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Breast cancer screening using computational approaches

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Breast cancer is a significant public health problem for women throughout the world. Women have better chance to survive if breast cancer can be detected early. The medical practitioners use different imaging sensors for detection of breast cancer like X-ray mammography, ultrasonography (USG), magnetic resonance imaging (MRI), Gamma Ray imaging etc. Among all these different imaging sensors, X-ray mammography has been considered to be one of the most reliable and conventional method for early detection of breast carcinomas. Mammograms are examined when evidences of direct/indirect signs of abnormalities like micro calcifications, skin thickening and masses are observed. However, it is difficult for radiologists to provide accurate and uniform interpretation for the enormous amount of mammograms generated in widespread screening. So they turn to computer assisted diagnosis for an alternative treatment planning. However, poor visibility of mammographic features is due to the minor difference in X-ray attenuation between normal glandular tissues and suspicious region. Thus the improvement of mammographic image contrast is essential for breast cancer screening. To deal with these problems, it is very important to enhance the contrast between the region of interest (ROI) and background, to segment and extract the features of suspected regions (SRs) effectively and hence to classify SR more accurately. Segmentation is designed to find suspicious regions containing masses/micro calcifications and separate the SRs from the background that will be used for extracting features of SRs. In the feature extraction, features of SRs are selected and hence will be classified into benign, malignant groups. It has been observed that micro calcifications appear as clusters of few pixels which corresponds to high frequency components in the image spectrum. These fine and granular spot of micro calcifications may not always be appeared in the segmented results. Using the multi-resolution capability, the wavelet transform could separate small objects (micro calcifications) from large objects (background structures). Finally, micro calcifications may be segmented using straightforward iterative, linear or local thresholding method. Recently hybrid fuzzy logic based segmentation algorithm has been developed to locate the suspicious regions in mammograms to resolve uncertainties inherent in the mammograms. The set of spatial features include: average gray level of the foreground, average gray-level of the background, standard deviation, skewness, uniformity, entropy of the gray-level of the region of interests and the contrast. A statistical method examining texture is the gray-level co-occurrence matrix. When the expert knowledge is not explicitly defined or cannot be represented in terms of statistically independent rules, ANF may provide a better solution than expert systems, and it can efficiently learn nonlinear mappings through examples contained in a training set, and conduct complex decision making. Finally, ANF can be effectively updated to learn new features. Experimental results show that the neural network classifier has better performance than the radiologists in term of the area under the receiver operating characteristics (ROC) curve. Although many previously proposed approaches have led to impressive results, several fundamental issues remain unresolved in the application of computer assisted systems. The major reasons are poor contrast of mammograms; problem to segment micro calcifications and localized masses appeared in the mammograms and the problem to resolve the impreciseness/vagueness of significant features. Nevertheless, designing better feature detection and feature selection still remain a challenge for such system. Therefore, there is still scope for improving the detection rate of masses/micro calcifications in computer assisted screening process of mammogram.

Biography

Mahua Bhattacharya is an Associate Professor since December 2006 of ABV Indian Institute of Information Technology and Management, an MHRD Institute of Govt. of India. She got her BTech and MTech degree from the Institute of Radio Physics and Electronics, University Of Calcutta. She worked as a Research Scientist at Indian Statistical Institute, Calcutta from 1995 till 2000 and got her PhD degree on Medical Image Processing in 2001. Her area of specialization is based on Image Processing, Pattern Recognition, Computer Vision, and Soft Computing. She has published more than 120 papers in international journals and conference proceedings and as book chapters. She is a selected member of Irish Pattern Recognition and Classification Society, 2006, UK and member of International Association of Pattern recognition (IAPR) and coordinating member of National Brain Research Centre (NBRC). She is invited speakers in different international and national forums and serves as Program Chairs, Session Chairs and Advisory Technical Committees of International Conferences. She is reviewers of IEEE, Elsevier, Springer and Wiley journals. She is also acting as Principal Investigator of various Govt. sponsored research projects.

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