Stock Market Forecasting using Hybrid Methodology

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Abstract: Prediction of stock market has been attempted by many researchers to maximize the growth potential of individual as well as corporate investors. Through the use of sophisticated algorithms for technical analysis, combined with some fundamental analysis, a higher accuracy of stock prices prediction can be achieved. We will attempt to summarize the methodology adopted, while developing the application and the achieved accuracy in the process of doing so.

1. Introduction

Recently, a lot of research has been done in the field of Data Mining Algorithms for forecasting price patterns and predicting stock prices. Most investors nowadays depend on Intelligent Trading Systems which help them in predicting prices based on various situations and conditions, thereby helping them in making easy and insightful investment decisions.

Accurate prediction of prices of corporate organizations is essential to take better investment decisions with low amount of risk. In view of the complexity of the financial time series data, resulting from a huge number of factors which could be economic or political [1-2].

We have implemented the Data Mining technique, which has been applied for stock trading in the market to predict the rise and fall in stock prices before the actual fluctuation in the stock price occurs. In particular the paper discusses the application of RSI, SMA, Bollinger Signals, Chaikins Money Flow algorithms in the context of Indian Stock market exchanges like BSE (Bombay Stock Exchange) and the NSE (National Stock Exchange).

2. Background

There are 2 Stock Prediction Methods used commonly:

Fundamental Analysis: This method is concerned more with the company rather than the actual stock and is performed by the Fundamental Analysts. The analysts derive insights based on the past performance of the company, the earnings in each financial quarter etc.

Technical Analysis: This method deals with the determination of the stock price based on the past patterns of the stock and is performed by the Technical Analysts, (using time-series analysis.)

When applying Data Mining to Stock Prices Data, we are more interested in doing a Technical Analysis to see if our algorithm can accurately learn the underlying patterns in the stock time series, rather than relying on fundamental analysis. This said, Data Mining can also play a major role in evaluating and forecasting the performance of the company and other similar parameters helpful in Fundamental Analysis.

3. Literature Survey

We had done the recce of sites like Bloomberg, moneycontrol, reuters and valuedopinions. These sites provide insights into the stocks creating a buzz in the stock market. We learnt finance related jargon from investopedia.com The sites like Bloomberg and Reuters provide personal finance, commodity, foreign exchange and economics related news. Bloomberg is a leading provider of local and global financial information to Indian businesses, banks, government ministries and universities. The India team has established working relationships with key government associations and regulatory bodies to ensure that local requirements are met. Reuters is the leading source of intelligent information for the worlds businesses and professionals , providing customers with competitive advantage. Intelligent information is a unique synthesis of human intelligence, industry expertise and innovative technology that provides decision-makers with the knowledge to act, enabling them to make better decisions faster. Moneycontrol.com is India’s No 1 Financial and Business portal. With in-depth market coverage, analysis, expert opinions and a gamut of financial tools, moneycontrol.com has been the premier destination for consumers and market watchers. A part of Network18, moneycontrol.com is the most influential destination for stock market
news and advice, business news and news about the Indian and global economy.

4. Data Pre-Processing

The Nifty Sensex data obtained from the Yahoo! Finance website contained these parameters- date, opening price, closing price, high, low and Adjusted closing price from the previous time step. Out of these, for certain stocks the past prices have to be adjusted as per the stock splitting. We used the following algorithm for pre-processing of data:

Algorithm: SampleData(date, closep, highp, lowp, openp, adjclose)

Input : date, closep, highp, lowp, openp, adjclose
Output: Sampled data

1. for i in range(len(openp)):
2.  rate=closep[i]/adjclose[i]
3.  if(closep[i]!=adjclose[i] and int(rate)>1):
4.    closep[i] = adjclose[i]
5.    openp[i] = openp[i]/rate
6.    highp[i] = highp[i]/rate
7.    lowp[i] = lowp[i]/rate
8.  end if
9. end for

5. The Algorithm

Chaikin Money Flow Indicator

Chaikin's money flow is based on Chaikin's accumulation/distribution. Accumulation/distribution in turn, is based on the premise that if the stock closes above its midpoint [(high+low)/2] for the day, then there was accumulation that day, and if it closes below its midpoint, then there was distribution that day. Chaikin's money flow is calculated by summing the values of accumulation/distribution for 13 periods and then dividing by the 13-period sum of the volume.

The Following formula was used to calculate CMI.

\[ \text{CMI} = \frac{\sum \text{AD} \text{for 13 periods}}{\sum \text{volume} \text{for 13 periods}} \]

where AD stands for Accumulation Distribution, Where n=Period; CL=today’s close price; OP=today’s open price; HI=High Value; LO=Low value.

Moving average

Moving averages smooth the price data to form a trend following indicator. They do not predict price direction, but rather define the current direction with a lag. The two most popular types of moving averages are the Simple Moving Average (SMA) and the Exponential Moving Average (EMA). These moving averages can be used to identify the direction of the trend or define potential support and resistance levels.

A simple moving average is formed by computing the average price of a security over a specific number of periods. As its name implies, a moving average is an average that moves. Old data is dropped as new data comes available.

Exponential Moving Average

An Exponential Moving Average (EMA) works by assigning a weighting factor to each value in the data series given according to its age. The most recent data gets the greatest weight and each price value gets a smaller weight as we go back in the series chronologically. The weight of each data point decreases exponentially, hence we call it Exponential Moving Average.

\[ \text{EMA} = \frac{\text{closing price} - \text{EMA (prev day)}}{\text{Multiplier} + \text{EMA (prev day)}} \]

Bollinger Bands

Developed by John Bollinger, Bollinger Bands® are volatility bands placed above and below a moving average. Bollinger Bands are based upon a simple moving average. This is because a simple moving average is used in the standard deviation calculation. The upper band is two standard deviations above a moving average; the lower band is two standard deviations below that moving average; and the middle band is the moving average itself. The upper and lower lines are plotted according to market volatility. When the market is volatile the space between these lines widens and during times of less volatility the lines come closer together.

\[ \text{Middle Band} = 20\text{-day simple moving average (SMA)} \]
\[ \text{Upper Band} = 20\text{-day SMA} + (20\text{-day standard deviation of price} \times 2) \]
\[ \text{Lower Band} = 20\text{-day SMA} - (20\text{-day standard deviation of price} \times 2) \]

Relative Strength Index (RSI)

This indicator compares the number of days a stock finishes up with the number of days it finishes down. RSI is a Leading Indicator. It uses the stock's current direction and momentum to determine whether the stock will continue to move in that direction or not. The direction and momentum can be measured by an oscillator, in the case of RSI, a number is generated between 0 and 100.

When the line falls below the 30 mark, it is an indication that the stock has a good chance of rising.(BUY signal). Conversely, when the oscillator climbs above 70, there is a high chance the stock price will fall soon.(SELL signal). RSI, these are the reference values one uses to check if a stock is overbought or oversold.
6. Implementation Methodology

In this Hybrid System, we have made use of four technical indicators: - Relative strength index, Simple moving average, Chaikin Money Flow Indicator and Bollinger Bands; for predicting the stock market trends. Here each algorithm requires a period of days for which the corresponding values are calculated in succession. In our approach we have programmatically calculated the period values for each stock under consideration for which we achieve the highest accuracy for a given technical indicator. We have made use of the knn-algorithm in case of RSI algorithm in order to obtain the overbought and oversold band values, as the general values of 30-70 indicates a market is overbought when the RSI value is over 70 and indicates oversold conditions when RSI readings are under 30. But these general values don’t hold good for each and every market stock to a greater extent. So to improve the accuracy of the prediction we made use of KNN – algorithm to find appropriate band values for every stock under consideration. All the values like the No. Of days in a period, band values and No. Of days up to which a particular indicator can retain the effect of a buy or sell signal has been dynamically calculated separately for every stock and are bound to differ over a period of time so as to keep on increasing our system’s accuracy of predicting the Indian Stock Market. As per the test carried out on the historical stock prices from 8th Feb,2010 to 15th Jan,2016 we have obtained an accuracy of 82.70%. The detailed outcome of the test has been tabulated and is as follows:-

<table>
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<tr>
<th>Ticker</th>
<th>Bollinger Bands</th>
<th>Relative Strength Index</th>
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<tbody>
<tr>
<td>TCS.BO</td>
<td>73.71428571</td>
<td>75</td>
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<tr>
<td>TCS.NS</td>
<td>73.44632168</td>
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<tr>
<td>ITC.BO</td>
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<tr>
<td>AXISBANK.NS</td>
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<td>5</td>
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<tr>
<td>HARDCAS.BO</td>
<td>80.434768261</td>
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</table>

Accuracy | Period | Lookahead
---|---|---
18 | 35 | 18
20 | 38 | 20
19 | 30 | 19
6 | 100 | 5
23 | 56 | 23
6 | 100 | 5
6 | 100 | 5
9 | 100 | 5
9 | 100 | 5
6 | 100 | 5
27 | 5 | 27
45 | 55 | 45
46 | 58 | 46
33 | 53 | 33
89.79447789 | 82.70% |
Future Work

Currently our system supports a few stock from the category of worst performing and best performing stocks of BSE and NSE, in the future the scope can be increased to accommodate all stocks of BSE, NSE, Commodities, etc and the prediction algorithm can be made more accurate by adding sentiment analysis on the market news to this technical analysis system.

Conclusion

Thus we had studied about various technical analysis indicators and implemented them to be analyzed and visualized on the personal profile page of the user. We had generated a graph of daily closing prices to be shown at the user end. The user can get the analysis in simple textual format, according to the prediction methodology using which he can take necessary steps regarding his stock market portfolio in order to obtain maximum gain for his investments.

References


