CHAPTER 9

CONCLUSION

9.1 CONCLUSION OF THE RESEARCH WORK

Cancer is a group of diseases that causes cells in the body to change and grow out of control. Breast Cancer (BC) is one of the leading causes of death among women. Mammography is a low-dose X-ray procedure that allows visualization of the internal structure of the breast. Mammography will detect about 80%-90% of the breast cancers in women without symptoms. A number of signs in mammograms can indicate the presence of breast cancer. The early detection and accurate diagnosis of breast cancer are still unresolved in modern imaging and is a challenge in CAD analysis. Unnecessary biopsies are taken and tumors frequently go undetected until a stage where therapy is costly or unsuccessful. The exact diagnosis of suspicious breast tissue is ambiguous in many cases. To overcome these limitations, new frameworks for the detection of masses and cluster of microcalcifications have been developed. The proposed framework consists of the combination of Bootstrap probability techniques with classical segmentation approach and hybrid feature extraction for detection of lesions.

In order to detect masses, K-means Bootstrap Subgroup (KMBS) and Expectation Maximization Bootstrap Subgroup (EMBS) methods have been proposed. The performances of the algorithms are tested using 164 mammograms extracted from the MIAS database. Among the 164 images, 89 images with confirmed masses and 75 images being normal mammograms.

Critical Evaluation based on the proposed EMBS method produces a detection accuracy of 94.5% with 0.26 false positive per image. Experimental evaluation based on the proposed KMBS method leads to a detection accuracy of 93.4% with 0.33 false positive per image. It is found that the proposed detection systems are capable of detecting masses of different types at low false positive rates.

Detection of clusters in microcalcifications is accomplished through three methods namely Pixcals Refined Bandwidth, Resampling pixcals and Unsupervised Bootstrap Morphological Segmentation (UBMS). A Pixcals Refined Bandwidth and Resampling pixcals method produce a detection accuracy of 61% with 0.46 false positive per image and 75% with 0.38 false positive per image respectively. In order to improve the detection accuracy, the third method UMBS is proposed which uses hybrid features and SVM classifier to detect the microcalcifications. It achieved TP rate of 93.3% with 0.26 false positive per image which is a considerable improvement over the TP rates of the other two proposed methods.

9.2 CONTRIBUTION OF THE WORK

The contributions of the research work are as follows:

- New improved methods have been developed for segmentation of suspicious region (masses and microcalcifications) which introduces combination of Bootstrap probabilistic techniques with classical segmentation approach.
- The hybrid features such as texture, shape and gray level from the suspicious regions which efficiently influence the accuracy of the classification system are identified and extracted.

- The novel methods classify the suspicious regions into mass, microcalcifications and normal tissues.
- Statistical and Mathematical framework are developed to integrate the whole spectrum of image information pertaining to mammogram in CAD system.
- It is to be highlighted that the proposed EMBS method gives more than 94% accuracy for detection of masses and UBMS method gives more than 93% accuracy for detection of cluster of microcalcification which is a major contribution in the development of CAD system.

9.3 SCOPE FOR FURTHER STUDY

The future scope of the work reported in this thesis is as follows:

- The 3D image of the breast may provide doctors with a clear overlapping view of breast tissue. The entire CAD system can be simulated with the 3D images instead of 2D gray scale images.
- Research work can be extended to find out the depth of cancer region using 3D images.
- The CAD system can be extended by testing against various databases and various classifier models.