Chapter-7
CONCLUSION AND SCOPE FOR FUTURE WORK

7.1 CONCLUSION AND DISCUSSION

Cognitive radio is viewed as a disruptive technology innovation to improve spectrum efficiency. Spectrum sensing is a major challenge in cognitive radio networks. Channel status prediction is important to Cognitive Radio Networks (CRNs) because it can greatly save the sensing energy and helps the secondary users to exploit the spectrum holes more efficiently. Extensive research has been performed on various prediction techniques and applications.

A reliable channel status prediction mechanism should ensure a lower probability of wrong predictions of the channel status. However, effort is still needed to design prediction based spectrum sharing methods, provide long-term accurate spectrum prediction, and devise Primary User (PU) activity map prediction schemes. The requirement of high precision spectrum sensing plays important role in the proper utilization of the spectrum. In real time analysis the true path of the states is hidden to the Secondary User (SU) and only the data available to the SU is the sensed data. As the statistics of channel usage in CRNs are difficult to be determined, we rely on adaptive schemes which do not require such a prior knowledge.

Three such adaptive schemes were studied for channel status predictor design, an artificial neural network predictor using Levenberg-Marquardt algorithm, a HMM predictor and a random predictor. In order to achieve better spectrum sensing and to overcome the limitations of the above techniques for channel status in cognitive radio, it is proposed and developed a GS-LM algorithm for state estimation and prediction. Optimization procedures have been attempted by hybridizing neural network with recently available algorithms.

We have chosen the Probabilistic Neural Network (PNN) on the proposed algorithm, because of its implementation simplicity and high computational speed in the training stage, when compared to others algorithms. A key feature of this supervised learning algorithm is that the requirements on the network size and
training of the predictive channels are directly incorporated in the methodology. As a consequence, the proposed algorithm often leads to a fairly effective network structure with satisfactory classification accuracy.

A qualitative analysis of all the prediction schemes has been presented using extensive simulations. Performance analysis has been conducted in simulation environment using MATLAB. MATLAB simulations were performed to illustrate the prediction accuracy of the proposed algorithm with varying channel states (1-15) and all the experiments were carried out for time slots zero to 100.

Number of idle slots sensed, number of idle slots predicted and throughput were the three performance parameters used in order to analyze the performance of the algorithms. It is observed that the throughput performance increases with the increase in time slots and also with increase in number of channels. Number of idle slots sensed (SU) decreases with increase in number of channels and the percentage improvement in the number of idle slots predicted (SU_{imp}) increases with number of channels. The comparative analysis was carried out by comparing proposed technique output to LM, HMM and random techniques. The proposed algorithm PNN (GS-LM) achieved higher values of evaluation metrics when compared with other methods and shows better performance at lower number of channel count.

7.2 SCOPE FOR FUTURE WORK

In this research work, hybridization of Artificial Neural Networks which is one of the streams in Artificial Intelligence techniques is attempted in order to increase the performance of channel status prediction. There is a scope for future work to use hybridization on other streams such as fuzzy logic and genetic algorithms for the prediction of the channel state.