CHAPTER 5

MOTIVATED RESEARCH AIMS AND OBJECTIVES

5.1 RESEARCH AIMS

Computer technology has had a tremendous impact on medical imaging; without computers modern radiological modalities like CT and MRI could not even exist. The computer may give wonderful images but they have to be interpreted only by the makers of the computer, i.e., humans. In the coming years, this may change; ever interpretation may be made by the computers.

Breast cancer is one of the most devastating and a deadly disease for women today, but early detection leads to significantly better survival rates. However, the precise diagnosis of breast cancer proves to be a difficult task. Even Mammography, the most commonly used technique of breast cancer screening fails to detect up to 30% of breast lesions and up to 2/3 of those lesions is visible in retrospect. Even for the physicians it becomes difficult to correctly diagnose and what they do is simply to refer their patients for biopsy because they have their own confusions about lesions. This practice notwithstanding, around 60%-80% of breast biopsies performed in the US turn out to be benign. The problem is further compounded when radiologists also make mistakes in their interpretations of the images.

It is here computerized decision support systems in mammography comes in handy and provides a fast, reliable, and cost-effective “second opinion” to aid physicians in making correct diagnosis. Several Computer Aided Detection (CADe) and Computer Aided Diagnosis (CADx) systems have been developed over the past two decades and several commercial CADe products are available now for mammography and clinically accepted.

This study aims to develop an efficient and automated system for the classification of digital mammogram images. In the medical field, automated processing and collection of information from medical images have become the need of the hour. This demand has led to the development of several techniques to classify digital mammograms.
Two of the important early steps of breast cancer that physicians look for as pointers during the process of diagnosis are microcalcifications and masses, of which masses are often detected in the dense areas of the breast tissue and are found to be thin with smooth boundaries. During diagnosis, microcalcifications and masses are being considered as two important early signs of the disease [37]. The masses are quite thin and often present in the dense areas of the breast tissue with smoother boundaries compared with microcalcification [133].

5.2 OBJECTIVES OF THE THESIS

The main objective of this thesis is to develop an efficient and automated (CADx) system for the classification of digital mammogram images.

Stage 1: To classify / differentiate between normal / abnormal lesions in breast

Stage 2: To classify the abnormal lesions into mass / Microcalcifications (MCs)

Stage 3: To classify benign / malignant based on the abnormal severity in mass / Microcalcifications (MCs)

A sequential classification of the above three stages using different combinations of texture features. In the medical field, automated processing system and collection of information from medical images have become the need of the hour. This demand has led to the development of several techniques to classify digital mammograms. The research objectives are as follows:

- To extensively review the available pattern recognition techniques for mammogram classification schemes.
- To develop efficient and automated (CADx) system for the classification of digital mammogram images.
- To identify the Dual Tree M-Band Wavelet Transform (DTMBWT) as a feature extraction technique and Support Vector Machine (SVM) as a classifier.
- To represent the mammogram images at different resolution levels by DTMBWT.
- To extract the significant features from the DTMBWT decomposed image for classification.
To design three stage SVM classifier to discriminate the given features into normal/abnormal, mass/Microcalcifications (MCs) and finally the abnormal severity into benign/malignant.

To implement the proposed system using MATLAB.

To validate the proposed system on well known mammogram database 'MIAS'.

To calculate the classification accuracy, sensitivity and specificity of the proposed CAD system to measure the performance of the system.

This research work mainly focuses on improving the classification of digital mammogram images. While considering computer applications, the classification of abnormalities in digital mammograms may be implemented by mammography procedure or computerization methods. After the classification of abnormalities, human assessment, pathology, automated methods, or combination of some three classifiers are used to classify the abnormalities. This research work may lay the foundation for overall automated mammogram classification system. The contribution of the thesis is the development of a Computer Aided Diagnosis (CAD) system for the classification of digital mammograms based on Dual Tree M-band Wavelet Transform (DTMBWT) and Support Vector Machine (SVM). The proposed CAD system improves the accuracy of interpreting mammograms by providing an important opinion to the radiologist. The proposed system can help the radiologists in distinguishing into between normal and abnormal cases. The abnormal cases are further subdivided into mass/Microcalcifications (MCs); the abnormalities of images are further classified either as benign or malignant in the subsequent stages. The goal of this research work to find efficient a method of extracting the extract the salient texture features for mammogram classification and then give the classification results to evaluate the corresponding features, thereby developing a novel approach for mammogram classification.