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# Application of Image Processing in Health Care: Survey and Discussions

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**Abstract:** *Breast cancer is the commonest explanation for cancer death in women. Consistent with the latest statistics, it's estimated that 40,610 women within the India have died in 2019 due Breast Cancer. As of March 2019, there are quite 3.1 million women with a history of carcinoma within the India. Mammography is one among the foremost widely used methods for carcinoma screening and has contributed significantly to the reduction of the death rate through early detection of cancer. Computer-aided detection (CAD), which employs image processing techniques and pattern recognition theory, has been introduced to supply an objective view to radiologist. In this paper, present review of image processing in health care sector and cover the breast cancer diseases diagnosis.*

**Keywords:** Health care, disease diagnosis, Breast cancer, Neural network, Classification.

## Introduction

Breast cancer is one of the major causes of death in women around the world. According to the American cancer society, 41,760 women and more than 500 men died from breast cancer recently. Breast cancer occurs in four main types: normal, benign, in-situ carcinoma and invasive carcinoma. A benign tumor involves a minor change in the breast structure. It is not harmful and does not classify as a harmful cancer. In cases of in-situ carcinoma, the cancer is only in the mammary duct lobule system and does not affect other organs. This type is not dangerous and can be treated if diagnosed early. Invasive carcinoma is considered to be the most dangerous type of breast cancer, as it can spread to all other organs. According to the authors in [7], breast cancer can be detected using several methods including X-ray mammography, ultrasound (US), Computed Tomography (CT), Portion Emission Tomography (PET), Magnetic Resonance Imaging (MRI) and breast temperature measurement. Usually, the golden standard is a pathological diagnosis for detecting breast cancer. This involves an image analysis of the removed tissue, which is stained in the lab to increase visibility. Hematoxylin and Eosin (H&E) are commonly used for the staining process. Breast cancer can be diagnosed using one of two approaches: histopathological image analysis or genomics. Histopathological images are microscopic images of breast tissue that are extremely useful in early treatment of the cancer.

Automatic disease diagnosis in healthcare filed is a very important and growing area of research for developing countries. This area involves lot of image processing steps and machine learning techniques associated with to achieve the fully automated and efficient model to diagnose the disease. Patient's image data is taken and put with their disease name with approval of medical researchers. In this ways lot of disease data associated with numbers of images

available for research. Image processing and machine learning techniques work to improve the quality and identifying the possible match with new patient's medical image with existing dataset, and attempts to find best possible image associated with disease.

Breast cancer is a major public health concern around the world, where its prevalence rate is the second-highest rate for women (excluding lung cancer) among all forms of cancer. The study of histopathological images remains the most commonly used tool for diagnosing and grading breast cancer, even with the substantial advances in medical science [8]. Early diagnosis can dramatically improve the effectiveness of therapy. The symptoms and signs of breast cancer are numerous, and the diagnosis encompasses physical analysis, mammography, and confirmed by core needle biopsy tissue (CNB) from the suspicious breast area. The sample tissue extracted from the CNB process demonstrates the cancerous cells and the grade of cancer associated with them.

## II. Literature Review

BC (Breast Cancer) is the most common type of cancer found in women, which are categorized based on the nature of affected cells. The three significant parts of the breast are connective tissue, ducts and lobules. Most of the BC found in either ducts or lobules and common type of BC are Invasive Lobular Carcinoma and IDC. According to WHO (World Health Organization), there are 1.38 million BC cases reporting every year. Among them, 458,000 death cases are registered. In India, every four minutes one woman was diagnosed with BC. There are various factors affecting the treatment and diagnosis of BC. [1] This paper makes several technical contributions towards the goal of developing neural networks to support radiologists in interpreting breast cancer screening exams. (i) They introduce a novel two-stage neural network for incorporating global and local information with an appropriate training procedure. This allowed us to use a very high-capacity patch-level network to learn from pixel-level labels alongside a network learning from macroscopic breast-level labels. With this strategy, our model not only achieves a human-competitive performance but also produces interpretable heat maps indicating locations of suspicious findings. Additionally, we show the utility of pixel-level labels even in a regime where we have a lot of image-level labels. (ii) They demonstrate the feasibility of training and evaluating the network with over 1,000,000 high resolution mammographic images–an extremely large data set in medical imaging, not just for breast cancer screening. This has a significant value in both informing future research design priorities as well as showing a proof-of-concept and proof-of value of this approach.

[2] Breast cancer is the second leading cause of death among a large number of women worldwide. It may be challenging for radiologists to diagnose and treat breast cancer. Consequently, primary care improves disease prevention and death. Early detection increases treatment options and saves life, which is the major target of this research. This research indicates the versatility of the methodology by integrating contemporary segmentation approaches with machine learning methods, which are developing areas of research. In the pre-processing process, an adaptive median filter is utilized for noise removal, enhancement of image quality, conservation of edges, and smoothing. This research makes a significant contribution by proposing a new parameter for evaluating K-means and a Gaussian mixture model (GMM) performance. A hybrid combination of segmentation and detection was applied to breast cancer. The proposed technique is significant for classifying benign and malignant tumors. The simulated results are discussed and evaluated to determine the competence of this method for the early diagnosis of breast cancer.

[3] To overcome the two class imbalance problem among breast cancer diagnosis, a hybrid method by combining principal component analysis (PCA) and boosted C5.0 decision tree algorithm with penalty

factor is proposed to address this issue. PCA is used to reduce the dimension of feature subset. The boosted C5.0 decision tree algorithm is utilized as an ensemble classifier for classification. Penalty factor is used to optimize the classification result. To demonstrate the efficiency of the proposed method, it is implemented on biased-representative breast cancer datasets from the University of California Irvine(UCI) machine learning repository. Given the experimental results and further analysis, our proposal is a promising method for breast cancer and can be used as an alternative method in class imbalance learning.

[4] Brain Cancer is one of the most threatening disease today. It caused due to the uncontrolled growth of unhealthy cells in the brain that could be either cancerous or non cancerous. In today's world a brain tumor are not only a life threatening disease but is also the prominent reason behind numerous deaths. Magnetic Resonance Imaging (MRI) is mostly used in brain tumor analysis. In this work, a new deep learning algorithm that is based on CNN with SVM is presented for efficient and automatic segmentation of brain tumor. The steps involved in the processing include preprocessing of the input image, extracting the important features, performing image classification, and finally segmenting the tumor in the brain.

[5] Breast Cancer (BC) is the common type of cancer found in women which is caused due to the abnormal growth of cells in the breast. An early BC detection helps to increase the survival rate of the patient and 80% BC type was Invasive Ductal Carcinoma (IDC) .In this work, a deep learning-based IDC prediction model is proposed with multiple classifiers and CNN (Convolutional Neural Network). The developed deep learning method used a sequential Keras model like conv2D, Maxpooling2D, Dropout, Flatten and Dense. The multiple classifiers are LR (Logistic Regression), RF (Random Forest), K-NN (K-Nearest Neighbors), SVM (Support Vector Machine), Linear SVC, GNB (Gaussian NB) and DT (Decision Tree). The CNN model generated by using SkLearn, Keras and Tensor flow libraries, and results are organized by MatPlot libraries.

[6] With the advancements in computer technology, there is a rapid development of intelligent systems to understand the complex relationships in data to make predictions and classifications. Artificail Intelligence based framework is rapidly revolutionizing the healthcare industry. These intelligent systems are built with machine learning and deep learning based robust models for early diagnosis of diseases and demonstrates a promising supplementary diagnostic method for frontline clinical doctors and surgeons. Machine Learning and Deep Learning based systems can streamline and simplify the steps involved in diagnosis of diseases from clinical and image-based data, thus providing significant clinician support and workflow optimization. They mimic human cognition and are even capable of diagnosing diseases that cannot be diagnosed with human intelligence. This paper focuses on the survey of machine learning and deep learning applications in across 16 medical specialties, namely Dental medicine, Haematology, Surgery, Cardiology, Pulmonology, Orthopedics, Radiology, Oncology, General medicine, Psychiatry, Endocrinology, Neurology, Dermatology, Hepatology, Nephrology, Ophthalmology, and Drug discovery.

[7] Cancer is one of the most dangerous diseases to humans, and yet no permanent cure has been developed for it. Breast cancer is one of the most common cancer types. According to the National Breast Cancer foundation, in 2020 alone, more than 276,000 new cases of invasive breast cancer and more than 48,000 non-invasive cases were diagnosed in the US. To put these figures in perspective, 64% of these cases are diagnosed early in the disease's cycle, giving patients a 99% chance of survival. Artificial intelligence and machine learning have been used effectively in detection and treatment of several dangerous diseases, helping in early diagnosis and treatment, and thus increasing the patient's chance of

survival. Deep learning has been designed to analyze the most important features affecting detection and treatment of serious diseases. For example, breast cancer can be detected using genes or histopathological imaging. Analysis at the genetic level is very expensive, so histopathological imaging is the most common approach used to detect breast cancer. In this research work, they systematically reviewed previous work done on detection and treatment of breast cancer using genetic sequencing or histopathological imaging with the help of deep learning and machine learning.

[8] Automated grading systems using deep convolution neural networks (DCNNs) have proven their capability and potential to distinguish between different breast cancer grades using digitized histopathological images. In digital breast pathology, it is vital to measure how confident a DCNN is in grading using a machine-confidence metric, especially with the presence of major computer vision challenging problems such as the high visual variability of the images. Such a quantitative metric can be employed not only to improve the robustness of automated systems, but also to assist medical professionals in identifying complex cases. In this paper, they propose Entropy-based Elastic Ensemble of DCNN models (3E-Net) for grading invasive breast carcinoma microscopy images which provides an initial stage of explainability (using an uncertainty-aware mechanism adopting entropy).

[9] Advances in technology have been able to affect all aspects of human life. For example, the use of technology in medicine has made significant contributions to human society. In this article, they focus on technology assistance for one of the most common and deadly diseases to exist, which is brain tumors. Every year, many people die due to brain tumors; based on “braintumor” website estimation in the U.S., about 700,000 people have primary brain tumors, and about 85,000 people are added to this estimation every year. To solve this problem, artificial intelligence has come to the aid of medicine and humans. Magnetic resonance imaging (MRI) is the most common method to diagnose brain tumors. Additionally, MRI is commonly used in medical imaging and image processing to diagnose dissimilarity in different parts of the body. In this study, they conducted a comprehensive review on the existing efforts for applying different types of deep learning methods on the MRI data and determined the existing challenges in the domain followed by potential future directions. One of the branches of deep learning that has been very successful in processing medical images is CNN.

[10] Early diagnosis is considered important for medical images of breast cancer, the rate of recovery and safety of affected women can be improved. It is also assisting doctors in their daily work by creating algorithms and software to analyze the medical images that can identify early signs of breast cancer. This review presents a comparison has been done in term of accuracy among many techniques used for detecting breast cancer in medical images. Furthermore, this work describes the imaging process, and analyze the advantages and disadvantages of the used techniques for mammography and ultrasound medical images. K-means clustering algorithm has been specifically used to analyze the medical image along with other techniques. The results of the K-means clustering algorithm are discussed and evaluated to show the capacity of this technique in the diagnosis of breast cancer and its reliability to identify a malignant from a benign tumor.

[11] Medical imaging plays a major role in disease diagnosis. It helps the physicians to look into the human body which is impossible otherwise. Computer Aided Diagnosis is gaining popularity in the detection of tumors from radiology images. Cancer is one of the most feared diseases as the survivors of the disease are very few. But when treated early one can actually increase the survival rate. In this research work MRI images of breast are used to identify and classify the tumors present in the

image as either benign or malignant. Convolutional Neural Network is a deep learning algorithm that is gaining lot of popularity in computer vision problems. They tend to produce promising and accurate results for image classifications as the one targeted here. As medical data are very sparse and difficult to obtain it is not possible to create a neural network and train from scratch as it requires huge amount of data. Transfer learning technique is used to handle this issue. Three pre trained models namely, VGG19, ResNet50 and Xception are employed here for the classification process and their results were studied individually. It proved that transfer learning improves the performance of the models as compared to the existing systems. And among the three pre-trained models VGG19 and ResNet50 came up with 98% accuracy and Xception showed a slightly lower value of 96% which also seem to be a pretty good performance when compared with existing systems that do not use transfer learning techniques.

### III. Artificial Neural Network

One other classifier used extensively in detecting cancer in mammograms is that the artificial neural network (ANN). This is classifier, imitating the biological neural network, such as the brain. The biological neural network consists of an incredible amount of connected neurons through a junction called synapses. Each neuron is connected to thousands of other neurons and receives signals from them. If the sum of these signals exceeds a particular threshold, a response is shipped through the axon. ANN imitates this setup. In an ANN, the neurons are called nodes and these nodes are connected to each other. The strength of the connections is represented by weights such the load between two nodes represents the strength of the connection between them. Figure 1shows the generic structure for ANN in mammography where the network receives the features at the input nodes and provides the predicted class at the output node. The inhabitation occurs when the load is -1 and therefore the excitation occurs when the load is 1. Within each node's design, a transfer function is introduced. The most used transfer functions are a unit step function, sigmoid function, Gaussian function, linear function, and a piecewise linear function. ANN usually has three layers of nodes: an input layer, a hidden layer, and an output layer. ANNs have certain traits that make them suit breast cancer detection and diagnosis using mammograms. They are capable of learning complicated patterns, they can handle missing data , and that they are accurate classifiers.

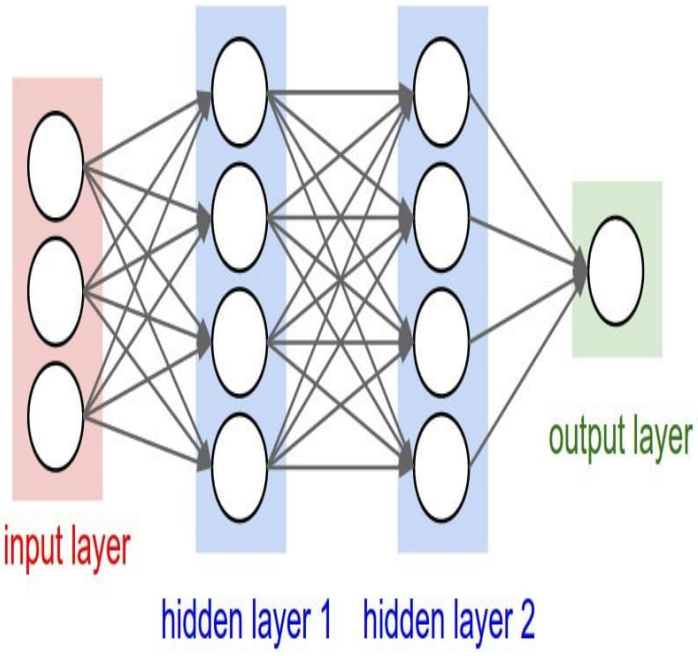


**Fig 1:** Artificial neural network model.

In carcinoma detection and diagnosis using mammograms, the nodes of the input layer usually represent the features extracted from the region of interest (ROI) and therefore the node within the output layer represents the category (either malignant or benign). The nodes of the input layer receive activation values as numeric information such the higher the knowledge, the greater the activation. The activation value is passed from node to node supported the weights and therefore the transfer function such each node sums the activation values

that it receives then modifies the sum supported its transfer function. +e activation opened up in the network from the input layer nodes to the output layer node through the hidden layer where the output node represents the leads to a meaningful way.

## IV. Conclusion

Now a day's use of image processing is an emerging tool contributing for betterment of healthcare sector. Image processing techniques provides a verity of reference, standard algorithms, and functions for image processing, image analysis, visualization, and algorithm development. Image analysis, image segmentation, image enhancement, noise reduction, geometric transformations, and image registration plays important role in disease diagnosis. Cancer is a term used for a group of disorders associated with abnormal cell growth. The abnormal cells have the potential to spread to other parts of the body (metastasis). Cancer can develop in any part of the body; the most common types are prostate, lung and bronchus, breast and colorectal. Cancer is staged according to its extent at the time of diagnosis. In this paper we review different technique in breast cancer diseases diagnosis, in future we plan to develop an efficient model to enhance the performance using neural network techniques.

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