PROPOSED METHODOLOGY

The literature survey in the chapter 2 emphasized that there are many challenges facing in the development of CAD system. The challenges CAD system facing are enumerated below.

1. For many CAD systems the false positive detection rates are high.
2. Implementation of breast border detection is complicated because of some factors such as the low contrast near the borders, image noise and artifacts.
3. Segmentation of the pectoral muscle is a complex and demanding task. The factor that contributes the challenge in pectoral muscle segmentation is the shape of muscle. Usually edge is not a straight line.
4. Selected features for the classification process should reflect the specificity of micro calcifications appearing in mammograms as precisely as possible.
5. Many machine learning algorithm fail in dealing with imbalanced data set. This affects in the classification of potential microcalcification and microcalcification clusters.

This chapter focuses on the requirement of model and the proposed methodology. Section 3.1 explains the model requirement and section 3.2 discusses proposed methodology.

3.1 Requirement of Model

In order to make the CAD system more effective there is a need to employ new techniques in all the phases of CAD system from preprocessing of mammograms to microcalcification cluster classification. The requirements of the model are captured in the following sections.

3.1.1 Preprocessing

A method needs to be used to remove noise and radiopaque artifacts contained within the mammogram and increase region homogeneity, with the objective being to improve in algorithm reliability and robustness by reducing false positives. Pre-processing is necessary to improve the image quality of mammograms.
Mammograms often contain artifacts in the form of identification labels, markers, and wedges in the unexposed air-background (non-breast) region.

3.1.2 Segmentation of breast contour

There are some parts in the image that are not useful for the mammographic interpretation. It is needed to extract only the region of the image that corresponds to the breast. Extraction of the breast region is an essential step in the process of computer aided detection. A method is needed to extract breast contour to allow the further stages to search for abnormalities in the region of interest without undue influence from the background of the mammogram.

3.1.3 Detection of potential microcalcification

Detecting microcalcifications is difficult because they are embedded in a non-homogeneous background and hence there is a need to develop reliable and effective automatic methods for automatic potential microcalcifications detection. Methods should remove background tissue to enhance the visibility and detectability of potential microcalcifications and segment the image using an optimal threshold.

3.1.4 Classification of potential microcalcification

To reduce the false positive detections in CAD system it would take the advantage of pre-classifier at the microcalcification level to decide whether the found objects are necessary for clusterization. Several features are needed in order to classify potential microcalcification. A method is used for feature reduction that deals with the “dimensionality curse”. The dimensionality reduction is performed by discarding the irrelevant features. Processing of mammograms generate a data set with an unbalanced distribution of cases between the microcalcification class and the non-microcalcification class, with the non-microcalcification cases outnumbering the microcalcification ones by a margin of more than 4:1. Aimed to improve the classification performance, a strategy needs to be used to deal with imbalanced data sets.

3.1.5 Detection and classification of microcalcification clusters

There is a need of methods for automated classification of clustered microcalcifications. The classifier is aimed to assist the radiologists in making more
accurate diagnoses of breast cancer. It should differentiate malignant from benign clustered microcalcifications.

3.2 Proposed Methodology

After careful study in this area, the following scheme shown in the figure 3.1 is proposed and designed. This proposed methodology improves in the detection and classification of clustered microcalcification.

Figure 3.1 Proposed methodology

After careful study and research in these areas techniques are designed to improve the performance of the CAD system. These techniques focus on the improvement in all the phases over the existing model by many added features.
Extensive research on the preprocessing and segmentation is carried out. According to these studies, there could be a high failure rate in the proper segmentation of breast area as many methods do not preserve the skin and nipple. A new technique is explored for breast region segmentation using morphological and filtering techniques. The technique is able to preserve the skin and nipple. As a part of pectoral muscle segmentation the region of interest containing pectoral muscle is located and processing area is later refined or reduced using proposed technique so that the processing time for pectoral muscle segmentation is reduced. This aspect is discussed in detail in Chapter 4 Technique for Breast Contour Extraction and Pectoral Muscle Segmentation.

Several features are needed in order to classify potential microcalcification. The dimensionality reduction is performed by discarding the irrelevant features. It is realized through literature survey that the problem of MC detection should not be simply treated as looking for “blobs” in an inhomogeneous image background. More accurate classification of potential microcalcification is possible by improving the performance of classifier in the classification of imbalanced data set. Effective methods have been used that deal with class imbalance for the classification of potential microcalcification. The issues when dealing with imbalanced data set for classification are well addressed by these techniques. The results of potential microcalcification classification are evaluated and compared in terms of performance using the widely accepted measures. These aspects are discussed in detail in Chapter 5 Classifier for the Classification of Potential Microcalcification.

Several features are needed in order to classify the microcalcification clusters. The dimensionality reduction is performed by discarding the irrelevant features. Effective techniques have been proposed that deal with class imbalance for classification of microcalcification clusters. The issues when dealing with imbalanced data set for classification are well addressed by these techniques. The results of microcalcification cluster classification are evaluated and compared in terms of performance using the widely accepted measures. These aspects are discussed in Chapter 6 Detection and Classification of Microcalcification Clusters.
In summary after careful study in this area a methodology is proposed which incorporates a new approach for segmentation of breast contour and pectoral muscle. New technique for potential microcalcification detection and new approaches for the potential microcalcification and microcalcification cluster classification are also proposed.