Chapter 6

Conclusion and Future Scope

6.1 Conclusion

The thesis discusses about speech database, speech recognition, EEG signals and analysis and classification, followed by the emotion recognition from electroencephalographic signals. The thesis is presented in six chapters to demonstrate the entire work carried out from acquisition of signals to analyses, classification and recognition system.

Chapter 1 is an introductory chapter. It discusses the basic concept involved in human computer interaction, components of HCI, and bio-signal based approaches for speech and EEG technology.

Chapter 2 describes the concept of production and perceptions of speech mechanism, types of speech recognitions. It also describes the work done in various institutes or universities related to brain signals along with details mechanism of brain signal acquisition i.e. invasive and non-invasive. The overall techniques have explained with their results.

Chapter 3 is specifically devoted to develop speech database and recognition system. The chapter contains description of design of Marathi Speech database for isolated words 50 subjects including males and female with the help of CSL. It describes the result obtained by using computerized speech lab (CLS) on isolated Marathi spoken words. The MFCC features based speech recognition system for Marathi isolated words was tried out. The features have been computed for the above database. The data of fifty subjects have been compared and calculated distance matrix. By comparing features of the database, the Euclidean Distances have been calculated; we found the values of diagonal elements are lower than the rest of elements. 100% recognition rate can be achieved for the isolated spoken words. The interpolation and dynamic time warping (DTW) methods have been tested for the optimal alignment between two time series. Both the methods can give 100% recognition rate for isolated Marathi spoken words.

In chapter 4 devotes to result come out from first experiment and basic concept related to brain and neural potential. For acquisition of signals, corresponding to different modes
were described for selected electrodes. The electrodes considered are Left Prefrontal, Right Prefrontal, Left frontal, Right Frontal, Left Anterior Temporal, Right Anterior Temporal, Left Posterior Temporal, Right Posterior Temporal Left Occipital, and Right Occipital. For same subject, each mode is compared with every modes and distances are measured have been calculated in form Euclidean distance. For the classification and clustering purpose, The Linear Discriminant (Fishers Algorithm) has been implemented on class-within class matrix dataset. Result of the LDA are made four groups of all modes labeled group1, Group2, Group3 and Group4 of all ten electrodes for Delta, Theta, alpha and Beta frequencies for single subject. The graphical representation of Sensitivity and Clustering of these groups for one subject of ten electrodes has been calculated.

In Chapter 5 concludes the LDA method is used for classification of the mood of subjects during the listening of songs. For this purpose, the experiment has been carried out on ten subjects for different types of Hindi songs. Observation from the figures from Appendix C, different portion of brain (Left Upper, Right Upper, Left Lower, Right Lower, Upper, Lower, Left Hemisphere and Left Hemisphere) are more crowded by electrodes at a particular point is seen (Less radius of groups). These portions are more sensitive except central and corner electrodes. More difference in distances among groups means more recognition. In figures from appendix C relaxation, happy, patriotic romantic and sad song modes are clearly classified. Each figure contains A, B, C, and D sections indicating delta, theta, alpha and beta respectively. Again, each section gives clustering of five groups.

6.2 Future Scope

This work has demonstrated that speech as well as brain signals can effectively used for interfacing. Both biological signals are sensitive to information. This work has used limited number of experiments. It is very obvious that the base of these experiments must be extended to broader examples. Many clinical based problems can also be taken for medical oriented application. For example, the Berlin group has designed wheel chair to be operated by thoughts. The applications are almost everywhere. In coming years, one expects to see lot of research activities.