԻՐԱՌՈՒՄԸ ԱՐԺԵԹՂԹԵՐԻ ԱՐԺԵՔԻ ԿԱՆԽԱՏԵՍՄԱՆ ՄԵՋ

ԲԱԼՅԱՆ ԱՐՄԵՆԱԿ

ԳՊՀ դասախոս

Արժեթղթերի արժեքի կանխատեսումը ֆինանսական վերլուծության ոլորտում հանդիպող ամենաբարդ խնդիրներից է: Այն բարդացնում են տվյալների մեծ ծավալը և գների տեղաշարժի վրա ազդող շատ գործոններ:

Կա արժեքները կանխատեսող երկու հիմնական մեթոդ՝ հիմնարար մեթոդ և տեխնիկական վերլուծության մեթոդ:

Հոդվածում քննարկվում են արժեթղթերի շուկայի վերլուծության հիմնական մեթոդները, ուսումնասիրվում են մեքենայական ուսուցման հիմնական ալգորիթմները, դիտարկվում է տեխնիկական վերլուծության գործընթացում մեքենայական ուսուցման մեթոդների օգտագործման հնարավորությունը՝ արժեթղթերի վարքը կանխատեսելու համար:

Առաջարկվող ալգորիթմը մեքենայական ուսուցման մեթոդներն օգտագործում է պատմական տվյալների հիման վրա՝ արժեթղթերի արժեքները կանխատեսելու նպատակով:

***Բանալի բառեր՝** մեքենայական ուսուցում, արժեթղթերի արժեքի կանխատեսում, տեխնիկական վերլուծություն:*

ПРИМЕНЕНИЕ МЕТОДОВ МАШИННОГО ОБУЧЕНИЯ ДЛЯ ПРОГНОЗИРОВАНИЯ ЦЕН АКЦИЙ

БАЛЯН АРМЕНАК

Преподаватель ГГУ

Прогнозирование стоимостей ценных бумаг является одной из сложнейших задач в сфере финансового анализа. Данную задачу усложняют большие объемы данных и большое количество факторов, влияющих на движение цен. Существует два основных метода прогнозирования цен: фундаментальный метод и метод технического анализа.

В данной статье рассмотрены основные методы анализа рынка ценных бумаг. Изучены основные алгоритмы машинного обучения. Рассмотрена возможность использования методов машинного обучения в процессе технического анализа для прогнозирования поведения акций во времени.

Предлагаемый алгоритм использует методы машинного обучения на основе исторических данных для прогнозирования стоимости ценных бумаг.

***Ключевые слова:** машинное обучение, прогнозирование цен акций, технически анализ.*

Հոդվածը ներկայացվել է խմբագրական խորհուրդ 10.07.2020թ.:

Հոդվածը գրախոսվել է 30.09.2020թ.: