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Stock Market Prediction with Various Technical Indicators Using Neural Network Techniques

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Abstract- Prediction of a financial market is more challenging due to non linearity and uncertainty of the system. Due to many drawbacks of traditional techniques for developing predictive model for stock market, intelligent techniques are widely used. This research work presents use of Artificial Neural Network (ANN) using various technical indicators suggested by researchers. The stock Index data with Open, High, Low and Close are used to extract features and then features are selected based on many existing rank based feature selection techniques and a new Index data with reduced feature subset is supplied to ANN for future value prediction. An empirical result show that feature extraction and then feature selection may play crucial role in terms of efficiency of the ANN model. Ten years historical daily Indian stock data were used for the experimental purpose from which a total of 16 features were extracted and then 7 features are selected for stock market prediction. The MAPE found with these seven features is 5.48.

Keywords- Feature Extraction, Feature Selection, Technical Indicator, Artificial Neural Network (ANN).

I. INTRODUCTION

Stock market is a complex and dynamic system with noisy, non-linear and chaotic data series. Prediction of a financial stock market is more challenging due to non linearity and uncertainty of the system. Conventionally, technical analysis methods, that predicts stock prices are based on historical prices and volume, Advanced intelligent techniques that are ranging from complete mathematical models and expert systems to fuzzy logic networks[1], have also been used by many financial predictive systems for predicting stock prices based on historical data [6]. Now days, most of the researchers are using Neural Network for future value prediction of stock market.

Neural networks have also been found very useful in stock market prediction. Artificial Intelligent techniques are used by various authors[6]. Due to many drawbacks of traditional techniques for developing predictive model, the approaches of computational intelligent methods have gain importance to predict the stock prices. Many researchers utilized ANN [7] and Fuzzy logic for this purpose. This paper explores the application of ANN for the prediction of stock using ANN with feature extraction and selection to get more accurate prediction of stock market. ANN is utilized with special reference to feature extraction and selection. The original feature available in the Indian stock index is used to extract features based on sixteen technical indicators suggested by many authors. The feature selection is a technique that choose the best features among many and removes the unimportant features to be finally utilized by ANN .Seven out of sixteen features are finally selected for stock market prediction

II. STOCK DATA AND TECHNICAL INDICATORS

The stock market data used in this study is daily BSE 30 data downloaded from (www.yahoofinance.com). The data consist Date, Open, High, Low, Close and Volume, however only first four features are used to find out new features based on various technical indicators as shown in Table1. These technical indicators are widely used to develop many models (suggested by financial experts).

Table I: List of Technical Indicators

S.No	Name of Technical Indicator	Description
1	Exponential Moving Average(EMA)	EMA reduces the lag by applying more weight to recent price.

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2	Moving average Convergence-Divergence(MACD)	MACD measures the difference between security's of 26-days and 12 days EMA's).
3	Relative Strength Index(RSI)	It shows price strength by comparing upward and downward close- to – close movements.
4	Stochastic Oscillator	It shows the location of the close relative to the high-low range over a set number of period.
5	Rate Of Change(ROC)	It measures the percentage change in price from one period to the next.
6	Money Flow Index(MFI)	MFI is an oscillator that uses both price and volume to measure buying and selling pressure.
7	Willium %R	It is a momentum indicator that is the inverse of the Fast Stochastic Oscillator.
8	Accumulation Distribution Line(A/D)	A/D is a Volume based indicator designed to measure the cumulative flow of money into and out of security.
9	On balance Volume (OBV)	It measures Buying and selling pressure as a cumulative indicator that ads volume on up days and subtract volume on down days.
10	Chaikin Oscillator(CHO)	It is the difference between the 3-day EMA and the 10-day EMA of the A/D.
11	Average True Range(ATR)	It is an indicator that measures volatility.
12	Average Directional Index(ADI)	It is used to measures trend strength without regard to trend direction.
13	Commodity Channel Index(CCI)	It is a versatile indicator that can be used to identify a new trend or warn of extreme conditions.
14	Chaikin Money Flow(CMF)	CMF is used to measures the amount of MFV over a specific period.
15	Percentage Price Oscillator(PPO)	PPO is a momentum oscillator that measures the difference between two moving averages as a percentage of the large moving average.
16	Force Index(FI)	It is an indicator that uses price and volume to assess the power behind a move or identify possible turning points.

III. STOCK MARKET PREDICTION TECHNIQUE

A. Radial Basis Function (RBF) Neural Network

Radial basis functions are powerful techniques for interpolation in multidimensional space [9]. A RBF is a function which built into distance criterion with respect to a center. There is an advantage of RBF neural networks that it does not suffer from local minima in the same way as Multi-Layer Perceptions. RBF Networks is basically of two-layer feed-forward networks [11], The hidden nodes implement a set of radial basis functions (e.g. Gaussian functions), The output nodes implement linear summation functions as in an MLP, The network training is divided into two stages: In the first step we determined weights from the input layer to hidden layer, and then from the hidden layer to output layer,

B. Error Back Propagation Network (EBPN)

EBPN is popularly used prediction technique suggested by [5] which can be trained using popular Error back propagation Algorithm and it is a generalization of delta rule. The delta value for a given input vector compare the output vector to the correct answer. It is most useful for feed-forward. Back propagation [4], requires the activation function used by the artificial neurons be differentiable. Backward propagation [8] of the propagation's output activations through the neural network using the training pattern target in order to generate the deltas of all output and hidden neurons.

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C. Feature Extraction and Feature Selection

Feature extraction is the process of constructing new feature space[2]from the existing feature space which may be important for analysis and classification[10] This technique is actually transforms the attributes, these transformed attributes or features are combinations of the original attributes. The goal of this technique is to improve the effectiveness and efficiency of analysis and classification [12] On the other hand feature selection is a process of selecting best feature subset. We should remove unneeded features because they might degrade the quality of discovered patterns and difficult to get accurate end efficient prediction [3], for some reasons like some columns are noisy or redundant. This noisy data makes it more difficult to discover meaningful patterns from the data and to discover quality patterns; most data mining algorithms require much larger training data set on high-dimensional data sets. Feature selections techniques are automatically discover the best features and it helps to solve the problems of having too much data that is of little value. Feature selection techniques to automatically discover the best features and it helps to solve the problems of having too much data.

IV. FRAMEWORK FOR STOCK MARKET PREDICTION

Proposed framework from stock market prediction is shown in Figure 1, this framework can be viewed as two parts: first Feature extraction and selection and second stock value prediction. The first part basically emphasize on data preprocessing which consists following steps:

Step 1.1: BSE 30 index data are collected from financial site.
Step 1.2: Sixteen features are extracted based on technical indicators as shown in Table 1.
Step 1.3: Index data with extracted features are normalized using simple normalization formula to range the value in between [0 1].
Step 1.4: Ranking based feature selection technique is applied, which provide rank of features. Features are then reduced one-by-one from lower to higher rank to obtained new index data with reduced feature subset.
Step 1.5: Data are divided into two parts as training and testing. Training data are for model building while testing data are used for validation of predictive model.

Second part of this framework describe about model building and model validation with the help of ANN techniques which consists following steps:

Step 2.1: 80% of data supplied to build model while 20% data are supplied to validate model to both the ANN technique RBFN and EBPN.
Step 2.2: Obtained forecasting next-day-close price from RBFN and EBPN are analyzed with the help of following error measures:

$$MAE = \frac{\sum_{i=0}^{n} |Y_{a,i} - Y_{p,i}|}{n} \quad (1)$$

$$RMSE = \sqrt{\frac{1}{n}\sum_{i=0}^{n} (Y_{a,i} - Y_{p,i})^2} \quad (2)$$

$$MAPE = \frac{\sum_{i=0}^{n} |Y_{a,i} - Y_{p,i}|}{n} \times 100 \quad (3)$$

Where Ya,i and Yp,i are respectively actual and predicted values of stock price on a particular day i and n is the total number of days.

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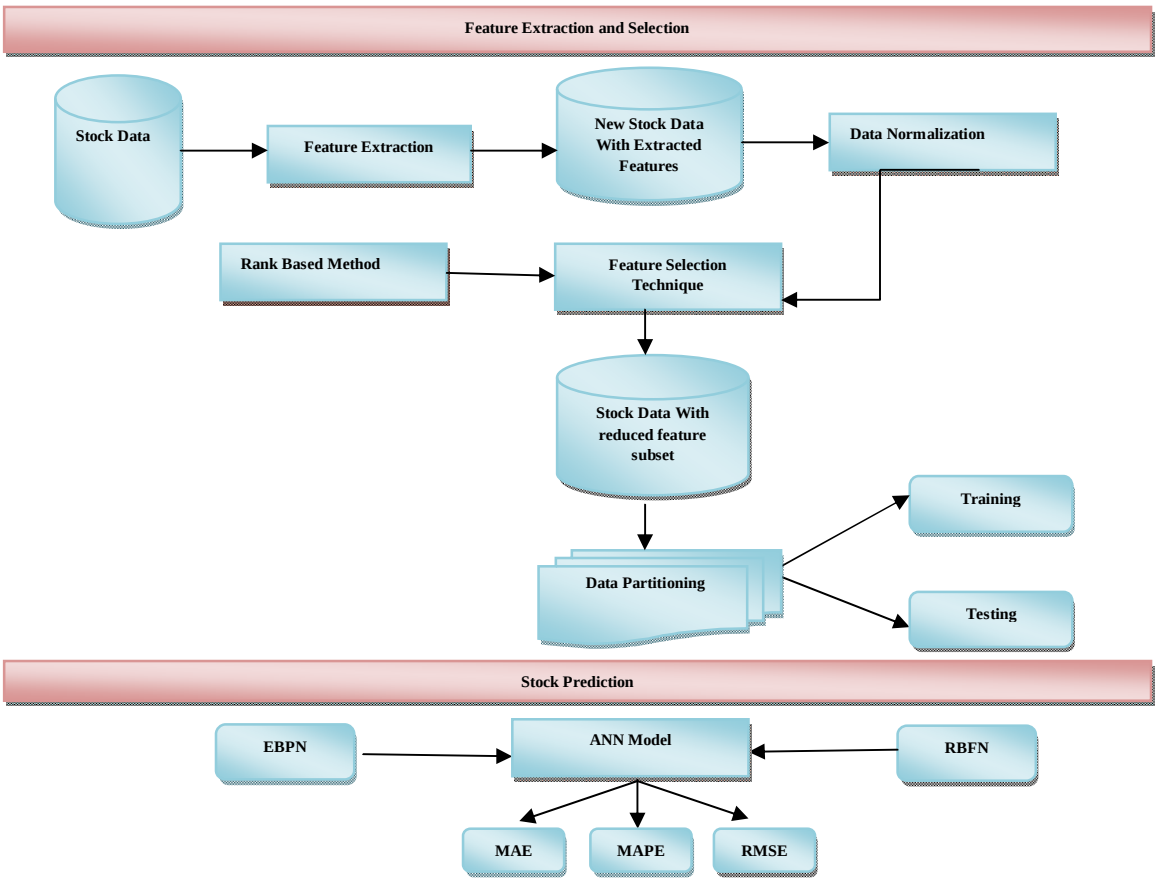

Fig 1: Process of implementing stock market prediction with technical indicators

V. RESULT AND DISCUSSION

Experimental work is carried out with simulation software where stock data are fed to EBPN and RBNF model one by one. The obtained next-day-close price of each trading day for all 16 extracted features and is shown in Table II, in term of MAE, RMSE and MAPE calculated using equation 1, 2 and 3 respectively. From the table it can be observed that EBPN is better as compare to RBFN.

Table II: Different measures obtained in case of ANN techniques with all 16 extracted features

ANN Techniques	MAPE	RMSE	MAE
EBPN	5.514	0.036	0.026
RBNF	8.259	0.012	0.008

Rank based feature selection technique is further applied with EBPN and RBFN, they constructed new feature subset which is used to choose feature with lowest rank for feature reduction. The Table III depicts the results after applying feature selection techniques. The result shown in Table III is quite satisfactory as MAPE in case of seven features highlighted are 5.485 and 5.902 respectively in case of EBPN and RBFN, which higher than that of MAPE of 16 features (5.514 and 8.260 respectively for EBPN and RBFN).

Table III: Results after applying feature selection techniques with EBPN

ANN Techniques	No of Features selected	MAPE	RMSE	MAE
EBPN	16	5.514	0.036	0.026

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	13	6.085	0.036	0.026
	11	6.110	0.036	0.028
	10	5.979	0.034	0.025
	7	5.485	0.343	0.025
RBNF	16	8.260	0.012	0.008
	12	9.037	0.014	0.009
	11	7.663	0.014	0.008
	10	6.750	0.137	0.007
	7	5.902	0.013	0.007

VI. CONCLUSION

Stock market is volatile in nature and it is very difficult to predict it with conventional techniques. ANN is widely accepted for stock market prediction due to its capacity of learning non linear pattern in more accurate way on the other hand historical data available in financial sites consists few features like open, high ,close, low and volume, but only these features are not sufficient to build models hence a new features are needed to be extracted from available feature space with the help of technical indicators suggested by financial experts. A total of 16 features extracted and then 7 best features are selected based on ranking based feature selection technique to be used with ANN. An empirical results show that ANN techniques are producing better results in terms of MAE, MAPE and RMSE in case of only 7 features.

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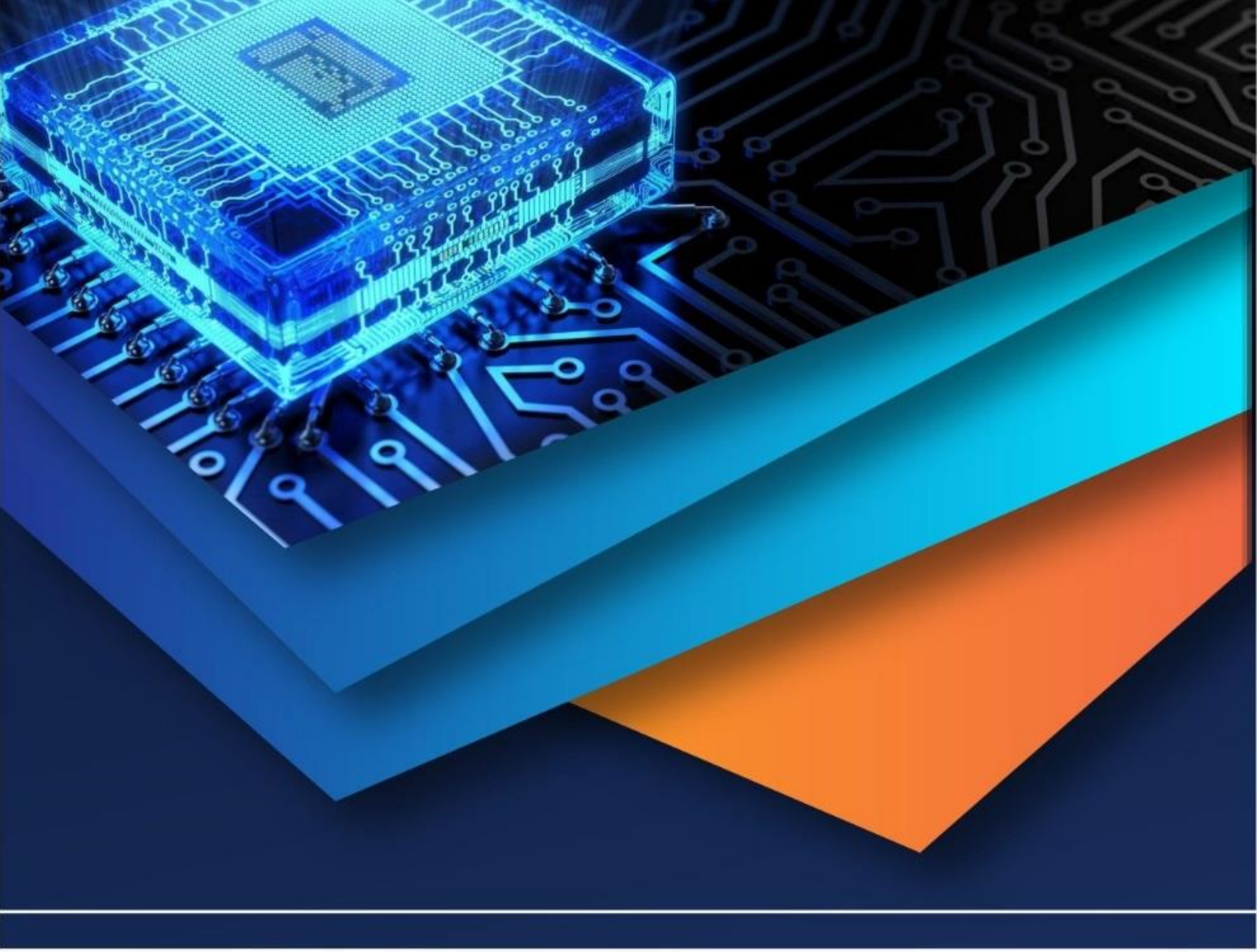

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