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Automatic Stock Market and Trading Algorithmic Improve using Machine Learning and Deep Learning Programming

Priyanka, Sachin Raghav, Biplab Sarkar and Jyoti Sondhi

Abhilashi University,
Chail Chowk, Mandi, Himachal Pradesh 175045, India.

ABSTRACT

Our Invention Automatic Stock Market and Trading Algorithmic Improve using Machine Learning and Deep Learning Programming is a Stock market prediction regards the forecasting of the price of any given stock within the desired real-time-frame and has been a heavily researched topic over past years due to the difficulty of predicting time-series that are considered to be random walks. Whilst some use traditional Technical Analysis processes and methods such as the calculation and consideration of trends, more recently the problem has attracted the attention of Machine Learning, Deep Learning, and Artificial Intelligence approach. This Invention explores and compares the current Machine Learning, Deep learning approaches involved in predicting the direction and prices of selected stocks for a given real-time range, considering short, medium, and long-term investments. Using these models alongside Natural Language Processing of financial news to predict sudden, extreme fluctuations and Portfolio Optimisation to balance risk and expected return before trading, and the automated trading agent is designed, implemented, and evaluated against the index performance that the stocks are traded upon.

Keywords: Automatic, Stock, Market,Trading, Algorithmic,Machine Learning,Deep Learning,Prediction,time-series.

BACKGROUND

Electronic mercantilism of economic instruments like stocks, bonds, futures, etc., has become commonplace.The recognition of electronic mercantilism has LED some exchanges throughout the planet to fully eliminate a lot of ancient styles of mercantilism, like open outcry.To with success trade monetary instruments in today's electronic surroundings, traders should develop mercantilism methods geared toward characteristic favorable mercantilism opportunities and act quickly once market conditions square measure deemed favorable per the strategy utilized.

A typical mercantilism strategy could involve analysis of historical market knowledge to spot favorable mercantilism opportunities. for instance, analysis of historical knowledge could show that once the market costs for 2 monetary instruments dissent by a precise quantity or by a precise quantitative relation, a shopping for chance exists for the instrument with the lower value.

In effect, the dealer is predicting, supported historical events, the longer term worth of the monetary instrument. Once the dealer acknowledges this shopping for chance, the dealer submits a purchase

order for the instrument at the required worth.One issue with mistreatment such a mercantilism strategy is that the tools utilized by traders to research the historical markets and establish favorable mercantilism opportunities in period market knowledge square measure usually break away the mercantilism platform wont to launch trade orders.

A dealer could utilize one tool to record market knowledge, another tool to research the recorded knowledge, and a 3rd tool that implements a mercantilism strategy to spot once current market conditions mirror a good mercantilism chance supported historical knowledge.Such a third tool could also be within the type of a program that needs manual knowledge entry and updates. This cumbersome, manual method delays the trader's ability to act quickly in submitting trade orders once favorable market conditions square measure gift.

Such delay will mean the distinction between the dealer creating a profit on the trade or taking a loss, significantly in fast-moving markets wherever favorable mercantilism opportunities may be fugitive.Traders are restricted by a current lack of analytical tools designed to create and implement multi-variant prognostic worth models on that mercantilism call could also be based mostly.As electronic mercantilism comes getting on, prime-tier traders should have access to analytical tools with advanced practicality if they're to take care of a competitive edge.

OBJECTIVES

1) The objective of the invention is to provide an Automatic Stock Market and Trading Algorithmic Improve using Machine Learning and Deep Learning Programming is a Stock market prediction regards the forecasting of the price of any given stock within the desired real-time-frame and has been a heavily researched topic over past years due to the difficulty of predicting time-series that are considered to be random walks.

2) The objective of the invention is to provide a traditional Technical Analysis process and methods such as the calculation and consideration of trends, more recently the problem has attracted the attention of Machine Learning, Deep Learning, and Artificial Intelligence approach.

3) The objective of the invention is to provide a explores and compares the current Machine Learning, Deep learning approaches involved in predicting the direction and prices of selected stocks for a given real-time range, considering short, medium, and long-term investments.

4) The objective of the invention is to provide models alongside Natural Language Processing of financial news to predict sudden, extreme fluctuations and Portfolio Optimisation to balance risk and expected return before trading, and the automated trading agent is designed, implemented, and evaluated against the index performance that the stocks are traded upon.

SUMMARY

Embodiments of this invention are delineated in conjunction with systems, clients, servers, methods, and machine-readable media of varied scope. additionally, to the aspects of this invention delineated during this outline, more aspects of the invention can become apparent by the relevance of the drawings and by reading the elaborated description that follows.Equipment and technique for a stock investment technique with intelligent agents are delineated and illustrated. In one embodiment, the invention could be a stock predicting system that through expertise learns to form cash-supported short stock

predictions and because of inherent flexibility continues to be profitable in nearly all market environments.

The invention will be summarized as a computer-implemented technique for commercialism a monetary instrument supported by a model of assumed value behavior of the monetary instrument.The prognostic model includes one or additional analytic levels with every analytic level having a plurality of analytic values divided into 2 or additional nodes wherever every node is related to a future value indicator, like a value offset representing associate assumed future value of the monetary instrument.

A current analytic worth is created in real-time for every one of the analytic levels and every current analytic worth is expounded to at least one of the nodes of a corresponding analytic level of the prognostic model.One or additional trade orders so generated for commercialism the monetary instrument at one or additional electronic exchanges at a trade value that's determined supported the longer-term value indicator related to a node to that the present analytic worth relates.

Trade orders are also generated once the longer-term value indicator of all nodes meets the trader's criteria for commercialism. As an alternative, trade orders don't seem to be generated unless the longer-term value indicator for all nodes of the prognostic model meets the trader's criteria for commercialism.The future value indicator will be measured in a very variety of how. In one embodiment, the longer-term value indicator is measured in units of the monetary instrument's tick size. In another embodiment, the longer-term value indicator is measured in units of a currency quantity.

Trade orders generated in keeping with the strategy might embrace resting orders that are submitted to associate exchange that rest on associate order book till the longer-term value indicator meets the trader's criteria for commercialism. Snipe orders may additionally be submitted and directly crammed once the longer-term value indicator meets the trader's commercialism criteria.Round trip orders may additionally be submitted, as well as a primary trade order that's listed at the trade value, and a second trade order that's submitted at a trip value that's different than the fill value wherever the distinction between the trade value and the trip value represents the trader's profit.

If a monger has nominative a second trade order offset for the aim of accelerating the probability of obtaining the trip leg crammed, then the second trip order is submitted at the full value of the primary trade order minus the longer-term value indicator and the second trade order offset. Analytic values contained at intervals in the prognostic model might vary greatly in nature. For instance, traders preferring to trade supported actual past value performance of associate instrument might turn out the analytic values from a mathematical analysis of market information. A monger may additionally specify the analytic values contained with the model.

Equipment and technique for a stock investment technique with intelligent agents are delineated and illustrated. The invention could be a stock prediction system that through expertise learns to form cash-supported short stock predictions and because of inherent flexibility continues to be profitable in nearly all market environments.A model of assumed value behavior of a monetary instrument is employed in commercialism the monetary instrument. The model includes one or additional analytic levels containing analytic values divided into nodes wherever every node is related to a future value indicator of the monetary instrument for a specific look ahead interval.

for every analytic level of the model, a current analytic worth is expounded to at least one of the nodes of that analytic level, and a trade order is generated once the longer-term value indicator related to a node to that the present analytic worth relates meets a trader's criteria for commercialism the instrument.Generated trade orders might rest on the book or be crammed directly. Resting orders is also re-priced as market conditions or current analytic values modification. Optionally, a monger might specify a footing that triggers the submittal of the trade order to associate exchange once the longer-term value indicator meets the inverse of the required edge worth.

For trip orders, the monger might specify a hedge offset that's intercalary to the trade value calculation to assist make sure the second leg of the trip order gets crammed. Trade orders are also generated once one or all analytic levels of the model indicate favorable commercialism conditions

BRIEF DESCRIPTION OF THE DIAGRAM

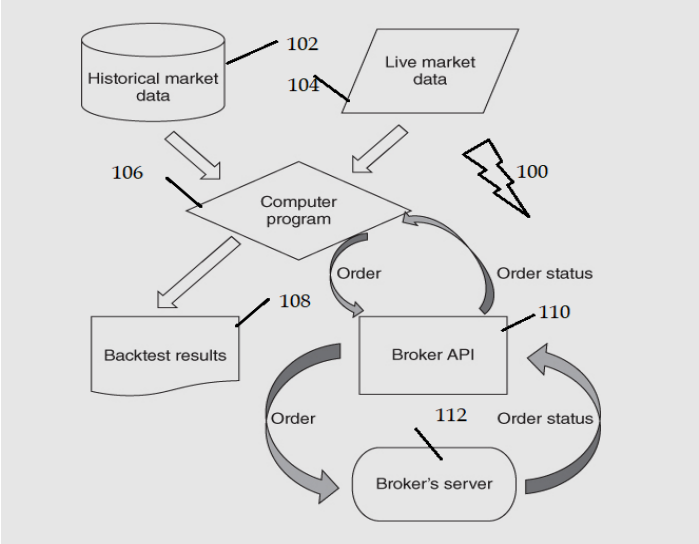

Fig.1: Automatic Stock Market and Trading Algorithmic Flow Chart.

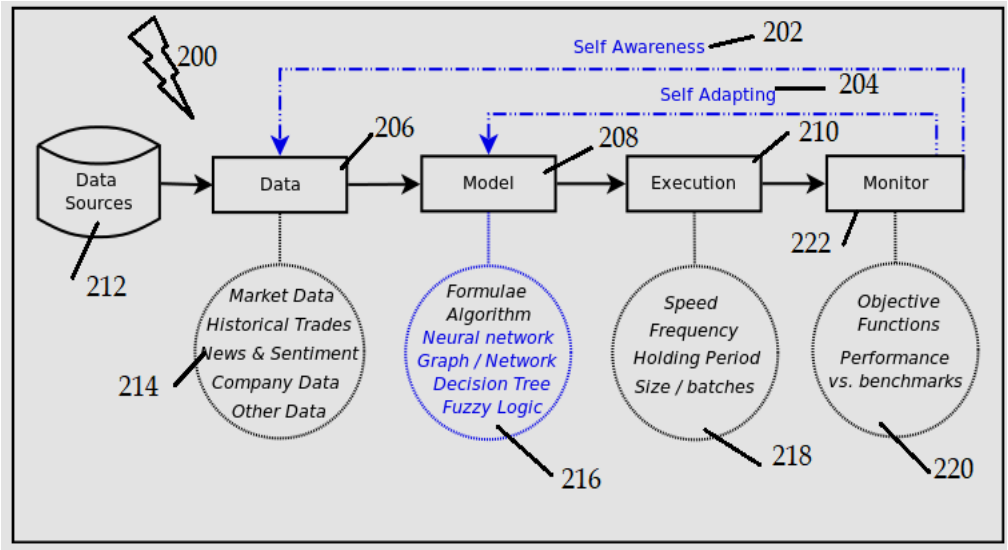

Fig.2: Automatic Stock Market and Trading Algorithmic.

automatic stock market and trading algorithmic improve using machine learning and deep learning programming

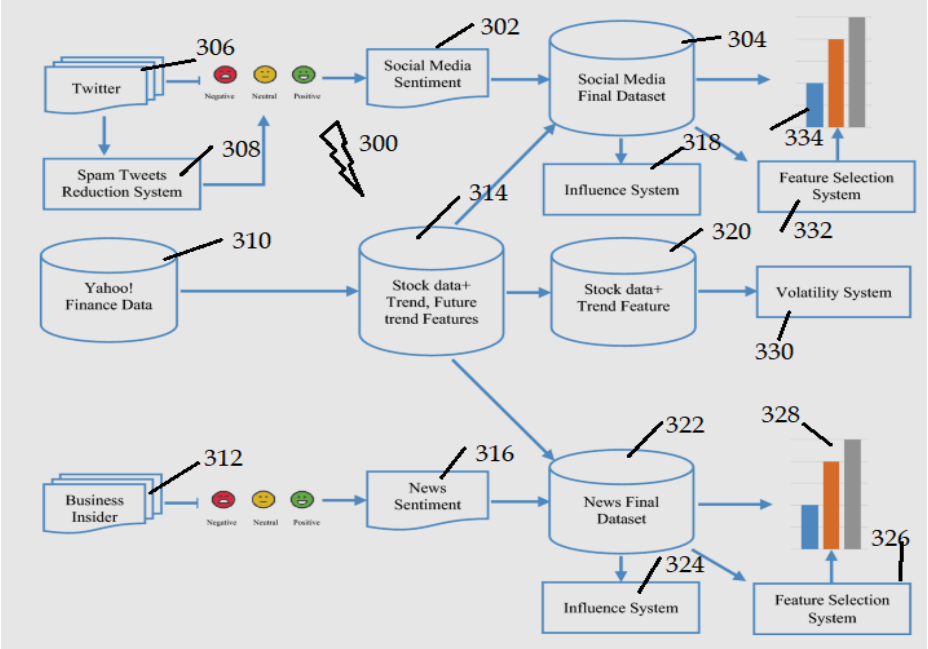

Fig.3: Automatic Stock Market and Trading Algorithmic Improve using Machine Learning and Deep Learning Programming.

DESCRIPTION

Motivation

Stock Market time-series behave differently to other applications; whereas scenarios such as using a retail store's historic customer volume and frequency data to predict busiest visiting times have time-series that can contain repetitive surges (for example, yearly increased footfall at Christmas) and are generally similar on a day-to-day basis.

Stock Markets have been considered to act as a Random Walk, showing very little correlation between days and can have sudden, large fluctuations with very few (if any) monthly or yearly cycles. Nevertheless, similar to other time-series, Stock Market data can have trends in the short, medium, and long terms, despite noisy data, allowing the possibility of prediction.

Contributions

This project aims to analyze and compare the latest Machine Learning stock market prediction methods and to develop a new variant of Artificially Intelligent Automated Trading System, improving upon existing applications, that utilizes a prediction model, Portfolio Optimization and Natural Language Processing to provide an 'All-in-One' software suite to automate trading without the need for human intervention.

Using an appropriate brokerage API, this software could be used to trade actual stocks in future work, however, the scope of this project focuses on simulating market performance offline (with actual stock market data) to allow for user practice. Most research concerning stock market prediction refers to the empirical analysis of a given set of Machine Learning models.

Technical Analyses but lacks consumer-level applications; within this project, such research is investigated and used to implement a full application, incorporating multiple methods of improving investment returns. The final deliverables include a practical and customizable consumer-level software package with uses outside the configuration described in this project, allowing non-expert users a greater opportunity for investing in stocks.

Stock Prediction

Many attempts have been made at predicting the price and/or direction of a stock (Increasing, No Change, and Decreasing) at a given time, using many different models. These models can range from simple linear regression to more recent novel attempts at the hybridization of multiple models such as Neural Networks and Support Vector Machines.

This Invention considers the applications of standard (non-hybrid) models alongside alternative trading and prediction methods, to increase profitability when investing in stocks. Standard models have been researched extensively in the past few years, with promising results, for example, 76.5% F-Score when selecting and classifying which stocks will increase by 10% within a year, using Random Forests.

While this is far from a more desired 90%+ accuracy, it certainly shows the possibility of performance greater than the coin-flip probability that is common with binary classification problems.Ensemble methods have also shown great potential in improving upon these base learners, combining multiple weak predictors to create a strong predictor.Bagging (Bootstrap Aggregation), Stacking, and Random Subspace methods have been used with Support Vector Machine, Decision Tree, and Artificial Neural Network models, with results suggesting that base-learners can be especially improved using Bagging.

In this chapter, we will consider the various methods that have been used to predict stock prices and determine their suitability towards the project, considering the results they have produced and their prominence in previous work.

Linear/Polynomial/Logistic Regression

is regarded to be one of the simplest methods of Machine Learning, modeling the relationship between an output variable and one or more (Multiple Regression) input variables using an unknown function.

Multiple Regression is usually required in stock market prediction using Regression (such as in Gustaf Forslund and David ˚Akesson's attempt due to the many variable inputs that can affect a price's value. Whilst Regression techniques have been used extensively in the algorithmic trading community-3 due to its ease of understanding for newcomers to the field, it is rarely used by itself for predicting stock prices in research.Instead, Linear/Polynomial Regression is used for technical analysis, being useful in identifying price trends in the long-term but often rarely outperforms the prediction accuracy of other models in the short term.

Artificial Neural Networks are non-linear models

That simulates the processes between neurons and synapses within the brain to model complex problems. They have been popular for use in predicting the Stock Market due to their black-box nature, allowing users to try an arbitrary amount of features to generate usable results, without having to know how it works. There are many variations of ANN that can be applied to time-series forecasting, such

as Multilayer Perceptron (MLP) the simplest variant, or Convolutional Neural Networks (CNN)[26] which encode price information into image formats to allow for convolutions to be performed.

Memory-based networks such as Recurrent Neural Networks (RNN) and Long Short-Term Memory (LSTM) networks allow for predictions to be remembered and forgotten; this can be useful when predicting extreme changes in a short space of time via the remembering of previous examples.Compared to other models, RNN and LSTM are suited towards sequential data such as stock prices, whereas other models must take a non-sequential, sample-independent interpretation of the data, considering only a single input and output sample at a time.

Random Forests

Are ensemble models that utilize a set of weak learners (in this case trees) and apply them to a separate subspace of the input matrix, taking the majority of the mean output of all the trees to create a single strong learner. Based on previous research, this method is very popular, reaching accuracies of up to 94.53% for predicting the price direction of a stock at 3 months.Random Forests in general provide very accurate results and are very efficient during runtime, compared to single trees which suffer from high variance and bias. They are more interpretable than models such as Neural Networks, with important deciding features being observable based on the splitting attributes at each node.

Crowdsourcing

The combined knowledge and opinions of Internet communities can be useful in predicting stock direction and velocity, by allowing users access to online voting systems to express their predictions.This information can be combined into a feature vector alongside prices and technical indicators with an appropriate weighting of objective versus subjective data or used individually. Similar insights can be obtained through the collection of expert analyst opinions however such information can be enough in itself to cause price shifts when influencing decisions made by other entities.

This method is not ideal as the variance between the subjectivity of opinions of different users is too great and the availability of such data is unreliable and inconsistent. Models must also ensure that the prediction of a user alone cannot outperform the performance of the final system as a whole, including the additional machine learning. The focus of this project is the implementation of a system that acts upon the most influential publicly available data such as news and therefore this method will not be used in the final software.

Optimization Portfolio Optimisation

Concern the selection of stock market indices or stocks from a large feature space, such that the selected indices or stocks provide the least investment risk. This provides a good base-point for automatically trading stocks, by eliminating particularly unpredictable or volatile stocks and giving a more reliable outcome.

The majority of the methods of Portfolio Optimisation are based on Mean-Variance Portfolio Optimisation Theory, proposed by Harry Markowitz, and have since improved upon his work, allowing for various constraints, such as the total amount of shares held, to be considered.Modern

attempts at solving this problem include the use of Artificial Intelligence and metaheuristics such as Genetic Algorithms and Simulated Annealing. Although each method has its strengths and weaknesses, they have shown good results, boasting returns of over 26%; considering this information.

The invention will focus on the use of Artificial Intelligence methods when determining optimal portfolio configurations. In this section, we explored many possible methods of predicting the stock market, including well-founded attempts, in addition to novel algorithms in their early stages.Due to the lack of peer-reviewed papers or further results/evidence to support these novel methods, this project will only consider existing methods with strong foundations and consistently promising results, including SVM, ANN, and Random Forests. We also considered modern methods of Portfolio Optimisation to improve upon Markowitz' original work, for a more optimal solution

Technical Indicator Extraction

Using exponentially smoothed stock prices, some of the most commonly used technical indicators are to be extracted, for use within feature vectors used for training and testing models.

Simple Moving Average (SMA) Pd i=d−n xi n x = Closing Prices i = Current Day n = Number of Days d = Day to calculate Exponential Moving Average (EMA) EMA0 = SMA EMAi = (xi−1 − EMAi−1) ∗ 2 n+1 + EMAi−1 x = Closing Prices i = Current Day n = Number of Days Moving Average Convergence Divergence (MACD) MACDd = EMA12d − EMA26d EMA12 = 12 Day EMA EMA26 = 26 Day EMA d = Day to calculate Stochastic Oscillator (StoOsc) StoOsc = 100 ∗ x−Low14 High14−Low14 x = Current closing price Low14 = Lowest price of last 14 days High14 = Highest price of last 14 days Relative Strength Index (RSI) RSI = 100 − 100 1+RS RS = AV G(Gainsi−14...i)

AV G(Lossesi−14...i) Gains = Price increase sum over last 14 days Losses = Price decrease sum over last 14 days Williams % R %R = hn−ci hn−ln ∗ −100 hn = Highest price over last n days ln = Lowest price over last n days ci = Current Close Price.

Simulated Annealing Simulated Annealing (SA)

is another global Optimisation method, inspired by the controlled heating and cooling of materials to result in an optimal formation. The algorithm accepts any improving solutions as the new best solution but can also accept worse solutions based on the current temperature value, giving it an edge on other search algorithms by allowing exploration of the search space, not just exploitation. Given an initial temperature $t \leq 1$, a minimum temperature $t0 > 0$ and a cooling rate $1 < c < 0$, the algorithm.

CLAIMS

1) Our Invention Automatic Stock Market and Trading Algorithmic Improve using Machine Learning and Deep Learning Programming is a Stock market prediction regards the forecasting of the price of any given stock within the desired real-time-frame and has been a heavily researched topic over past years due to the difficulty of predicting time-series that are considered to be random walks. Whilst some use traditional Technical Analysis processes and methods such as the calculation and consideration of trends, more recently the problem has attracted the attention of Machine Learning, Deep Learning, and Artificial Intelligence approach. This Invention explores and compares the current Machine Learning, Deep learning approaches involved in predicting the

direction and prices of selected stocks for a given real-time range, considering short, medium, and long-term investments. Using these models alongside Natural Language Processing of financial news to predict sudden, extreme fluctuations and Portfolio Optimisation to balance risk and expected return before trading, and the automated trading agent is designed, implemented, and evaluated against the index performance that the stocks are traded upon.

2) According to claim1# the invention is to an Automatic Stock Market and Trading Algorithmic Improve using Machine Learning and Deep Learning Programming is a Stock market prediction regards the forecasting of the price of any given stock within the desired real-time-frame and has been a heavily researched topic over past years due to the difficulty of predicting time-series that are considered to be random walks.

3) According to claim1,2# the invention is to a traditional Technical Analysis process and methods such as the calculation and consideration of trends, more recently the problem has attracted the attention of Machine Learning, Deep Learning, and Artificial Intelligence approaches.

4) According to claim1,2,3# the invention is to explore and compares the current Machine Learning, Deep learning approaches involved in predicting the direction and prices of selected stocks for a given real-time range, considering short, medium, and long-term investments.

5) According to claim1,4# the invention is to models alongside Natural Language Processing of financial news to predict sudden, extreme fluctuations and Portfolio Optimisation to balance risk and expected return before trading, and the automated trading agent is designed, implemented, and evaluated against the index performance that the stocks are traded upon.

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