



Stock and Forex Market Trend Prediction

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ABSTRACT

The stock market is a complex system that enables individuals and organizations to buy and sell shares of publicly traded companies. It plays important role in the global economy by providing companies with access to capital and investors with opportunities to grow their wealth. The stock market is influenced by a variety of factors, including economic indicators, political events, and company-specific news. The stock market is influenced by a variety of factors and their impact on the stock market can be challenging, but it is essential for investors to make informed decisions about buying and selling stocks. The foreign exchange (forex) market is a decentralized, global marketplace where currencies are traded 24 hours a day, 5 days a week. The forex market is the largest financial market in the world, with daily trading volumes reaching trillions of dollars. The market is comprised of a diverse range of participants, including banks, hedge funds, corporations, individual traders, and central banks.

Keywords: Technical Analysis, Sentiment Analysis, Technical indicators, Historical Patterns, News and Events, Trend Lines, Support and Resistance Levels, Moving Averages, Ichimoku Cloud, MCAD, Relative Strength Index, Simple moving average.

1. Introduction

Financial time-series prediction is an attractive research area for investors, market analysts, and the public because it offers opportunities to increase wealth. In financial markets, various assets such as stocks, bonds, currencies, and commodities are traded at prices determined by market forces. stock market is characterized as dynamic, unpredictable, and non-linear in nature. Predicting stock prices is a challenging task as it depends on various factors including but not limited to political conditions, global economy, company's financial reports and performance etc.

The foreign exchange or forex market is the largest financial market in the world where currencies are bought and sold simultaneously. It is even larger than the stock market. It is a non-centralized market the operates 24 hr a day except the weekend, which makes it unique from other financial market, unlike stocks, is one of the most complex markets. In the forex market, currency pairs are traded, with the base currency being the first listed currency and the quote currency being the second. Currency pair compare the value of one currency to another.

2. Literature Review

2.1 Short-term stock market price trend prediction using a comprehensive deep learning system.

In this paper they have focused on predicting short-term price trends from different aspects: feature engineering, financial domain knowledge, and prediction algorithm [1].

The high-level architecture of our proposed solution could be separated into three parts. First is the feature selection part, to guarantee the selected features are highly effective. Second, we investigate the data and perform the dimensionality reduction. And last part, which is the main contribution of our work is to build a prediction model of target stocks. They focused on the short-term price trend prediction. They have used only raw data with no labels. So, the first step is to label the data. If the price trend goes up, we mark it as 1 or marks as 0 in the opposite case.

There are many features in the raw data; if we involve all the features into our consideration, it will not only drastically increase the computational complexity but will also cause side effects if we would like to perform unsupervised learning in further research. So, they leverage the recursive elimination (RFE) to ensure all the selected features are effective. The very first step before leveraging PCA is feature Pre-Processing. Because some of the features after RFE are percentage data, while others are very large numbers, i.e., the output from RFE are in different units[1].

After Performing the data pre-processing part, the last step is to feed the training data into LSTM and evaluate the performance using testing data. The LSTM structure is formed by two layers. The input dimension is determined by j after the PCA algorithm. The first layer is the input LSTM layer, and

the second layer is the output layer. The final output will be 0 or 1 indicates if the stock price trend prediction results is going down or going up, as supporting suggestion for the investors to perform the next investors to perform the next investment decision [1].

2.2 Survey of feature selection and extraction techniques for stock market prediction

In this paper, they have used Autoregressive Integrated Moving Average (ARIMA), one of the most efficient and robust statistical models, was applied to predict daily stock returns and prices. An ARIMA model has also been combined with other methods, such as XGBoost, wavelet transform, and neural network models (Wang and Guo March 2020; Shan et al. 2015), to predict the one-day-ahead open prices of different stocks. A hybrid method of ARIMA with a neural network and long short-term memory (LSTM) network was applied to predict the Bursa Malaysia stock exchange during the COVID-19 pandemic period [2].

In this paper, they have used the support vector machine (SVM), a popular ML method, was successfully deployed for regression and classification tasks using technical indicators and macroeconomic factors. The SVM methods also provided good prediction performance for high-frequency data [2].

In this paper, they have used DL model in there project the DL neural networks to extract the essential characteristics of highly complex stock market data. The authors applied an artificial neural network (ANN) to predict the stock market, index DL models to predict the prices of National Stock Exchange (NSE). A Recurrent neural network (RNN) model was applied to predict the up and down direction of stock on the basis of financial news and historical stock prices [2].

2.3 Stock Closing Price Prediction Using Machine Learning Techniques

In this paper, they have collected five company's historical data from yahoo Finance. And the dataset includes five years of data of Nike, Goldman Sachs, Johnson and Johnson, Pfizer and JP Morgan Chase and Co. Here only the day-wise closing price of the stock has been extracted. They have created six new variables for prediction of stock closing price. And those variables have been used for train model. 1. Stock High minus Low price (H-L), 2. Stock Close minus Open Price (O-C), 3. Stock price's seven days' moving average (7 DAYS MA), 4. Stock price's fourteen days' moving average (14 DAYS MA), 5. Stock price's twenty-one days' moving average (21 DAYS MA), 6. Stock price's standard deviation for the past seven days (7 DAYS STD DEV) [3].

Here they have used ANN, is one of the intelligent data mining techniques that identify a fundamental trend from data and to generalize from it. ANN is capable of simulating and analysing complex patterns in unstructured data as compared to most of the conventional methods. And this model works on three different layers. It consists of input layer, hidden layers and output layer. The input layer consists of all new variables in it. And hidden layer consists of two neuron, And output layer consists only one neuron [3].

Here Random Forest (RF) is an ensemble machine learning technique. It can perform both regression and classification tasks. They have combined the multiple decision tree is order to determine the final output and reduce the noise in the stock market data. It aims at minimizing forecasting error by treating the stock market analysis as a classification problem and based on training variables predicated the next day closing price of the stock for a particular company [3].

2.4 Forex Sentiment Analysis with Python

As implied by the project's name, it focuses on the historical currency pair data taken from www.investing.com. in addition to historical data, trend line observation were also made on historical candle charts. In this project they are collecting data from Twitter, is one of the social media that is often used by market participants to convey their opinions or sentiments on topic or issue related to the Forex market [4].

Tweets data retrieval in this research was carried out with two different Python libraries, namely Tweepy and Snsrape. After collecting data, the next process is data cleaning. This step aims to remove parts of the data that are not related to the data processing to be carried out (in this case, is sentiment analysis). They have used Regular Expression technique for cleaning data which has been collected from twitter. The data that has been collected and cleaned is then processed to determine the sentient. Experiments were carried out with two libraries, namely the TextBlob library and the VADER Sentiment library from NLTK [4].

The predetermined sentiment score for tweets data is then visualized. The goal is to observe the number of sentiments (positive, negative, and neutral) from the collected tweets every day [4].

2.5 Evaluating the Prediction Accuracy of MACD and RSI for Different Stocks in Terms of Standard Market Suggestions.

In this paper, they researched on the MACD, has been use as an important technical parameter for understanding future prospective asset price direction. MACD is an indicator that follows the trend momentum, depicting a relation between two moving averages of a security's price. The calculation of MACD is carried forward by deducting the 26-period EMA (Exponential Moving Average) from the 12-period EMA [5].

The exponential moving average (EMA) is a type of moving average (MA) that lends greater weight and significance to the most recent data points, and it is also know as the weighted moving average (EWMA) [5].

The Relative Strength Index (RSI) is an impulse indicator that assesses the magnitude of recent price swings to determine if an asset is overbought or oversold. RSI values of 70 or higher are traditionally interpreted and used to indicate that the investment has become overbought or costly and is due for a trend reversal or corrective price decrease. In market research and trading signals, the RSI is considered a bullish indication when it rises over the horizontal 30 reference level. On another said, The RSI that goes below the horizontal 70 reference level is considered a bearish indicator [5].

2.6 A Primer on the Ichimoku Cloud Indicator

In this paper, they worked on the Ichimoku Cloud indicator that is used to identify potential trend reversals and support/resistance levels in financial markets. The indicator was developed by a Japanese journalist named Goichi Hosada in the late 1930s, and it is sometimes referred to as the Ichimoku Kinko Hyo or Ichimoku indicator [6].

The Ichimoku Cloud is composed of several components that are plotted on a price chart, are Tenkan-sen (Conversion line), Kijun-sen (Base Line), Senkou Span A (Leading Span A), Senkou Span B (Leading Span B), Chiku Span (Lagging Span).

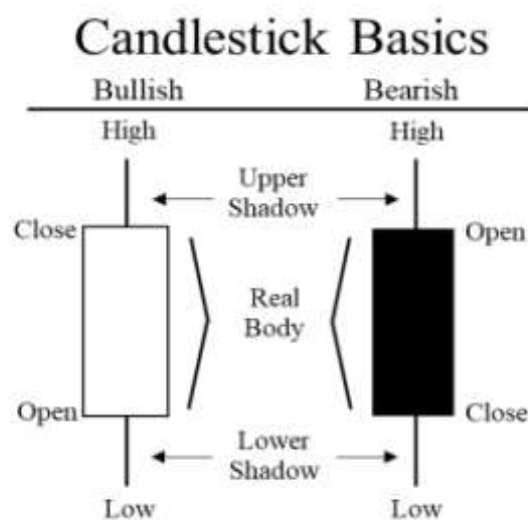
Most of the time Ichimoku Cloud used to identify potential trend reversals and support/resistance levels. If the price is above the cloud, it is considered bullish, and if the price is below the cloud, it is considered bearish. The traders looks for crossover between the Tenkan-sen and Kijun-sen as potential entry or exit points.

2.7 Generating Trading Strategies Based on Candlestick Chart Pattern Characteristics

In this paper, they trained data using Chi-Square Automatic Interaction Detector (CHAID) algorithm to build a trading strategy in from of a classification tree using features which can recognize candlestick chart patterns. Candlestick pattern recognition is a technique used in technical analysis to identify potential trading opportunities in financial markets. Candlestick charts are a popular charting method that displays price movements using candlestick-shaped bars. These bars show the opening, closing, high, and low prices of an asset over a given period. Traders use candlestick pattern recognition to identify patterns in the price action that may indicate a potential change in trend or direction [7].

Candlestick chart is a popular method to display stock price information. Patterns of candlestick series are found to provide hints for the price of the next one. There are so many types of candlestick chart patterns which are difficult to be used effectively. Traders often combine candlestick pattern recognition with other technical indicators to confirm potential trading opportunities and manage risk. It is important to note that no trading strategy or indicator is perfect, and traders should always use proper risk management techniques when making trading decisions. It's worth noting that while these patterns can be useful in identifying potential trading opportunities, traders should not rely solely on candlestick pattern recognition. It's important to use other technical indicators and analysis techniques in conjunction with candlestick patterns to make informed trading decisions [7].

Patterns of candlesticks are found to provide hint on future prices. CHAID uses Pearson's Chi-square test of independence, which tests for an association between two categorical variables, to determine the p-value which is used to select the variables to split a node.



2.8 A Control Chart Pattern recognition system using a statistical correlation coefficient method.

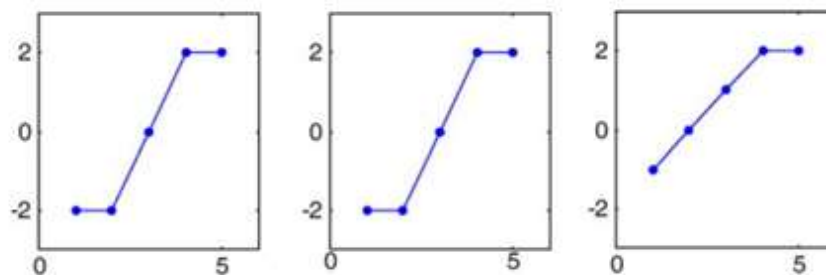
The chart pattern recognition is an important step for industrial production processes, many researchers have made efforts toward finding various efficient methods for recognizing unnatural patterns in control charts. Hwang and Hubele (1993) used a back-propagation neural network technique for detecting X-bar control charts. They created a fuzzy-soft LVQ to promote the recognition rate for control chart patterns. In order to decrease the number of reference

vectors for each pattern used to identify different variation quantities, few researchers constructed a so-called ‘matched filter’ using a correlation analysis technique based on an inner product vector product [8].

Their inner-product correlation technique got good results in recognizing trend, cycle, and systematic patterns. However, this method is poor in recognizing shift patterns. This is because the inner product presents the consistency in positive and negative components values in two vectors, but each component at the same position with an opposite sign will counteract the final inner product value.

They used a statistical correlation coefficient to create a simple mechanism for recognizing single and concurrent unnatural patterns where a change point from normal to abnormal may occur in control charts. By adding a threshold criterion, the proposed method becomes more powerful for practical applications.

They applied a back propagation network (BPN) for recognizing these concurrent patterns where two unnatural patterns may exist simultaneously. However, the training process of the BPN-based system tends to be relatively slow (see Guh & Tannock, 1999). On the other hand, the BPN construction is also complicated for a control chart pattern recognition where its performance may heavily depend on the number of neurons and layers. The statistical correlation coefficient between two random vectors x and y is defined as:



2.9 Predicting stock market index using LSTM.

In this paper, the author proposed multivariate financial time series data collected from different sources, the goal of the proposed model is to predict the next day closing price using a multivariate sequence of input features. The following LSTM implementation procedures are considered to accomplish this task. From the original dataset $X = (x_1, x_2, \dots, x_n)$ of size $k \times n$, the sequences $\{x_1, x_2, \dots, x_{n-1}\}$ and $\{y_1, y_2, \dots, y_{n-1}\}$ are created, where $x_t \in \mathbb{R}^{k \times 1}$ is the input sequence and $y_t \in \mathbb{R}$ is the next day closing price at time t . Here k and n are number of input features and the total number of observations respectively [9].

In this project, they have taken S&p 500, a popular US stock market index, is used for the model prediction. The process of feature selection includes identifying the core factors that contribute to the index value fluctuations. The closing price is predicted based on the fundamental trading data, macroeconomic data, and technical indicators of the underlying index. A combination of all the features from three different categories.

They implemented single layer and multilayer LSTM architecture to predict the closing price. Within each of these models, several options are considered with different number of neurons. Prediction accuracy and reliability of these models are assessed by calculating three different performance metrics — RMSE, MAPE, and R.

2.10 Forex Market Prediction Using NARX Neural Network with Bagging

In this project they have used NARX neural network, based prediction is a suitable tool for forecasting in non-linear time series applications. With neural network approach to time series, it is not necessary to know any information regarding the cause that generates the signal. The architectural approach proposed here to deal with Forex market is based on Nonlinear Autoregressive models with exogenous input (NARX model). All other dynamic networks have either been focused networks, with the dynamics only at the input layer, or feed-forward networks. NARX is a recurrent dynamic network, with feedback connections enclosing several layers of the network. It is based on the linear ARX model, which is commonly used in time-series modelling. This is a powerful class of models which has been demonstrated to be well suited for modelling nonlinear systems and especially time series. It has been shown that in NARX networks learning is more effective than in other neural networks and that these networks converge much faster and generalize better than the other networks [10].

For learning, a dynamic back-propagation algorithm is needed to evaluate the gradients. This is more computationally than static backpropagation. In addition, the error can be larger for dynamic than for static networks. Training is more likely to fall into local minima. The process of training a neural network involves iteratively presenting it with the input data so that it is calibrated and can be used later as a forecasting tool. The objective of the training is to minimize a defined error function, which implies that the neural network fit the [10]

The prediction is done hourly. The dataset used here is pulled from Alpari-Forex.com. For the news release data, two sources on relevant currencies are used: (1) Fxstreet.com, economic calendar from 2001; and (2) Bloomberg.com, economic calendar from 2001.

3. Conclusion

The use of technical analysis and chart patterns, Candlesticks recognition, Sentiment analysis, in predicting stock market behaviour can be helpful but should be approached with caution. While historical price and volume data can provide valuable insights into market trends and potential price movements, it is important to remember that past performance does not guarantee future results. Additionally, the interpretation of chart patterns can be subjective, leading to different predictions among analysts. As such, it is important for investors to use a combination of technical and fundamental analysis, as well as risk management strategies, to make informed investment decisions. Ultimately, successful investing requires a disciplined approach, a long-term perspective, and a willingness to adapt to changing market conditions.

Predicting the movements of the foreign exchange (forex) market is a complex and challenging task. There are many factors that influence the forex market, including economic indicators, geopolitical events, and central bank policies, among others. While technical analysis can provide insights into market trends and potential price movements, it is important to consider fundamental analysis as well. Understanding the underlying drivers of currency values is crucial in making informed trading decisions. Additionally, risk management strategies such as stop-loss orders and position sizing are essential for mitigating losses and maximizing profits. Successful forex trading requires a disciplined approach, continuous learning, and an ability to adapt to changing market conditions. It is important for traders to understand that there is no magic formula for predicting forex market movements, and that losses are an inevitable part of trading. Therefore, proper risk management and a long-term perspective are key to achieving success in the forex market.

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