ABSTRACT

Breast cancer is the most frequently diagnosed cancer among women, and accounts for about 360,000 deaths annually worldwide. Early detection and diagnosis of breast cancer is the key in reducing breast cancer related mortality in women. The common radiological imaging modalities used to detect breast cancer is X-ray mammography, Ultrasound (US), and Magnetic Resonance Imaging (MRI). Multimodal imaging techniques provide more accurate analysis. Ultrasound Elastography (UE) is believed to produce the best results in detecting cancer and reducing unnecessary biopsy. Manual delineation is time consuming and idiosyncratic. Therefore delineation of tissue formation contours and discernment of contour variations by the radiologist is prone to error and may give rise to potentially avoidable delineation faults. Computer-aided detection programs recognizing patterns in breast images associated with cancer may help radiologists improve diagnostic accuracy rates. Efforts have been made to find efficient methods for unsupervised/automatic breast image segmentation. Textural and edge features have been found relevant to identifying benign and malignant tumors. Several breast image segmentation methods available, but none automatically segments gray scale UE breast images. This research has developed few automatic segmentation techniques for operator independent identification of lesions in UE images. Literature shows research has been focused on unsupervised breast lesion identification using ultrasound, mammography employing only a single feature or a combination of multiple features that reported encouraging results. The goal of this research is to explore the area of gray scale UE image segmentation and to improve unsupervised tumor contour delineation by evolving a novel UE breast image segmentation technique. This scheme is a five phase method comprising of image enhancement, feature extraction, feature selection, K-means clustering and post processing. In the multi-feature analysis reported here, the study develops two methods for automatic segmentation of breast lesions using parametric edge and texture
features, using gray level information and multi-dimensional discrete wavelet transform. Multiple features are extracted using the statistical methods GLCM (Gray Level Co-Occurrence Matrix), LBP (Local Binary Pattern) and Edge operators. This is achieved by using statistical moments and comparative position of neighboring pixels in an image, as well as functions that counter monotonic brightness variations with computational simplicity. The sub-set of first five ranked features showed better results and could differentiate malignant and benign tissues, with higher superiority over other sub-sets of features for overlap, combination metrics, accuracy, sensitivity and specificity. The subset with first five features shows an accuracy of 79%. Then the wavelet analysis is done on these features. Daubechies Wavelet which is considered for most of the medical applications is applied on the sonoelastographic breast images. The experiments are conducted on the Daubechies Family Db1 to Db6. All in all, the edge features showed the best results in all the Daubechies coefficients (Db1 to Db6) used with accuracy ranging from 78% to 86%. This shows that the edge features in the cH sub-band is useful for segmentation of UE breast images. The Db1 wavelet at the first level decomposition for the subset of edge features gave a better result than the other families showing an accuracy of 81% to 86% in all the sub-bands, with the cH sub-band reaching an accuracy of 86%. Additionally, this method performed better than the multi-feature analysis. A novel method MM-LBP (Modified Mean- Local Binary Pattern) was proposed aimed in improving the segmentation accuracy which was an improved version of the basic LBP (Ojala T et al. 1996). MM-LBP when compared with the LBP and its modification (Ojala T et al. 2002) was found to perform even better than these and the multi-features analysis. MM-LBP has a segmentation accuracy of 85%. MM-LBP was approximately similar to the results of the segmentation based on the wavelet analysis. Theschemes are still in the early developmental stage and has prospect for future advancement because of its plainness, which will prompt better breast cancer diagnosis by
radiologists. It can also help in finding the type of benignity of the breast tumor by analyzing the features of the tumor detected.