ABSTRACT

Optimal day to day operation of electric power generating plants is very essential for any power utility organization to reduce input costs and the prices of electricity. Power plants powered by fossil fuel can benefit power generation by generating the reasonably required load and also it extends to environmental issues like reducing air pollution. So to generate reasonably the required power, one needs to forecast the future electricity demands since power generation relies heavily on the electricity demand. Hence for both the cases, an accurate and reliable electric load forecasting system is very much required.

Power planning is the process of taking careful decisions on distribution and utilization of power. Load forecasting is vitally important, that goes beyond the electrical distribution arena. Load forecast has three different horizons: short term forecast which are usually carried out for an hour to a week, medium term forecast which are usually carried out for a month to a year, and long term forecast which are usually carried out for more than a year. Short term forecast are important for economic dispatch, unit commitment, fuel allocation and maintenance scheduling which is the area of research.
Recently majority of researchers have used Artificial Neural Network (ANN) approach for Short Term Load Forecasting (STLF) and in that most of the models are based on Multi Layer Perceptron Network. But still there is a need to find optimal ANN structure or convenient training approach that could possibly improve the forecasting accuracy, as it is important in load forecasting which could reduce the operation cost. In this work, five different models have been developed for STLF. These models have been trained and tested using actual load data obtained from Load Dispatch Centre of Tamil Nadu Generation and Distribution Corporation for Chennai city, India and weather data to predict the load of Chennai city for one day in advance.

The models have been divided into two classes: first, forecasting the load with feed forward network and then with recurrent network. The feed forward network consists of three models while recurrent network consists of two models. Four activation functions for all models to forecast the hourly load has been used. The models have been developed to ensure efficient forecasting application with an incremental training approach of ANN.

The feed forward models such as minimized Backpropagation Network (BPN), functional link network and functional link with minimized BP network have been developed to forecast the load with minimum training time and maximum classification rate. These models are trained by BP algorithm and activated by log sigmoid, tan sigmoid, radial basis function, log sigmoid
with slope parameter functions at hidden and output layer. In the minimized BP network, modifications are carried in the training algorithm by stopping the weight updation of the neurons in the output layer upon attaining the target. By this the number of epoch and hence the training time gets reduced.

In functional link network, additional inputs have been generated using the functional link concept of tensor model by multiplying two inputs together and feed forwarding the inputs similar to BP network. The training of network is performed with BP algorithm by investigating it for four activations functions. Such modification enhances the performance of the network.

In functional link with minimized BP, enhanced inputs have been obtained by functional link. The inputs are feed forward and trained by BP algorithm. With minimized BP network, modifications have been carried to stop the neurons that reach the target value. These enhancements increase the network performance as well as reduce the training time.

In case of recurrent network, two models namely minimized Elman network and functional link with minimized Elman network have been developed. The minimized Elman network feed forwards the input data and the network is trained by BP algorithm. Similar to minimized BP network, training of the output neurons in the output layer have been stopped, once the target is reached. This process does not affect the functionality of context units that are connected to the hidden layer. The functional link with
minimized Elman network increases the number of inputs thereby improving the training time and performance.

The feed forward and recurrent network models have been proposed to increase the network performance and reduce the training time so that STLF could be accurately carried for day to day operation of any power generating plants. The classification rate by the proposed models have been increased by 20% and error reduction of about 1.8% while reducing the training time by 60% in the number of epochs.