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Implementation of Artificial Neural Networks and Fuzzy Logic for Closing Stock Exchange

Suresh Naik
Department of Computer Science Engineering, VNR Vignan University, Vizag
Corresponding Author: sureshcse@gmail.com

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Abstract*: The Hybrid ANN model of Functional Link Fuzzy Logic Neural Model proposed for this study is used to predict future stock close price of BSE and NSE stock exchanges. The pre-processing of raw data of the BSE and NSE stock exchange's, historical raw data has been made such that it falls between 1 and 0. The inputs are first pre-processed before they are viewed by the functional expansion function to perform neural actions. Fuzzy sets are applied on the neuron's activation function to show the upcoming near price of the BSE and NSE stock exchanges. The model is trained with historical data from stock exchange, which had undergone pre-processing and during testing phase; prediction rate of (Functional Link Fuzzy Logic Neural Model Proposed Hybrid ANN is ascertained by means of performance metrics.*

Keywords*: Back propagation, BSE, ANN, FLFNM, MAPE, SENSEX*

I. Introduction

Just like the broad network of the human brain, a neural net is a network of nodes connected. A mathematical or computer model, derived from the biological neural networks, is known as the artificial neural network [1]. The business community is highly interested in locating trends and patterns in financial information to support decision-making undertakings. So far, some statistical methods, such as the regression analysis and the statistical clustering, have been the primary mechanisms for trend and pattern discovery.

However, since the data is often very nonlinear, the mathematical models associated with these techniques of economic forecasting are linear and they may not be in a position to predict the junctures of the economic cycles. Some of the new techniques that have found some prominence in trend analysis are the neural networks, knowledge-based systems, genetic algorithms among many others.

Such neural networks are especially frequently used for financial forecasts, such as bond yields, futures in trading commodities, exchange of foreign currencies, and stock markets. Recent revival of interests in NNs has been fueled by new developments in the analogue VLSI circuits, the parallel processing methods as well as the NN learning algorithms. The simulation of physical processes, which can be best described in terms of the massively parallel networks, is one of the main applications of artificial neural systems.

II. ANN Modelling Suitability and Forecasting

The Indian stock market has long been regarded as the foundation of the country's economy and a high-return investment area [3, 4, 5]. It is extremely challenging to predict the movement of the stock market since it is influenced by a wide range of intricately interconnected economic, political, and even psychological elements. Predicting involves making statements about the future that are likely to contain errors. The mistake must be as little as possible in order to generate a meaningful prediction. Investors employ a variety of methods, including mathematical models, technical analysis, and fundamental analysis, to forecast stock market returns.

These approaches, however, cannot provide an accurate estimate of the expected price. To increase the accuracy of prediction and computational efficiency in comparison to the existing methods, the current research uses the soft computing techniques such as (soft computing is the branch of computing that was adapted from the physical sciences) granular computing, rough sets, neural networks, fuzzy sets, and genetic algorithms. The advancements in the technology of computers and telecommunication today are making the world's major economies and the financial

markets more globalized. Financial markets are becoming more inter-connected as a development of this process, and studying financial markets will become more and more the business of basic issues. The major technical analysis approaches in the world market employing a simulation and back-testing of the simulated market's own historical price (or volume) behavior to the modelling of a specific market is rapidly becoming non-competitive. Both individual traders and financial institutions are increasingly using the new technologies in financial forecasting. Recent research show that the Nonlinear domains can be better modelled by these technologies (such as the artificial neural networks) than linear statistics and single market approach, which have dominated in such analysis for the last decade.

ANN implementation also produces another benefit of the distribution of processing over many nodes [1], [3]. In fact, in case some of the nodes fail, the system performance will not be greatly affected. If this claim is to be verified, one needs to disable m randomly selected hidden layer nodes and observe the effect on system performance. However, network pruning is essential as a way of trimming the redundant nodes in the inputs and speeding the training and recall process due to the huge number of the inputs. Neural network's network topology, computational functions, and training method are all significant elements of a neural network [5].

III. Analysis of the Connected Network

By establishing non-linear decision boundaries, the single layer, single neuron FLANN architecture possesses the remarkable capacity to construct intricate decision regions. The linear weighting of the input pattern generated by the linear linkages of the more well-known Multi-Layer Perceptron (MLP) is not the same as the design of the FLANN [2]. The property to create complex decision regions is the outstanding ability of the one-level-one-neuron FLANN architecture-based system to determine non-linear decision borders. The linear weighting of the input pattern created by way of means of linear linkages of more well-known Multi-Layer Perceptron (MLP) is different from the design for the FLANN [2].

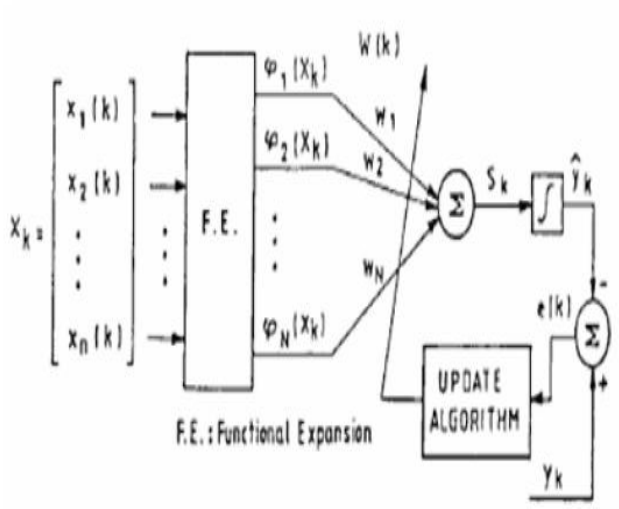

Fig 1: FLANN model architecture

The FLANN has a very straightforward structure. There is no need for a hidden layer because it is a flat net. As a result, this network uses a straightforward computation and learning approach. The input vector's dimensionality is effectively increased by the functional expansion of the network's input; as a result, the FLANN's hyper-planes offer improved discrimination capabilities in the input pattern space. In recent years, there have been reports of various system identifications, picture classification systems, noise cancellation, and control of nonlinear systems. These tests have demonstrated FLANN's capacity to provide adequate solutions for issues involving dynamic and extremely non-linear data.

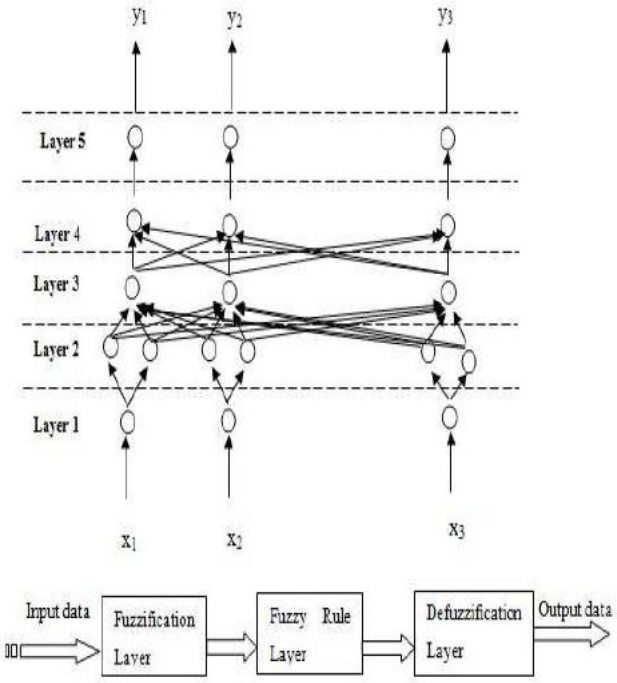

Fig 2: Fuzzy Logic Neural Network architecture

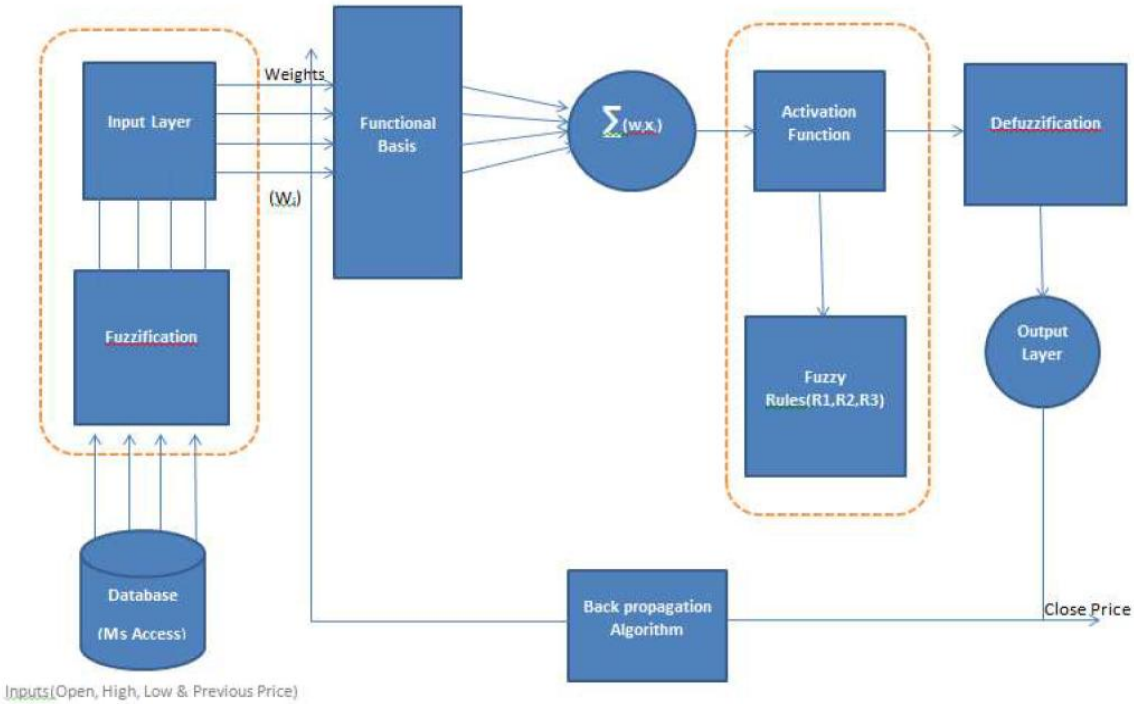

Fig 3: Hybrid Functional Link and Fuzzy Logic Neural Model Architecture

IV. Error Rate Accuracy and Analysis

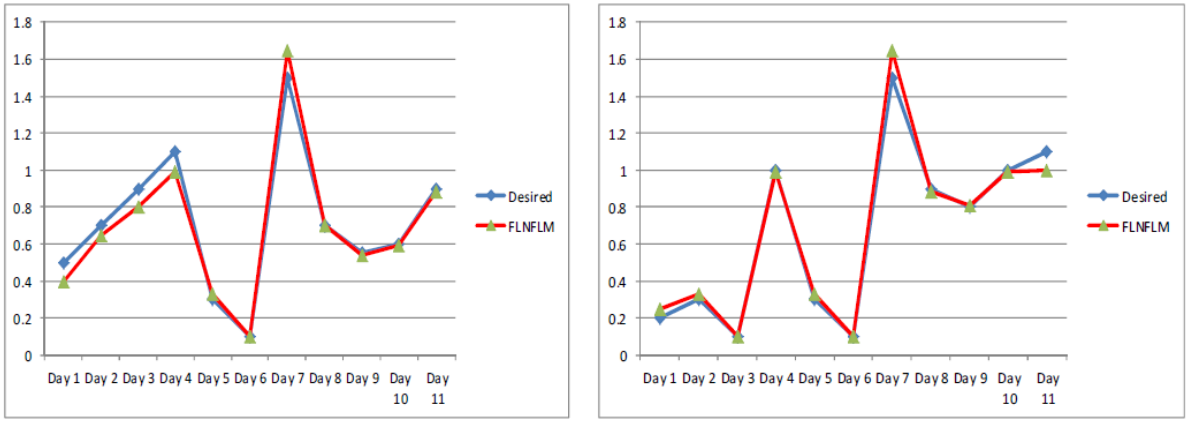

Fig 4: Error rate of BSE, SENSEX and NSE

V. Conclusion

Using historical data from the past, the suggested Hybrid Network model forecasts the closing prices of both the BSE and NSE stocks in the future. The accuracy and error rate of the FLFNM model are calculated using ANN performance metrics, which show that it is more efficient than the current model. In the future, appropriate relations that can identify different aspects of the stock market case study can be added to the fuzzy sets.

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