ABSTRACT

Alzheimer's disease (also called pre-senile dementia) is a serious degenerative brain disorder usually occurring in adults aged between forty and sixty. Although the currently existing treatments cannot stop the disorder from becoming more serious, they can temporarily slow the worsening of symptoms and improve the quality of life of the victims and their caregivers, if identified earlier. For the diagnosis of Alzheimer’s, brain Magnetic Resonance Image is normally taken. This fact opens the possibility of applying image processing techniques in order to facilitate and improve diagnosis in different ways. Automatic detection of any disease from the sample is very useful for doctors in terms of saving time and increasing accuracy. The development of automatic disease detection system from the human structural images are challenging because of the noises produced during the process. The automatic detection of Alzheimer’s disease is bound to be difficult due to the limitations of automatic segmentation algorithms. There is, therefore a need to develop an automatic Alzheimer’s disease diagnostic system, which is very accurate, fast and user friendly. At present, most of the techniques used to detect the Alzheimer’s disease based on brain structural images are from volume measurement. The present research is focused on the development of a new automatic Alzheimer’s
disease detection system based on the hippocampus Magnetic Resonance Image texture features.

The research is also focused on developing a new de-noising technique to remove noises from Magnetic Resonance Image for the accurate segmentation of hippocampus based on wave atoms shrinkage. The performance of this method is compared with wavelet shrinkage. A new automatic segmentation method is also developed for delineating the hippocampus using level set methods. The performance of this method is compared with the ground truth. The texture features on hippocampus area are computed using statistical properties of the intensity histogram, Gray Level Co-occurrence Matrix, wavelet transform coefficients and wave atoms transform coefficients. The important features are selected either by using Singular Value Decomposition or Principal Component Analysis. The features are classified into Alzheimer’s by Support Vector Machine classifier. The performance of this automated system is validated by taking samples from Alzheimer’s Disease Neuroimaging Initiative. The parameters such as precision, sensitivity, specificity and accuracy are calculated to qualitatively validate the system. The performances are also presented by displaying the confusion matrix and Receiver Operating Characteristic curve. The experimental results show that the texture features extracted using wave atoms give better classification rate. In all phases of analysis, misclassification is more in the case of age less than 65. Also the analysis show the misclassification is independent on sex. The scope for further
research is identified. That is, the system can be further improved by adding Mild Cognitive Impairment datasets to identify the Mild Cognitive Impairment patients. Also the system can be implemented in hardware.