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GekkoSays

A financial system analyzer

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***Abstract*—The financial market in itself is highly dynamic in nature and is affected by factors that are multifaceted. Human beings have the ability to monitor and assess several of these factors simultaneously. However, similar versatility is not easily achieved by software. Our aim is to create a analysis system that showcases some of this desired versatility, with the help of several algorithms and techniques, that will help capture more than one factors needed for efficient and thorough analysis of such a complex market. Moreover, the precision and robustness required to analyze the mammoth amount of financial data available is beyond human capacity. A combination of a holistic approach along with an added layer of efficiency will create a system capable of much more than mere analysis of the facts.**

The key component of the financial market in India is the stock market. The stock market is represented by the securities, in the form of company shares, debt securities, etc, traded on the two exchanges - BSE and NSE. Analysis of the prices and other factors related to these securities gives a general idea of the economy of the country with respect to its financial status.

Participants of this industry must adhere to certain rules laid down by the Securities Exchange Board of India(SEBI) and trade according to the established guidelines. Additionally, trades are a way of making profits and to do so, lot of research and analysis is required. This is done mainly by trained individuals, but in today's age of automatization, we would want this process performed by a computer software that will enable us to tap into unventured avenues that could not have been explored before due to a lack of human cognition. Machines, if developed properly, can achieve a level of precision that open up new ways of analysis.

***Keywords*—Technical Analysis, Fundamental Analysis, Portfolio, Public Sentiment, Securities.**

I. INTRODUCTION

The stock market is highly dynamic in nature and hence to predict its behaviour would mostly prove ineffective. Instead, analysis of the stock market, the sectors, the macro and micro economic indicators, fundamental and technical indicators, will provide useful insight in the form of patterns that can be projected into the future to give a possible movement of a particular security. The vision behind GekkoSays, is the creation of an all inclusive system that is aimed at helping people invest consciously and efficiently. Along similar lines, the objective is to demystify the investment culture in such a way as to facilitate the general public to make sound decisions about their money without any external influence or interference.

II. EASE OF USE

A. Lacuna in the Existing System

The already available predictive and analysis tools available are esoteric in nature and hence fail to capture a larger and more general audience. Today's economy has facilitated rise in investing practices, but this phenomena is restricted to the few who have veritable knowledge needed to perform trades. The general public is oblivious to relevant practices, facts and information needed to invest in the stock market. Moreover, the background and expertise needed to actually make sound investments over time, is vast. Our system proposes to fill this gap between the public and their lack of needed know-how.

B. Relevance of the Proposed System

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III. LITERATURE SURVEY

Several algorithms and machine learning techniques have been employed to give gauge market behaviour and predict the general direction of the market with fair accuracy. Existing research and implementations vary in the approach taken to analyze a financial market and usage of affecting factors.

C. Soft Computing for Stock Market Analysis

A neuro-fuzzy system combines features of a neural network with that of fuzzy logic to make excellent forecasting tools that factor in unpredictability. This approach uses scaled conjugate gradient algorithm to train the neural network and then modeled the deviation of the output as a fuzzy variable

and used an FIS to account for the uncertainty in the decision making.[1]

D. Support Vector Machine for the Financial Time Series Forecasting

SVMs search for global optimums as solutions and hence are less likely to get stuck on local minimas as other ANN. This system has used 12 technical indicators to make up the initial attributes[2] . Linear scaling is used to independently normalize every feature component into a scaled range. The kernel function of the SVM use a Gaussian radial basis function.

E. Hybrid Algorithms for Stock Market Forecasting

The SVM system is the least prone to the overfitting problem and hence is used as to train the model. Genetic Algorithms are helpful when selecting a collection of factors that prove to provide results with highest possible accuracy. In this system GAs are combined with SVMs to provide stock market predictions. GAs are used to select technical indicators as input features to the SVM.[3] This system also utilizes the concept of correlation among companies.

F. Indian Stock Market

Along with the securities being traded on the exchanges, the system will also analyze the various sectors of the Indian economy. Based on this analysis, a prediction can also be made regarding the securities pertaining to the relevant sector. Various sectors include infrastructure, real estate, telecom, fast-moving consumer goods(FMCG), metal, and many more.

The two exchanges, BSE and NSE, each have an index that measures the volatility and general market behaviour. These are the BSE SENSEX and the NSE NIFTY respectively. These indexes comprise of a set of companies that issue securities on the exchanges. The movement of these companies as individual entities and with respect to each other give a broad view of the stock market situation as a whole.

Traders doing business on these exchanges, sell or buy securities according to a motivation to make profits. In order to do this, a thorough understanding of the working of the financial system is needed.

IV. METHODOLOGY

The system will be made available in the form of a website, wherein a user can create an investment portfolio and keep track of all the securities that he/she has invested in. The backend processing will include three main processes.

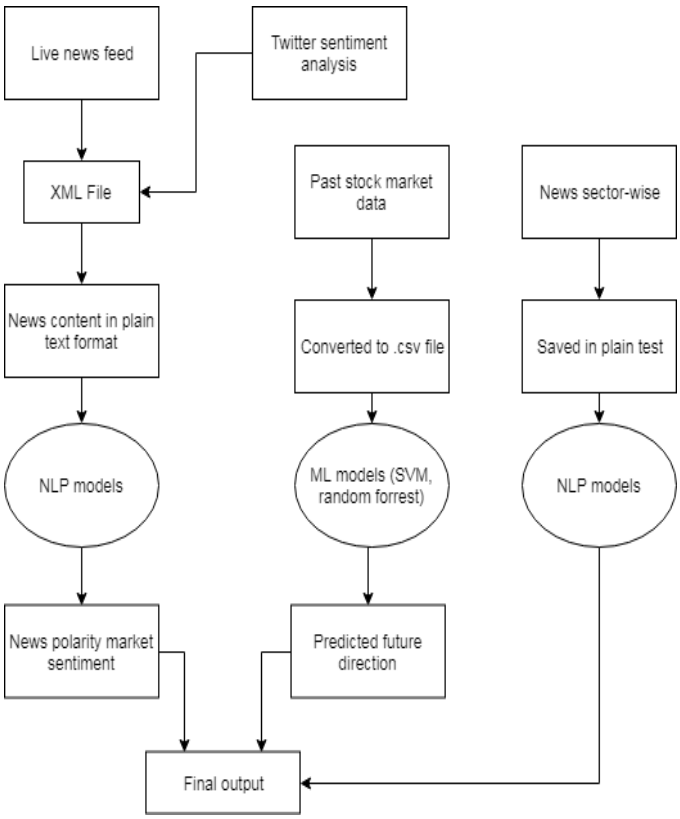

Fig. 1. Block Diagram of GekkoSays

G. Training of ML Model

The system will obtain historical stock market data and run it through an ML algorithm to make a model that tries to predict the movement of stocks in a user's portfolio. Technical indicators along with fundamental ratios help to model market behaviour.

Technical Analysis includes identifying trends in the statistical models of a Financial market with various mathematical models used to analyze and depict the aforementioned trends. These indicators help make sense of an otherwise complex, and, at times esoteric environment. Technical indicators interpret the trends in a way that helps us determine whether a particular security is worth holding.

There is a bevy of such indicators available, that is what makes the selection of these indicators so crucial. An apt set of technical pointers should provide all the information needed about the market but at the same should not produce redundant results.

Feature Name	Formula
Momentum	(C(i)/C(i-N))* 100
Williams %R	(HH(n)-C(t))/ (HH(n)-LL(n))*100
Rate of Change (ROC)	(C(t) – C(t-n))/C(t-n)
5 Day Disparity	(C(t)/MA(5))*100
10 Day Disparity	(C(t)/MA(10))*100
Stochastic %K	(C(t) – L(t))/(H(t) – L(t))
Price Volume Trend (PVT)	((C (t) – C (t-1)) / C(t-1)) * V

Fig 2. Figure representing various technical indicators along with the formule

The technical indicators in the figure above are described as follows-

- Momentum Factor- This is a basic indicator that compares the current price of the security to its past price. Within a certain range, this gives an indication of a mere buy/hold.

- William R Factor- This indicates an entry and exit point in the market and indicated if a security is over/under-bought.

- 5 Day Disparity- A technical indicator that measures the relative position of the most recent closing price to a selected moving average and reports the value as a percentage[9]. A value greater than zero suggests that the asset is gaining upward momentum, while a value less than zero can be interpreted as a sign that selling pressure is increasing[9].

Fundamental Ratios, on the other hand are used to fathom the actual intrinsic value of a company. Stock prices can be volatile and the fluctuations are not often representative of the performance of a company. To provide a more long-lasting and reliable point of view, the actual value of a company and its profit generating capability should be taken into consideration. The various fundamental ratios to be considered are :

II. Working Capital Ratio - The health of a company can be assessed by calculating its liquidity, which is how easily that company can turn assets into cash to pay short-term obligations. The working capital ratio is calculated by taking a ratio of current assets by current liabilities.[4]

III. Earnings per Share - When buying a stock, you are inherently participating in the future earnings (or risk of loss) of the company. Earnings per share (EPS) measures net income earned on each share of a company's stock. It is found by dividing the net income by the weighted average number of common shares outstanding during the year.[4]

IV. Price-Earnings Ratio - Called P/E, this ratio reflects investors' view of those future earnings. To calculate the P/E ratio, determine the share price of the company's stock and divide it by EPS to obtain the P/E ratio.[4]

V. Debt-Equity Ratio - The debt-to-equity is calculated by adding unpaid long and short term debt, and dividing it by the book value of equity.[4]

A. News Article Analysis

The second process consists of a web scraper that scans through major news websites and looks for relevant news articles. These news headlines are then stored in a '.csv' file. The system then uses word embeddings to analyze the context and sentiment of these news headlines and try to understand how these events affect the stock prices for a particular stock. This correlation between news and stock prices helps in making a more educated prediction.

B. Twitter Sentiment Analysis

The last phase uses a traditional bag of words approach to analyze public sentiment regarding a particular company or sector. Since public opinion moves the stock market, considering public sentiment in the predictive model gives a better overall result when it comes to accuracy of said predictions. We chose Twitter for public sentiment analysis, which offers a lot of data, and presents a lot of raw opinions people have about a subject. The system will thus search for relevant tweets using the Twitter API, and performs an NRC sentiment analysis. The NRC sentiment analysis uses NRC emotion lexicon, which associates every word with the following emotions (anger, fear, anticipation, trust, surprise, sadness, joy) and two sentiments (negative and positive). The system then takes an aggregate of these values and breaks down people's sentiment about a company into these 8 emotions thus representing what the public thinks about that particular company. This gives a basis for finding a correlation between the public sentiment about a company, and how the stock moves. This correlation is then used for making a well informed prediction that increases the accuracy of the result

VI. RESULT

The result of this review paper consists of a comparison of the various algorithms that can be employed to deploy the system. Through research and study, the advantages and drawbacks of

these algorithms have been computed. Based on these results, the development of the system will proceed.

Algorithm	Advantages	Drawbacks
Artificial Neural Network	Neural Networks are efficient mechanisms that can operate in unknown environments and do not need prior knowledge of the said environment.	Some studies, however, showed that due to noise and the multi-dimensions present in the financial data, neural networks maybe rendered ineffectual. This is because ANNs are deprived of consistency and predictability when working with noisy data.
Support Vector Machines	Unlike other neural networks, SVM has a lower chance of overfitting the classification curve. Further, the problem of local maxima which is encountered in ANN is solved in SVM. The solution to the problem is achieved by solving a linearly constrained quadratic problem which leads to a unique and globally optimum solution.	SVMs with a single kernel need tuning to fit the hyperparameters inherent to the stock market. To improve this, multiple kernel learning is used which although can work through the hyperparameters, is time and resource consuming.
Backpropagation Neural Networks	A BPN is again a neural network and has the same advantages an ANN has. But, BPN takes it a step further and self-propagates the error signal which helps it adjust its learning parameters more accurately.	Although, BPN is a viable choice, studies have shown SVM to perform better than BPNs when it comes to financial markets.
Bag of Words	The Bag of Words approach has been used as the traditional standard of financial article research primarily because of its simple nature and ease of use.	This approach fails to capture the true context of the text, for example, sarcasm.
Word Embedding	Word embeddings use multidimensional vectors to represent each word. Each word has been represented in form of such vectors. This approach helps better represents the structure of a sentence. It can find similar words using the cosine distance, and thus has a better understanding of the context of the text.	Slower than bag of words approach. Can't handle out of vocabulary words.

VI. Conclusion

The process so far has been concentrated towards planning, collection of data and selection of suitable techniques. To summarize-

- As mentioned earlier, the stock market is highly dynamic in nature and hence to predict its behaviour would mostly prove ineffective. Instead, analysis of

the stock market, the sectors, the macro and micro economic indicators, fundamental and technical indicators, will provide useful insight in the form of patterns that can be projected into the future to give a possible movement of a particular security.

- Companies in themselves are not isolated entities, but belong to some sector that groups together companies with similar areas of work. The analysis of such sectors plays an important part when it comes to analysing a stock exchange as a whole.

- Following the methodology shown above we will be capable of analysing the various securities' data of a company and giving a hint to the user whether he should invest in the particular company or not.

Acknowledgment (HEADING 5)

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