The main objective of this research is to segment the breast boundary and to detect breast tissue region with an improved accuracy and develop a fully automated system to analyze mammogram images and to detect masses that may indicate the presence of cancers.

It is important to confine the breast tissue region from the background to improve the efficiency of the mass detection algorithm. Hence it was proposed to improve a manual breast skin line estimation system into a fully automated breast boundary segmentation system. As the first step of this task preprocessing of the mammogram images was performed to improve the image quality by removing external artifacts such as patient identification tags, artifacts introduced due to image acquisition system and to improve the uniformity of gray-levels at different regions of the mammogram. Mainly, morphological methods were used for the above preprocessing. Then an automatic seed region selection and automatic selection of end point were introduced to start and end the region growing algorithm respectively. In seed region selection specific thresholding value and morphological operators were used. Peak points of intensity gradient profile were used to determine the breast orientation and to select the end point.

Once the region of interest was extracted from the background next task was to detect masses from the breast tissue region. Radiographically masses are described over its shape, margin and density. Adaptive threshold and entropy based methods were used to detect regions which can include a mass. These regions were named as blobs. Statistical features which interpret the shape and texture of each segmented blob were calculated in feature extraction step. Out of 15 features related to blobs, 5 features were selected for classification of masses by using factor analysis. Finally, the feed-forward back propagation artificial neural network was modeled to classify true masses from other blobs. The proposed system in this dissertation validated using mammogram images in MIAS mammographic image database. Finally, a Graphical User Interface (GUI) was developed to provide a user friendly environment.

To evaluate automatic breast boundary segmentation; 136 images taken from mini-MIAS database were used for the experiment. This database consisted all types of mammograms. According to the evaluation of breast tissue segmentation results, mean completeness was 99.2% and correctness of the extracted region was 99%. Average quality measure of proposed algorithm is 98.21%. When evaluating the automated mass detection system; 101 extracted blobs were used in neural network which includes 16 true mass blobs. 80 blobs were used in training with 12 true masses and 21 blobs were used in testing which includes 4 true masses. All the true masses were detected by the system and one false positive was marked. The results showed an accuracy of 95.24%. The trained model returns the results within an average time of 15-25 seconds. The system was tested on 300 normal mammograms and false positive rate was 0.54 false positive per image. Compared to the previous studies the proposed method performs better in both sensitivity and specificity measures.