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Review Paper on Load Forecasting Using Neuro Fuzzy System

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Abstract *: Load forecasting is essential for developing a power supply strategy to improve the reliability of the power line and provide optimal load scheduling for many developing countries where the demand can be increased with high growth rate. Load forecasts are extremely important for energy suppliers and other participants in electric energy generation, transmission and distribution .Electricity supplier use forecasting models to predict the load demand of the consumers to increase or decrease the power generated and to minimize the operating cost of producing electricity. An adaptive neuro-fuzzy interference system ANFIS is used for load forecasting, it combines the intelligibility of fuzzy rules and self learning algorithms of neural networks. By using Neuro-Fuzzy approach to obtain the best performance in prediction of load forecasts.*
Keywords*: Fuzzy logic, Neural network, Neuro –Fuzzy ,ANFIS,Forecasting,Prediction*

I. Introduction

Forecasting is a phenomenon of knowing what may happen to a system in the next coming time periods. Accurate load forecast provides system dispatchers with timely information to operate the system economically and reliably, It helps in electric utility to make important decisions including decisions on purchasing and generating electric power, load switching, and infrastructure development. Owing to the importance of load forecasting, a wide variety of models have been proposed in the last two decades, such as the exponential smoothing model, state estimation model, multiple linear regression model and stochastic time series model. The techniques employed for those models use a large number of complex and non-linear relationships between the load and factors behaviour. Therefore, some new forecasting models have been recently introduced such as artificial intelligence (AI), expert systems, artificial neural networks (ANNs), and fuzzy systems have been the most popular methods applied for load forecasting.

In this paper, a neuro-fuzzy based approach is proposed for load forecasting. Fuzzy systems convert exact information into symbolic information using linguistic sets through a process called fuzzification. In the field of artificial intelligence, neuro-fuzzy refers to combinations of artificial neural networks and fuzzy logic. Neuro-fuzzy hybridization results in a hybrid intelligent system that synergizes these two techniques by combining the human-like reasoning style of fuzzy systems with the learning and connectionist structure of neural networks. Neuro-fuzzy hybridization is widely termed as Fuzzy Neural Network (FNN) or Neuro-Fuzzy System (NFS).

This paper gives a review of load forecasting based on existing technologies. Load forecasting use of Neuro-Fuzzy base approach is proposed in this project. The rest of the paper is organized as follows. Section II summarizes the literature review on the existing systems. Section III analyzes the main aim and prime objective of the load forecasting system. Section IV describes the basic need of the project. Section V describes the proposed system. Finally, Section V deals with conclusion and future scope. And the last is the reference papers and publications.

II. Literature Review

After the research in various load forecasting techniques, researchers found that the yield of forecasting do not properly predict. Use of some technology in the load forecasting plays important role in managing the production and purchasing in an economically reasonable way also plays a crucial role in helping the electric utility to make unit commitment decisions, to reduce the reserve capacity and to schedule device maintenance plan properly. Some of the researchers tried for betterment of forecasting and provides the systems that use technologies which are helpful for managing the production and purchasing. Some of such researches carried out in the load forecasting are summarized below.

IT2 TSK FLS models are used for the problem of short term load forecasting [18], [19], [20] ,[21] these models can be used to minimize effects of prevailing uncertainties on forecasting results. Report[14] present the development of an ANN [16] based short-term load forecasting model for the 132/33KV sub- station, Kano, Nigeria technique which has one of the best learning rates was used as a back propagation algorithm for the Multilayer Feed Forward ANN model[22],[23].The simulation results [15],[17]obtained using the forecasting model showed that Short Term Load Forecast can be accurately implemented using only past load values.The accuracy of the forecasts was verified by comparing the simulated outputs from the network with obtained

results from the utility company. Load Forecasting based on neuro-fuzzy shown different results with different algorithms use [8],[9],[10] where Monthly Generation of CSPGCL Thermal Units during 2008, 2009, 2010, 2011 and 2012 in MW[11].Enhanced Neuro-fuzzy Architecture[12],structure determination and parameter identification[13]. Additional progress in load forecasting [6],[7] can be achieved by providing short-term load forecasts in the form of probability distributions rather than the forecasted numbers. Forecasted load power is obtained by adding a correction to the selected similar day[24] Since, the neural network output a correction which is small data, it is not necessary for the neural network to learn all the similar day's data. Therefore, it is possible to reduce the neural network structure and learning time.

In this paper [3] the proposed fuzzy based long term forecasting has been demonstrated on a relatively smaller scale/magnitude. But, the algorithm is capable of forecasting load with very good accuracy even when forecasting is done on a larger magnitude.

Fuzzy inference [1],[2] is used to correct the similar day load curves of the forecast day to obtain the load forecast, further the parameters for fuzzy inference are optimized which further improves the forecasting results. Another the used of new approach[4],[5] to forecast the daily load demand in a shorter period of time to half-hourly load demand, new set of rules developed for this purpose has highlighted the importance of information.

III. Aim And Objective

3.1Aim

The main aim of the research is to develop and to test an forecasts system having a low cost, to find a precise result for load forecasting using neuro fuzzy system with minimum time and suitable measurable values, to improve load forecasting accuracy by using the neuro-fuzzy approach.

3.2Objective

The main objective of load forecasting is to present the power load consumption for operation and planning. To make decisions on purchasing, load switching, power generating, and for timely dispatcher information, to taking many decisions regarding energy purchasing and generation, to schedule device maintenance plan properly. It plays a role not only in reducing the generation cost but is also essential to improve the reliability of power systems.

The objective of the study was to develop an accurate and reliable model for load forecasting which may assist to economically optimize power system operations.

The main objective of load forecasting is to provide load predictions for generation scheduling; economic load dispatch and security assessment at any time.Another objective of the power utility is to generate electric power according to the consumers demand of energy at all times and at minimum cost.

IV. Need Of The Project

Since industrialization, there has always been a need for accurate forecasting of future load demands. Load forecasts are used by participants in electric energy generation, transmission, distribution, and markets for a variety of decision-making processes, such as economic dispatch, unit commitment, hydro-thermal coordination, transaction evaluation, and expansion planning. However, the need for accurate forecasts has intensified in the last decade due to energy industry deregulation.

Planning: Every participant viz GENCO, TRANSCO, DISCO and Traders need load forecast inputs to prepare new schemes of extension or enhancements or capacity additions or infrastructure development. The network and system planning is always based on load requirements. Advanced load forecasting tools or applications gives appropriate future long term load requirements.

The need of project to improve load forecasting accuracy by using the neuro-fuzzy approach,to develop and test forecasts system having a low cost with minimum time.

Types of Load Forecasting:

Depending the period of the forecast done, it is classified into three different types.

They are:

1. Long term load forecasting (LTLF) : Long term load forecasting with a time period of more than one year.
2. Mid term Load Forecasting (MTLF) : Medium term load forecasting, which forecasts within a time period of one month to one year.
3. Short term Load Forecasting (STLF) : Short term load forecasting, which forecasts within a time period of one day to one month

Load Forecasting Tools & Methodology:

1. Artificial Neural network.(ANN)
2. Fuzzy logic (FL).
3. Autoregressive model.
4. Similar day approach.
5. Time series.
6. Expert system.
7. Support vector machine.

ANN and FL are the popular and commonly used mathematical tools for LF applications.

V. Proposed System

1. Neural Network:

The use of artificial neural networks (ANN or simply NN) has been a widely studied electric load forecasting technique , neuron is an information processing unit that is fundamental to the operation of a neural network.

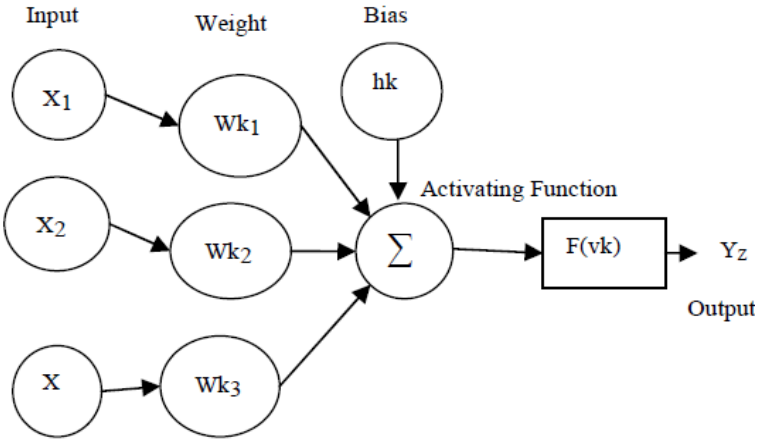

Fig.1. Neuron model

The three basic elements of the neuron model are:

1) A set of weights, each of which is characterized by a strength of its own. A signal xj connected to neuron k is multiplied by the weight wkj. The weight of an artificial neuron may lie in a range that includes negative as well as positive values
2) An adder for summing the input signals, weighted by the respective weights of the neuron
3) An activation function for limiting the amplitude of the output of a neuron. It is also referred to as squashing function which squashes the amplitude range of the output signal to some finite value.

2. Fuzzy Logic:

Fuzzy logic is a generalization of the usual Boolean logic used for digital circuit design. An input under Boolean logic takes on a truth value of "0" or "1". Under fuzzy logic an input has associated with it a certain qualitative ranges.

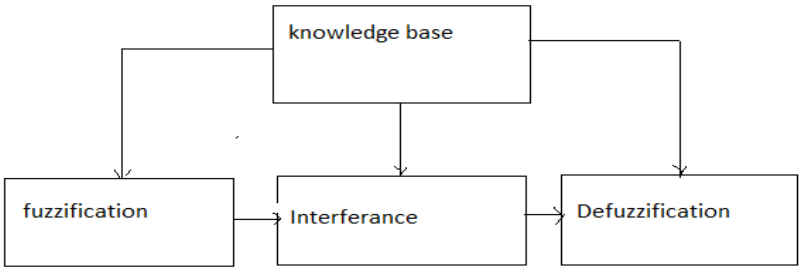

Fig2. Block diagram of a fuzzy system

Fuzzy logic is a form of many-valued logic, it deals with reasoning that is approximate rather than fixed and exact.

3. Neuro-Fuzzy:

In the field of artificial intelligence, neuro -fuzzy refers to combinations of artificial neural networks and fuzzy logic.Neuro -fuzzy system incorporates the human-like reasoning style of fuzzy systems through the use of fuzzy sets and a linguistic model consisting of a set of IF-THEN fuzzy rules.

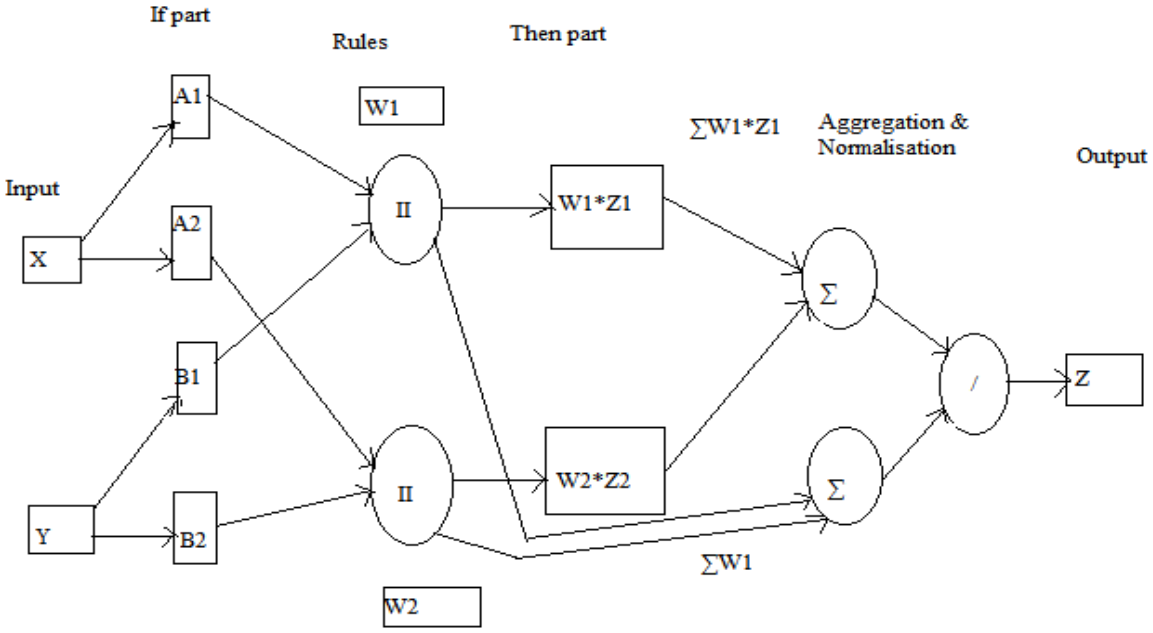

Fig3. Neuro-Fuzzy Model

The work presented here is divided into three steps:

1. Fuzzy Set Based Classification: Classification of training data using Fuzzy Set.
2. Training of Neural Network: Training of the neural network for each hour of each day for which the load is to be forecasted using the training data of that particular class to which that hour belongs.
3. Short term load forecasting: Forecasting of hourly load using trained neural network.

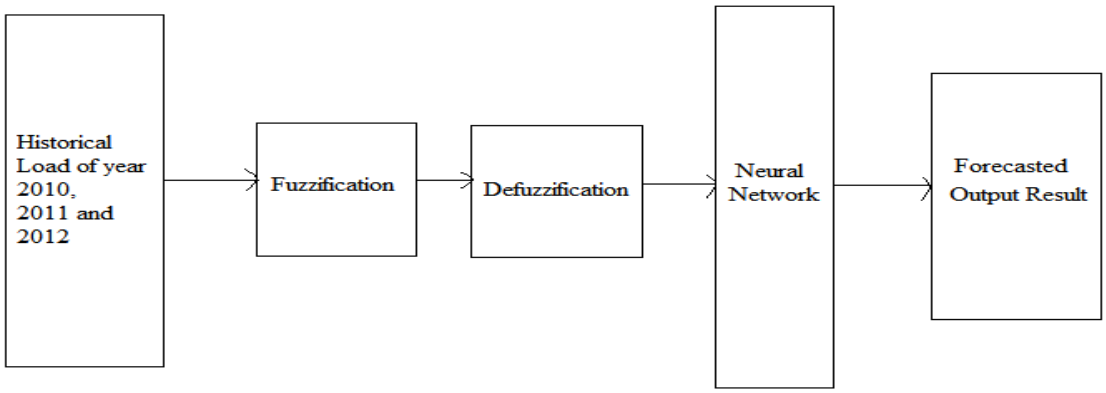

Fig4. Basic Block Diagram Of Neuro-Fuzzy Model.

VI. Conclusion And Future Scope

It can be concluded that the use of neuro fuzzy systems will be advantages for better predicted output. Accurate load forecasting is very important for electric utilities in a competitive environment created by the electric industry deregulation. In this paper review some statistical and artificial intelligence techniques that are used for electric load forecasting. Also discussed factors that affect the accuracy of the forecasts such as weather data, time factors, customer classes, as well as economic and end use factors. Load forecasting methods use advanced mathematical modelling believes that the progress in load forecasting will be achieved in two directions:

1. Basic research in statistics and artificial intelligence and
2. Better understanding of the load dynamics and its statistical properties to implement appropriate models.

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