CHAPTER 7

CONCLUSION AND SUGGESTION FOR FUTURE WORK

The objective of the work was to provide the power system load dispatcher with an accurate and convenient short term load forecasting model as well as to reduce the operation cost. Precise load forecasting is essential for energy trade and spot price establishment. The inspiration of ANN and the significance of STLF made to develop new models for load forecasting.

The performance of the network for short term load forecasting has been carried out by the proposed models using

- Minimized Backpropagation approach
- Functional Link Network approach
- Functional Link Minimized Backpropagation approach
- Minimized Elman Network approach
- Functional Link Minimized Elman Network approach

The proposed models have been investigated for activation functions such as

- Log Sigmoid
- Tan Sigmoid
- Radial Basis Function
- Log Sigmoid with slope Parameter
The standard BPN network has been trained under feed forward network while Elman network was used for recurrent network and tested for the real time application of Chennai city load. Two years load data of 2008 and 2009 were obtained from Load dispatch centre of Tamil Nadu Generation and Distribution Corporation Limited, Chennai, India, pertaining to Chennai city load. The training parameters were trained for different values and the best values were fixed for training all the models. The training and testing of samples has been carried at 60% training and 40% testing, 70% training and 30% testing and 80% training and 20% testing. Three sets of training and testing have been carried to obtain the maximum and minimum epoch. The BPN has been taken as reference to be compared with the proposed models in feed forward network and Elman network as reference in recurrent networks.

7.1 STLF WITH MBPN APPROACH

The BPN training results for all activation functions indicate the maximum classification rate of 73.97% and mean of 72.6%. The maximum error has been 1.19%. The maximum epoch has been 1992 and minimum epoch of 887.

The MBPN training results indicates maximum classification rate of 75.29% with radial basis function and mean of 74.09%. The mean error was about 0.84 which is 2% less compared with BPN. The training time has been reduced by 65%. The radial basis function of MBPN model performed better among the other functions with respect to training time and reducing the error.

7.2 STLF WITH FLN APPROACH

The enhanced input model of FLN performed better with higher classification rate of 85.68% using slope function. This made to achieve 10% increase in classification rate with no drastic changes in the epoch. The error was reduced by 0.6% at the mean error of 0.57%. The slope activated function had better performance in improving the classification rate.
7.3 **STLF WITH FLMBPN APPROACH**

The FLMBPN model increased the classification rate by 17.63% compared with BPN while the mean classification rate has been 90.23%. The error has been reduced by 0.88% in comparison with BPN while the mean error has been 0.28%. The training time has been reduced by 65% and the minimum epoch has been obtained by tan sigmoid function but with less classification rate. The FLMBPN model performance has been better among the feed forward network with higher classification rate, less number of epoch and less error.

7.4 **STLF WITH MEN APPROACH**

The Elman network is taken as a reference for RNN and the maximum classification rate is 76.57% with slope parameter. The maximum error was about 2.08% with radial basis while the number of epoch was also less with this function. The mean error was 1.96%.

The MEN model helped to achieve the training time reduced by 60%. The maximum classification rate of 80.43% with slope function and mean epoch of 78.75%, has made this model to increase the classification rate by 6%. The error was reduced by 0.3% making this model to carry out the training faster.

7.5 **STLF WITH FLMEN APPROACH**

The FLMEN model has been successful in achieving the maximum classification rate of 93.88 with slope function thereby increasing the classification rate by 17%. The number of epoch has also been reduced by 60% hence reduction in training time. The maximum error was 0.58 and minimum error is about 0.27 thereby reducing the error by 1.44% compared
with Elman network. The performance of this model has been good by better classification rate, reduction in the number of epoch and reduction in error.

7.6 CONCLUSION

In the feed forward network, although various activation functions has been investigated for all the models, good classification rate with good convergence has been obtained for most of the models with slope parameter. The FLMBPN model performs better than the other two proposed models.

A good forecast was attained with simple recurrent network, the Elman network. In the proposed Elman models certain times Tan sigmoid function performs well with less training time and most of the time log sigmoid with slope parameter performs better. The FLMEN model performs better and gives good accuracy of STLF forecasting of all the models.

7.7 SUGGESTION FOR FUTURE WORK

The following recommendations may help to further contributions in this area.

- Two activation functions could be carried for a network at a time, one at hidden layer and another at output layer.
- Electricity price and market mechanism are influential to load which could be considered as additional inputs
- Load data of Chennai city alone was considered in this research, which is more than 1/3 \( \text{rd} \) of the total state load and this could be expanded to the state load
- Input enhancement in FLN could be considered by combination of three inputs, as combination of two inputs has been used in FLN.