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A Survey on Short Term Load Forecasting

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Abstract- In recent years, load forecasting has become one of the major areas of research and mostly traditional forecasting models and artificial intelligence techniques have been tried out for this task. Three kinds of forecasting can be performed depending on its time scale: short-, medium- and long-term. Short-term forecasts, in particular, have become increasingly important due to extensive rise of the competitive market. One of the most important benefits of the STF is reliability for the system i.e. to make these investments reliable via optimal accurate forecasting.

Several techniques have been traditionally used for forecasting. Out of several classical techniques, ARIMA and regression were widely used in the earliest works. However, their low adaptability, mainly to solve problems with highly nonlinear series, has generated an increasing interest in artificial intelligence tools: neural networks expert systems or hybrid methods, such as neural networks combined with fuzzy logic.

Artificial Neural Networks (ANNs) have been found useful in many non-linear applications employing knowledge-based techniques. This change has occurred, at least in part, because ANNs offer computational and training advantages over alternative techniques. This is particularly true for applications such as time-series analysis. The success of applying ANN s in time-series analysis has motivated a number of researchers to explore their use in solving the STF problem.

The adaptive neural-fuzzy inference system presents a good alternative for complete and automatic parameter determination for non-linear and real time scenarios. The proposed work deals with the design of short term forecasting using Adaptive Neuro Fuzzy Inference System (ANFIS). ANFIS incorporates the best features of fuzzy systems and neural networks. Also, the comparison of the proposed work with the existing will be done which will provides the accurate measurement of the system parameters.

I. INTRODUCTION

In recent years, load forecasting has become one of the major areas of research. Depending on the time interval it is classified as short, medium & long term forecasting. In particular, short term load forecasting (STLF) is essential for variety of decision making processes such as expansion planning, transaction evaluation, economic dispatch, etc. As energy prices may boosted by a factor of ten or more during periods of peak demands. To deal with such situations STLF is vitally used.

Forecasting can be broadly categories: 1) Traditional methods such as Regression model, ARIMA, Kalman filtering. & 2)Artificial intelligence such as Neural Network, Fuzzy logic systems.

Neural network & fuzzy logic system are the universal approximator with the capability of identifying approximating non-linear relationship between inputs and targets. NN posses an excellent capability of learning & approximating the non linear relationship. Generally for load forecasting the past data is often non linear.

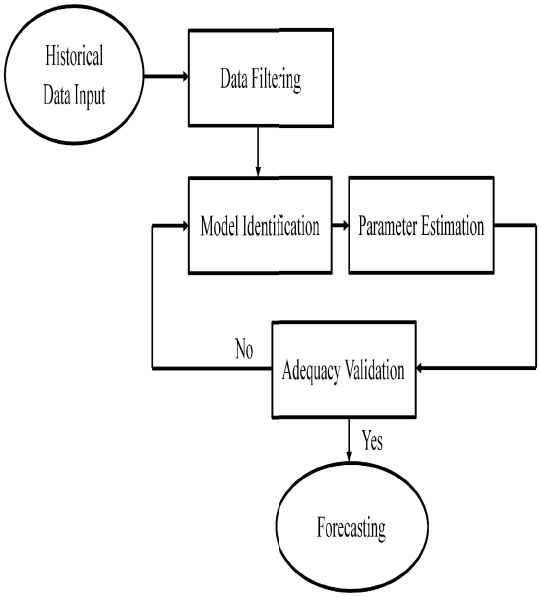

Figure 1. Basic forecasting model

Electrical load forecasting plays a central role in the operation and planning of power systems. In this dissertation Short Term Load Forecasting (STLF) will be considered. One of the most important benefits of the STLF is reliability for the power system i.e. to make these investments reliable via optimal accurate load forecasting. Past historical data will be used to
train the model & then the model is tested based on current data. Ability of the model to forecast in advanced will be tested on the basis of some performance parameters if forecasted value is nearer to the actual value then model validation is accepted as shown above in figure 1.

II. AIM

The aim of this Dissertation is to design the model for short term load forecasting using adaptive neuro-fuzzy inference system.

III. OBJECTIVES

The objectives of the Dissertation are as follows:

1) To design short term load forecasting (STLF) using ANFIS.
2) To train the model with the help of historical data.
3) Testing & verification of the model based on performance parameter.
4) Graphical representation of evaluation parameter and compare them with the existing parameters.

IV. REVIEW OF LITERATURE

Shyh-Jier Huang et. al proposed an autoregressive moving average (ARMA) model identification approach for short-term load forecasting including non-Gaussian process considerations.[1]

H.M. Al-Hamadi et. al, uses the Kalman filter based estimation for short term load forecasting which produces the improved results than the existing model. Also it presents a novel time-varying weather and load model for solving the short-term electric load-forecasting problem. It used to estimate the model parameters using previous history of load and weather data. [2]

Eva Gonzalez-Romera et. al, proposed monthly electric energy demand which is forecasted by splitting it in to two series: trend and the fluctuation around it. Then two neural networks are trained to forecast them separately. These predictions are added up to obtain an overall forecasting. The proposed technique has been applied to the Spanish peninsular monthly electric consumption. By extracting the trend accuracy of the forecasting is improved than direct prediction. [3]

The objective of this study is to construct prediction intervals for future loads instead of forecasting their exact values. A Khosravi et. al, used delta technique which is applied for constructing prediction intervals for outcomes of neural network models. Also it is aimed to investigate the short load forecasting problem from a prediction interval perspective. Instead of developing neural network models for predicting exact load values, prediction intervals were developed based on the delta technique.[4]

A Khosravi et. al, develop a fuzzy logic system based model using interval type two (IT-2). This system is train & tested by giving hourly electricity load demands for past three years. Based on the observations two day ahead load forecast is proposed. Performance of the developed model is evaluated on the basis of evaluation parameters, such as correlation coefficient (CC), coefficient of determination (R2) & root mean square error (RMSE). [5]

Neural Network (NN) based method for the construction of prediction intervals (PIs). A newly introduced method, called lower upper bound estimation (LUBE), is applied and extended to develop PIs using NN models. A new problem formulation is proposed by Hao Quan et. al, which translates the primary multiobjective problem into a constrained single-objective problem.[6]

In this paper, Fuzzy theory, artificial neural network and generalized neural network are used as powerful tool of solar power Forecasting. Proposed soft computing technique will be suitable for solar power forecasting modeling. So on the basis of this study, solar radiation is not only parameter for solar power variability.[7]

Proposed a model to predict the stock price based on combining Self-Organizing Map (SOM) and fuzzy – Support Vector Machines (f-SVM). For each partition, a set of fuzzy rules is extracted based on a f-SVM combining model. The experimental results shows that the proposed model by Duc-Hien Nguyen et. al, has been used to predict stock market.[8]

Many researchers have done the work on load forecasting based on various techniques, using the regressive model, ARMA, ARIMA, fuzzy logic system (FLS), neural network (NN). Here proposed short term load forecasting(STLF) model will be designed using adaptive neuro-fuzzy inference system (ANFIS) in order to evaluate the performance parameters.

V. PROPOSED METHODOLOGY

ANFIS is a combination of fuzzy logic and neural network approaches and inherently carries the advantages of both. This makes ANFIS quite attractive option for this purpose.

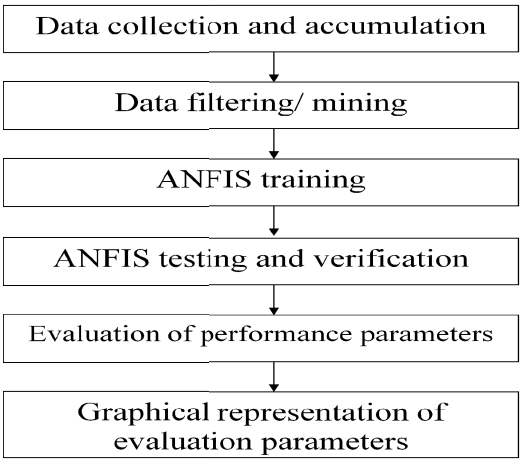

Figure 2. Proposed design flow

Figure 2 shown above, represents the design flow of the proposed work which consists of several steps. Firstly historical data is collected and then data is filtered to obtain the data that will be used for training the proposed model. Once the model is trained we will provide the current data to the model to test the performance of the model. Performance of the model will be evaluated with the help evaluation parameters.

VI. TOOLS REQUIRED

1) MATLAB 7.10 (R 2010b)

CONCLUSION

Short-term forecasting, have become increasingly important due to extensive rise of the competitive market. Several techniques have been traditionally used for forecasting

to achieve accuracy between forecasted and actual data .

We are proposing the forecasting method using ANFIS which is a combination of fuzzy logic and neural network in order to achieve better accuracy.

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