A REALISTIC OVERVIEW OF MAMMOGRAPHIC TECHNIQUES

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ABSTRACT

Breast cancer is the second most common cancer in Indian women. This paper presents the survey of the mammographic techniques and the survey considers most of the algorithms that are already in use. The major factor that is to be considered while composing any of the intelligent algorithms is the learning time. Even expert radiologists sometimes fail to detect a significant proportion of mammographic abnormalities.

Keywords: Mammography, Microcalcification, ELM, SLFN, RBF, GLDM.

INTRODUCTION

Breast cancer is the most common cancer and continues to be a significant public health problem among women around the world. Breast cancer is the primary cause of death in women over 40 years old in the world. Its early detection can significantly increase the percentage of survival of the patients. It can be detected by analyzing microcalcifications, i.e., small objects located on the breast tissue. These can be viewed by a radiologist on digital Thermograms. Depending on the size and type of these elements, it is possible for a radiologist to diagnose whether or not a tumor is malignant without the need for a surgical procedure. Primary prevention seems impossible since the cause of this disease still remains unknown. It is believed that the most promising way to decrease the number of patient suffering from the disease is by early detection. The earlier breast cancer is detected, the better the chances that treatment will work and the better a proper treatment options can be provided. Image pre-processing techniques are necessary, in order to find the orientation of the mammogram, to remove the noise and to enhance the quality of the image. Before any image-processing algorithm can be applied on mammogram, preprocessing steps are very important in order to limit the search for abnormalities without undue influence from background of the mammogram. Digital mammograms are medical images that are difficult to be interpreted, thus a preparation phase is needed in order to improve the image quality and make the segmentation results more accurate. Breast cancer is one of the leading cancers in the female population. About 25% of all cancers diagnosed in women are breast cancers and about 20% of all lethal cancers are breast cancers. It is the leading cause of death due to cancer in women. Because the means to prevent breast cancer have not yet been found, early detection is important. Mammography is a low dose x-ray procedure for the visualization of internal structure of breast. Mammography has been proven to be the most reliable method and it is the key screening tool for the early detection of breast cancer. Mammography is highly accurate, but like most medical tests, it is not perfect. On average, mammography will detect about 80–90% of the breast cancers in women without symptoms. It works fairly well in the postmenopausal women and is inexpensive. In a screening mammogram, each breast is X-rayed in two different positions: from top to bottom and from side to side. When a mammogram image is viewed, breast tissue appears white and opaque and fatty tissue appears darker and translucent. A mammogram mainly contains two regions: the exposed breast region and the unexposed non-breast region. It is necessary to first identify the breast region for the reduction of the processing and then to remove the non-exposed breast region.

Early detection of carcinoma is taken into account as a serious public health issue. Carcinoma incidence is that the highest among feminine cancers and therefore the second reason behind mortality within the western countries. To handle this downside, it is necessary to form the adequate conditions permitting the installation of mass detection campaigns, i.e. involving the most range of ladies in danger. Diagnostic procedure relies on the distinction in absorption of X-rays between the assorted tissue elements of the breast like fat, growth tissue, and calcifications. Its high sensitivity and specificity, even little tumors and small calcifications will be detected on mammograms. The projection of the breast will be made of totally different angles. The 2 most typical
projections are medio-lateral oblique (side read taken at associate angle) and cranio-caudal (top to bottom view). The 2 most significant signs of carcinoma which will be seen on a X-ray photograph are focal plenty and small calcifications. Once a mass is present in an exceedingly breast, a medical specialist can estimate its malignancy by staring at the looks of the lesion and therefore the close tissue. the foremost necessary sign of malignancy is that the presence of spiculation i.e. spiky lines diverging altogether directions from a central region extending into close tissue. Benign plenty have sharp, circumscribed borders wherever malignant plenty have slightly jagged or spiculated borders.

Machine learning and artificial intelligence have apparently never been as essential and vital to real-life applications as they're in today’s autonomous, huge information era. The success of machine learning and computer science depends on the being of 3 necessary conditions: powerful computing environments, made and/or massive information, and economical learning techniques. The ELM as a rising learning technique provides economical unified solutions to generalized feed-forward net-workas as well as however not restricted to neural networks, radial basis operate (RBF) networks, and kernel learning. ELM indiscriminately chooses and fixes the weights between input neurons and hidden neurons supported some continuous likelihood density operate, so analytically determines the weights between hidden neurons and output neurons of the SLFN. Single Layer Feed forward Network (SLFN) could fix then connections on one level and only change the connections on the opposite level and there's no gain achieved by an algorithmic program ready to change weights on each levels at the same time.

**Literature Survey**

The most economical methodology to search out breast cancer is Thermography. However, the breast cancer is difficult for radiologists to predict micro-calciﬁcation bunch. They developed an automatic methodology for predicting early stage micro-calciﬁcation clusters in thermogram pictures. To classify the pictures into traditional, suspect and abnormal, the Genetic Algorithm’s best set of options are given as input to the adaptive Neuro Fuzzy Interference system. The real time pictures consist each traditional and abnormal pictures that is employed to assess this methodology. They had given a brand new application of ANFIS for classiﬁcation of the carcinoma. The given ANFIS model combined the neural network adaptive capabilities and also the formal logic qualitative approach. Some conclusions regarding the prominence of options on classiﬁcation of the carcinoma they obtained through analysis of the ANFIS. The classiﬁcation results and applied math Measures were used for evaluating the ANFIS whereas evaluating the system with the sample of 13 pictures, the typical time complexity is looks to be around 9 second. In over all the planned ANFIS model is often employed in classifying the carcinoma by taking into thought the misclassiﬁcation rates. The performance of the planned technique is analyzed in terms convergence time. Experimental results shows that the options used are clinically vital for the correct detection of breast tumor.

The key to enhance the carcinoma prognosis is by early detection. The vital sign for the carcinoma detection is that the presence of lesion like micro-calciﬁcation clusters (MCCs). The CAM systems are planned for MCCs detection and identiﬁcation of carcinoma prognosis. Basically, CAM consists of 2 vital sub systems, i.e. CAD and CADx. Since the scope of is predicated on mammography-based approach, solely CAD and CAD/CADx were mentioned. There are 3 main stages in CAM, particularly preprocessing, MCCs detection and MCCs classiﬁcation (diagnosis). For CAD, image process could be a technique chiefly enforced to interpret the mammographic pictures, whereas neural network is well-liked technique for classiﬁcation of MCCs cluster among researchers. Mytical monster and FROC analysis are commonplace methodologies for activity of performance of detection and identiﬁcation algorithms in CAM. Currently, several researchers measure their system’s performance mistreatment these analysis methodologies. Though there are several outstanding performances achieved by CAM systems, the challenges and future directions of analysis are still remaining.

Mammography is the effective technique for the screening of carcinoma and abnormalities detection. Screening is one in all the key factors to scale back the death rates. The robust correlation between abnormalities and carcinoma shows that radiologists may get proﬁt by the CAD (Computer aided Diagnosis) system with talents of automatic breast tissue classiﬁcation. They evaluated the effectiveness of dimension reduction and distribution transformation in raising the classiﬁcation accuracy. While the transformation, the distinction in performance of the SVM classiﬁer and also the Naive Bayesian classiﬁer was not statistically essential. Despite the foremost disadvantage of principal element analysis, i.e., it will eliminate a dimension that's smart for discriminating positive cases from negative cases; this unattended dimension reduction algorithmic rule improved the classiﬁcation accuracy of each classiﬁers. The performance of the 2 classiﬁers when applying PCA was terribly similar, with no applied math variations within the space underneath the mythical monster curve. The algorithm employed in Bayesian networks assumes that inside every state of the category the ascertained continuous options follow a standard distribution. For SVM classiﬁer, the chieﬂy transformation had no noticeable impact on the performance, whereas it's going to provide the most effective result by mistreatment six samples. The objective of preprocessing is to enhance the standard of the image and build it prepared for any process by removing the digressive noise and unwanted components within the background of the mammogram. There are totally different strategies in preprocessing an X-ray photograph image. The preprocessing is employed to scale back noise, edge- shadowing impact, accurately observe pectoralis, and suppress the pectoralis with success while not losing any data from the image. The resultant mammogram are often used in any of the automatic abnormalities detection of human breast like calciﬁcation, circumscribed plenty, speculated plenty and alternative unclear plenty, circumscribed lesions, spatial.
The detection of cancer signs in mammograms could be a troublesome task because of irregular pathological structures and noise that are present within the image. It’s been shown that in current carcinoma screenings 8%-20% of the tumors are incomprehensible by the radiologists. For this reason, lots of analysis is presently being done to develop systems for computer assisted detection to enhance the accuracy. Currently, several researchers measure their system’s performance mistreatment these analysis methodologies. The vast quantity or analysis associated with analysis of diagnostic technique, yet as widespread interest from the health profession stimulates the event of economic CAD systems. Though by these square measure several outstanding performances are achieved by mammogram CAD systems, the challenges and future directions of analysis are still remaining within the Field of CAD for mammogram mass & MCC detections.

They proposed an image segmentation technique primarily based on region cluster. The mammogram is divided into clusters on the idea of information density. In every region the likelihood density is calculated victimization Parzen estimator, and therefore the results of the image segmentation procedure is a picture containing all potential regions of interest. The regions of interest are then presented to the human skilled for additional analysis. They planned a completely unique approach for accomplishing mammographic feature analysis through multi-resolution representations. Selecting wavelets or analyzing functions that are simultaneously localized in each of the space and frequency, ends up in a strong methodology for image analysis. Multi-resolution and orientation property, known biological mechanisms in primate vision, are constituted in ripple representations and encourage the techniques bestowed. They presented a strategy for accomplishing feature improvement by multiscale ripple representations. They demonstrated however scale-space weight functions are often used to acquire local emphasis of features in mammography. Increased pictures were reconstructed by modifying 2 ripple representations like, transform coefficients and remodel edges computed from the modulus. Future directions for analysis include the introduction of multi-wavelet decompositions to enhance the visual image of mass carcinomas and therefore the application of true two-dimensional wavelets to extend orientation sensitivity for improved detection and improvement of mammographic options.

Mass segmentation plays a crucial step for the cancer detection. Notable researches were done and still moving towards the effective detection of plenty in mammograms. In most of the segmentation techniques, the region of interest is chosen manually. To thrash this, a brand new computer power-assisted absolutely automatic mass segmentation theme has been planned. The planned technique includes automatic seed choice by extracting the statistical options and therefore the region growing technique was used. The distinction within the mean of the manual markup by a knowledgeable and therefore the planned segmentation obtained was 0.356. The results of the segmentation area unit compared with the segmentation done by a knowledgeable. From the result it's inferred that the planned technique holds sensible for mass segmentation. In future, additional range of samples is often incorporated and classification is often administered by anyone of the classifier to classify the character of the mass.

An improvement of early diagnostic techniques is crucial for women’s quality of life. Mammography is that the main check used for screening and early identification. Early detection performed on X-ray diagnostic procedure is that the key to enhance carcinoma prognosis. So as to extend radiologist’s diagnostic performance, many computer-aided identification (CAD) schemes are developed to enhance the detection of primary signatures of this disease: masses and small calcifications. Abundance are space-occupying lesions, delineate by their shapes, margins, and denseness properties. A benign tumor is smoothly marginated, whereas a malignancy is characterized by a bedimmed border that becomes additional speculated with time. Attributable to the slight variations in X-ray attenuation between plenty and benign organ tissue, they seem with low distinction and sometimes terribly blurred. Small calcifications are small deposits of Ca that seem as little bright spots within the X-ray picture. They bestowed a search on diagnostic technique pictures victimisation Morphological operators and fuzzy c – suggests that cluster for cancer growth mass segmentation. The primary step of the cancer signs detection ought to be a segmentation procedure able to distinguish plenty and small calcifications from background tissue victimisation Morphological operators and eventually fuzzy c - suggests that cluster (FCM) algorithmic rule has been enforced for intensity primarily based segmentation. The results indicate that this method will facilitate the doctor to discover carcinoma within the early stage of identification method.

They planned AN algorithmic rule that uses chance of mammographic image as input for vector quantization. For region forming Kekre’s Proportionate Error (KPE) algorithm is used and codebook of size 128 was fashioned. Additional these 128 clusters were used for region merging victimisation KPE algorithmic rule for re-clustering. To separate growth, post process is completed by morphological operations. For this growth sectional space is calculated and center purpose is compared with LBG algorithmic rule for segmentation of mammographic pictures. The results shows that center purpose by planned algorithmic rule is nearer to the middle purpose (338,314) that is mentioned within the mini-mias info for the particular image .For this growth sectional space is calculated and center purpose is compared with LBG algorithmic rule for segmentation or below segmentation.

They bestowed a brand new technique for registering pictures in presence of abnormalities. By abnormalities, they mean variations of image intensity that are because of pathologies and can't be corrected by registration. Their approach consists of characterizing them as outliers. This characterization is obtained during a bayesian framework, by shaping registration constraints as mixtures of distributions that describe statistically image gray-level variations on each inlier and
outlier pixels. They use artificial pictures and mammograms for instance the properties of the strategy and to check it with some classical ones. With some experiments, they need incontestable that it improves the X-ray picture registration within the presence of lesions. Because of an outlier map, the new technique permits U.S.A. to require under consideration abstraction and gray-level data regarding lesions which can be present in pictures. Within the future, they specialize in a way to style outlier maps for the various styles of lesions, by adapting strategies designed for the detection and improvement of lesion in single image. Moreover, they're going to adapt the model presented here to mix the estimation of the lesion map and of the deformation at identical time. Digital image processing is the commonest technique for early carcinoma detection. Machine-driven analysis of those pictures is incredibly necessary, since manual analysis of those pictures is slow, expensive and inconsistent. The target of their paper is to discover the diagnostic technique image for its malignancy. Totally different strategies are often accustomed discover the malignancy. Their paper represents GLDM feature extraction technique and SVM classifier consistent with the provided examination, will say that GLDM technique are often used for mass/tumor detection Experiments were conducted on MIAS data. The results show that combination of GLDM feature extractor with SVM classifier is found to allow acceptable results. Microcalcifications are tiny deposits of calcium in breast tissue. Dense nature of breast tissue and poor contrast of mammograms prohibit effectiveness in detecting microcalcifications. Thus, to detect and differentiate the microcalcifications from normal tissue, proposed system uses wavelet analysis. Clusters of microcalcifications in digital mammograms are important and early sign of breast cancer. They presented CAD system for detection of clusters of microcalcifications in digital mammogram. Proposed system also makes use of extreme learning machine which has better generalization performance at extremely fast learning speed. ELM also avoids problems like local minima, improper learning rate. In this proposed system, raw mammographic image taken from MIAS database and it is morphologically preprocessed to remove labels and noise. Then, windowing function is applied to extract sub images of 32×32. Selected wavelet based feature extraction of sub images are used for classification and for this system extreme learning machine is used as classifier and backbone of whole system. Combination of wavelet analysis and extreme learning machine proves proposed system best in its performance. Performance measure is done by ROC curve. In a Receiver Operator Characteristics (ROC) curve the sensitivity, which in this study is the share of malign tumors that is correctly classified, is plotted against 1-specificity, the share of benign tumors that is falsely classified, for different cut values. Often the ROC analysis is used to find an optimal cut value sometimes referred to as criterion, for use in decision-making. By changing the cut value of the system it is possible to achieve the optimal balance between sensitivity and specificity that is needed for a certain purpose. If the cost of not detecting a particular disease is very high to society, for example a highly contagious disease, one could change the cut value to achieve a very high sensitivity, but consequently lower specificity.

CONCLUSION

Nowadays, breast cancer is the most frequent and prevalent cancer among women and it is leading cause of mortality in women each year. Mammography remains most effective diagnostic technique for early detection. In our future system, we are going to select Extreme Learning Machine as classifier. For selecting ELM as a classifier, ROC graph is used. Receiver Operating Characteristics (ROC) is a technique for visualizing, organizing, selecting classifier based on performance. It depicts relative tradeoffs between true positive rate and false positive rate. One point in the ROC is better than the other if it is to the northwest of the first. ELM comes under the class of SLFN (Single Layer Feed Forward Network) whose learning speed is thousand times faster than conventional feed forward network.

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