Chapter 6

Knowledge-based Stock Market Prediction
Information System

6.1. Introduction

Computer based information systems (CBIS) have the potential to extend a person’s problem solving abilities beyond his normal capabilities. Knowledge-based systems are designed using domain knowledge and reasoning mechanism to process the knowledge-base and enabling a user to make an appropriate decision. As the processing continues the system enhances its knowledge-base for future use. Using these concepts [74] and based on the work on intraday price prediction for a stock and intra-stock weekly prediction, we develop an integrated “Knowledge-based Stock Market Prediction Information System”. The system is designed to take the user experience in transactions of buying or selling a stock into consideration. The proposed model is based on combining the conventional wisdom of the user along with the technical analysis of the data to build a strong knowledge base, which is further used to generate an efficient buy or sell signals from the market as it emerges. Aim of this work is to utilize the knowledge gained by the user along with the prediction methods that are discussed in chapter 3 and chapter 4 for enhancing the reliability of prediction and complete a transaction for maximizing the profit.

In stock market transactions choosing an appropriate time for performing a transaction is the most important activity for an investor. Failing to identify and use the right time results in loss of investment and a missed opportunity. Hence an investor looks for the best support mechanism to take a decision. There are several commercial products in the markets that are available for investors in giving all sorts of inputs for making a decision.

6.2. Commercial Products and their features

Among the several commercial products available in the market we try to look at few of the products, their features and short fall.
6.2.1. NeuroXL Predictor

It is a neural network forecasting tool and uses Microsoft Excel, as the incoming data is in the form of Excel Compatible. Microsoft Excel provides a built-in tool for predictions, but the accuracy of its results significantly reduced when non-linear relationships or missing data is present, which is often the case when analyzing historical data. Neural networks are a proven and widely used technology for such complex prediction problem, which uses learning process from the previous experiences.

The application is developed to discover non-linear relationships in input data which is highly dynamic and diverse in nature. NeuroXL Predictor draws its processing capabilities using latest developments in Artificial Intelligence which recognizes subtle relationships between variables. Since users make predictions through the familiar Excel interface, learning time is minimal, greatly reducing the interval between loading the software and performing useful predictions. The application is extremely intuitive and easy-to-use for beginners yet powerful enough for the most demanding professionals.

In addition to stock market prediction, NeuroXL Predictor is also ideally suited to making predictions in other financial areas, such as: Foreign exchange trading, Financial planning, Commodity trading, Economic forecasting, Currency trading, Corporate bond ratings, Oil and gas trading.

Though the product has all the advanced features using the latest technologies the main limitation is that it predicts the closing price of the product and not the fluctuation of it within a day, from time-to-time. Our aim through the model is to overcome the limitations of these commercial products, and present the predicted price of the stock to the user from time-to-time.

6.2.2. DeepInsight.com

The application uses tools of artificial intelligence for its prediction process and adopts expert system model. It uses historical data mainly containing the day-wise transactions selects a specific company stock and trains the model. The model has the option of using automated stream data feed or using archived data. The training is a learning process for the specified stock model. It accumulates knowledge about the stock trading patterns for the previous days, finds any
correlations between trading activity and future price movement from the stock historical data and builds itself into a stock analysis and trading expert. It also helps the user find the best performing model and trading strategies by generating appropriate signals during transactions.

The system provides long and short signals for the user to help in trading. Buy or Sell signals inform the user to perform a transaction, but the system does not have a mechanism to inform the user regarding the actual price change that could take place in a day. It provides this information symbolically as Hold/Avoid signals. Though these features help the user in trading, it fails to provide the signals in the form of actual price.

Another important feature in the system is to provide the fluctuation of a stock price for five days predicting their future price of a week. It helps the user to make a short term decision regarding to hold or sell the stock. It also provides a mechanism to find the hot stocks that are trading in the market through the feature of market scan. Stop-loss signal is another feature where the user tries to minimize his loss while he wants to sell the stock.

However we try to provide better system to the user in trading through BUY/SELL, HOLD/AVAOID signal by giving the possible price the stock may reach in a day. In our proposed system there is no significance to stop-loss signal as we provide the possible price the stock may reach during the day. The user will be better off having the knowledge of the stock reaching the maximum, minimum price and the time at which it reaches.

There are several other products in the market which provide stock price forecasting such as estockwise.com, stock-forecasting.com, ipredict.it, etc. almost all of them use neural network mechanism and predict the maximum price of the stock for the day and the accuracy of these predictions is between 94.5% to about 98.5%.

6.3. Proposed System:

These commercial products though provide a good insight into all sorts of analysis the prediction is mainly for the day for a specific stock, and do not predict the price changes from time-to-time within a day. Overcoming this shortfall in the commercial products our aim is to predict the price of a stock continuously for the
day. Further in the process we provide a most reliable mechanism using the experience of the user. Many a times an investor forgets his previous transaction experiences, and may tend to do the same mistake again and again in selection of time for a transaction. In this context, it is essential that the investor should have a support of his own previous experience along with a broad idea of the movement of the markets, which can act as a supportive knowledge base and enhance his decision making. Based on these objectives the following knowledge-based system is proposed.

![Diagram of the Knowledge-based system]

**Figure 1. The Knowledge-based system**

### 6.4. Model

The model mainly consists of three parts: i. The user interface ii. The knowledge-base and iii. The Interface and Processing Engine.

#### 6.4.1. The user interface

The user interface enables the investor to interact with the system to enter his instruction and to receive information from it. The instructions specify the parameters that guide the system through its processing. The information in general is in the form of selection of certain options and assigning values to certain variables. It is designed to facilitate a two-way dialogue between the system and the user. At the user end screens may be designed using simple HTML to provide the user interface.
The system is designed to output the required solution. User end screens are designed to provide the output of predicted prices for different time intervals for the selected stock for the current day. It also helps the user by providing possible weekend gain trend, enabling the user to make a decision to transact. If the user wants to go ahead with transaction, the system provides the statistics of his previous transaction experience and the possible time at which the stock may reach his choice of price.

6.4.2. The knowledge-base:

It basically consists of a warehouse of stock market data and a database associated with user experience. The stock market data is represented in different tables for each of the different stocks. They are:

i. Each companies:
   a. Daily stock data
   b. Daily data represented as patterns
   c. Support value tables
   d. Day wise records with progressive gains representing sequence of events
   e. Daily records containing episodes with their width and height being recorded.
   f. Weekly data representing day-wise episodes along with most significant episodes

ii. Each Investors:
   a. Table containing all the transactions recording the gain/loss made by him.

Daily Stock Data: The incoming data is a continuous stream which is displayed to the investor for his decision making, and in the mean time saved into a temporary table to be processed at the end of the day as required by the system. The data is represented as a day wise record for fixed number of time intervals.

Daily data represented as Patterns: The daily data represents the open, close, high and low price of a stock for a given time interval. As the price of a stock one year back is not comparable with current price, it is converted into gains and further represented as upward, downward and neutral trends based on a cut-off value. These symbolic data is comparable whatever may be the price of the stock on a given day.
The incoming data is converted into a record at the end of the day for every stock and is added into the table.

Support value tables: As these tables are created with historic data comprising of 5 (five) years transactions, their values may not significantly get effected in a day. Hence at the end of every month, the tables may be recalculated taking into consideration the month's records.

Day wise records with progressive gains representing sequence of events: The day wise records are processed to represent progressive gains for all the time intervals of a day. Considering the upward or downward trend of a stock as event, the sequences of similar events represent a continuous gain or loss of a stock. These event sequences are dependent on one another and further help us to recognize episodes.

Daily records containing episodes with their width and height being recorded: We represent an episode as two consecutive sequences of events with two different trends. The width of these episodes represents stability of the price over this time period, and the height represent the gain or loss the stock made during this period of time. Hence recording this is as significant as the price of the stock itself. The number of episodes in a day also is a significant factor, as the number of episodes represents the fluctuation of the price over a day.

Weekly data representing day-wise episodes along with most significant episodes: In order to predict the price for a week, we create this table. It consists of week wise transaction days, episodes in each of the day, and number of most significant episodes along with actual gain or loss of the price at the end of the week.

Associated with an Investor we represent a table containing his previous experience while transacting a specific stock. It represent the day of transaction, the opening price of the stock, the type of transaction (buy/sell) made by an investor, the cost at which he has made the transaction, and the result of the transaction.

6.4.3. The Interface and Processing Engine.

This is the most important part of the system, proving system interface between different subsystems, processing the data as required, performing periodic automatic processing to update the databases.

Interface Engine provides an interface to the system with the incoming data. The incoming data is usually in a standard format sent by the stock brokerage firm.
which handles all the transactions. This data needs to be captured and converted in
to the required form as needed by our Information System (usually the data sent is
in the Microsoft Excel compatible form which is converted in to database format as
needed by us). Operating systems through their database APIs (for example OBDC
in Windows OS) provide this interface. Database systems and languages also
provide drivers (line JDBC drivers in JAVA) for creating appropriate interfaces for
data. These interfaces are hidden from the user, and the user will only see the data
in their required format on his screen (user interfaces).

Processing Engine provides appropriate processing tools which are activated
according to the choice of the user. It also provides an automatic updates of tables
as required by the system periodically.

6.5. The User Interface and the Working

The user interface consists of options for the users providing different functionalities.
Selection of these functions activates different components of the system resulting in
processing and output of the results. The functions and the resultant working could be as
follows:

1. Selection of a Stock: This allows the user to select a specific stock, which he
would like to trade in the market. Selection of this option activates the relevant
databases associated with this stock.

2. Opening price of the selected Stock: If the system is an on-line system having
automatic incoming data, the opening price of the stock is selected from it.
Otherwise the user is expected to give the opening price of the stock.

3. User's previous experience: This option allows to cross-check his previous
trading experience for the selected stock and can make appropriate decision.

4. Display of Outputs: Depending on the selection of a specific stock for a day,
prediction of the stock price for different time intervals is made through this
interface. Similarly once the user has chosen to check his previous experience
the current possible trend of the stock needs to be shown along with previous
trends of the stock on the days of his trade.

5. Trading Signals: The user is provided with the option of setting certain trading
signals such as, Buy or Sell, Hold or Avoid, Stop-loss, etc., signals.

6. Finding Hot Stocks: Since the system can find the fluctuation of stock price, it
can process and the stocks and find the stocks which have highest fluctuation and
display and the hot stocks. Since these stocks can give maximum profit if traded.
6.6. Conclusions

In this work we have proposed a model combining the previous work, and maximizing the profits for an investor. Developing this model into a working model is simple as we have specified the complete structure, the inputs and the possible outputs for the system. Specific interfaces may be developed depending on the requirements of the user.