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Performance Analysis of Breast Cancer Diagnosis using Supervised Machine Learning Classification Techniques

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Abstract: *Image processing is a process to process the digital image through some algorithm or function and provide some processed image for a target application. It is a very demanding area of research and application in daily life. Cancer detection and diagnosis is one of the most important areas of research in medical field. Neural networks have been used for medical sciences by many researchers, for different classes of cancer. The feed forward neural network is one of famous approaches in neural network. It is mostly used in many medical applications and the classification of dataset into respective categories such as for the education, marketing and network security. In this work we present the feed forward neural network classifier for the breast cancer detection and improved the accuracy and other parameters value than previous method.*

Keywords: *Neural networks, Cancer disease, World health organization, Classification techniques, Machine learning.*

1. INTRODUCTION

Image processing is a process to process the digital image through some algorithm or function and provide some processed image for a target application. It is a very demanding area of research and application in daily life. With the help of image processing problems like noise and distortions from the input image is also being removed during processing. The World Health Organization (WHO) has defined 2 distinct but related strategies to promote the early detection of cancer: early diagnosis, which is the recognition of symptomatic cancer at an early stage, and screening, which is the identification of asymptomatic disease in a target population of apparently healthy individuals. In low income and middle-income countries (LMICs), a large proportion of women with breast cancer present or ultimately are diagnosed with later stage (locally advanced or metastatic) disease [1]. In such settings, efforts to promote early diagnosis are a necessary prerequisite to population-based screening because early diagnosis will improve outcomes for all patients with breast cancer, whereas less than one-half of breast cancers are screen-diagnosed even in the most effective screening programs. 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 recently1. 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 [2], 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.

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. However, the complexity of mammograms (MGs) and therefore the high volume of exams per radiologist may result in false diagnosis. Computer-aided detection (CAD), which employs image processing techniques and pattern recognition theory, has been introduced to supply an objective view to radiologists. Studies have shown the effectiveness of CAD models; however, accurate detection of carcinoma has remained challenging. Recent studies show that CAD models cannot improve significantly the diagnostic accuracy of mammography [3]. The most important challenge in using CAD for abnormality detection in MGs is that the high false positive rates (FPR). False positives end in patient anxiety, additional radiation exposure, unnecessary biopsies, high callback rates, increased health care costs, and additional assessment. Within the India, many women undergo screening mammography annually, as a result, even a little reduction within the FPR end in a widespread benefit. The restrictions of current CAD indicate the necessity for brand spanking new, more precise detection methods. Recent advances in computational technologies, significant progress in machine learning and image processing techniques, and prevalence of digital MG images have opened an opportunity to affect the challenging issue of early detection of carcinoma using deep learning (DL) methods [7,14].

The rest of this paper is organized as follows in the first section we describe an introduction of disease detection and cancer disease overview. In section II we discuss disease diagnosis flow graph and image processing. In section III we discuss the proposed work and proposed work flow graph. In section IV we present the experimental result in cancer disease diagnosis detection, finally in section V we conclude the about our paper.

2. DISEASE DIAGNOSIS

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. Following possible steps may involve for disease diagnosis.

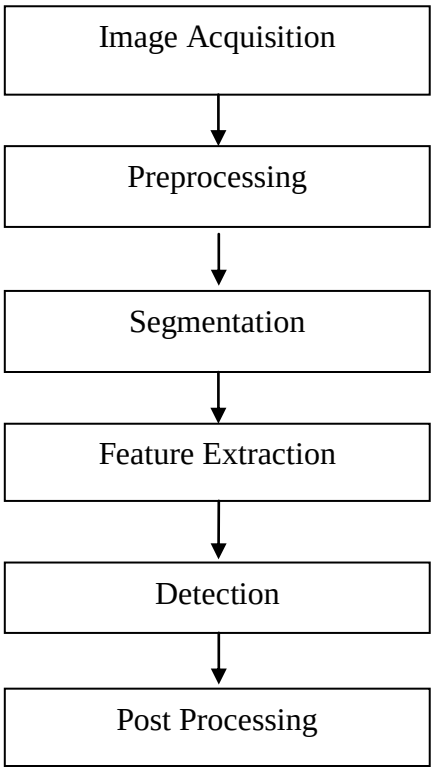

Figure 1: Flow diagram of disease diagnosis.

3. PROPOSED WORK

The ANN is the duplication of an animal's central point nervous organism deliberately designed to meet the assistance of machine learning for pattern recognition. The neural network is a three-layer demonstration as shown in below figure that diverts the input and progression it to generate output. Being user needy for its design ANN has no single depiction. In this mode, the neurons are trained to fire in an exacting manner. In case if input pattern does not bear a resemblance to the trained list of patterns, dismissal rules take the resolution of firing or holding the inputs. In an explicit circumstance, BPNN's output matches Bayesian Posterior Probabilities. Statistical of samples (m) is represented in an adequate way to order prospect samples in the methodology developed for W number of weights and N number of nodes.

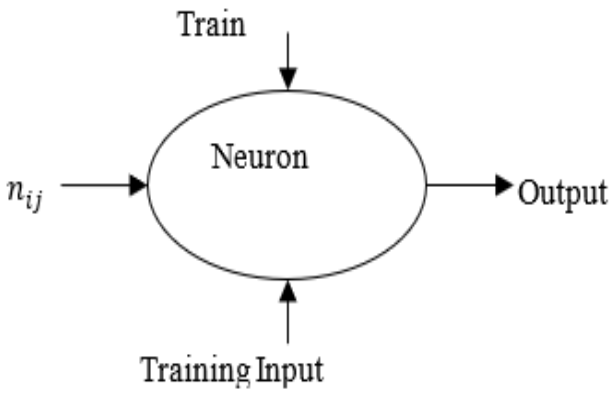

Figure 2: Representation of Single Neuron.

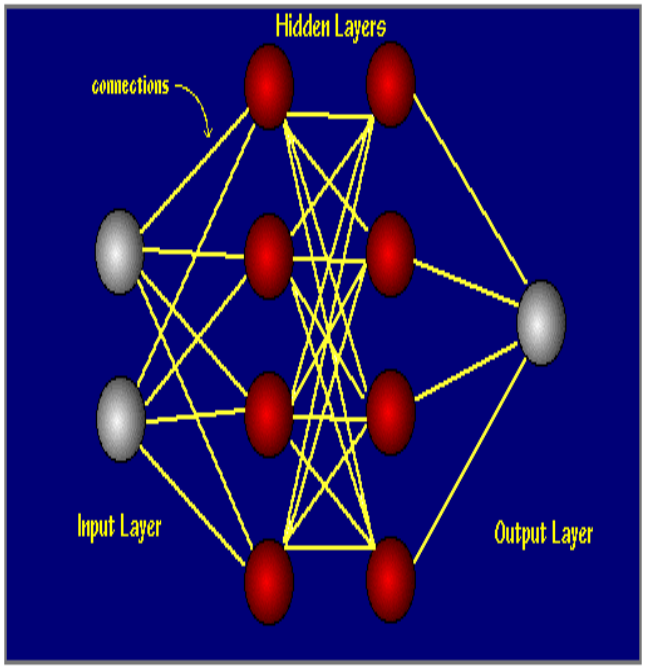

Figure 3: Neural Network with 2 Hidden Layers [12].

They are utilizing a feed-forward neural network, which processes signals in just one direction, from input to output. There are no feedback loops set up at any layer, and the output does not affect the same layer. This design is used in the majority of pattern recognition investigations. To create the adequate response of input signals, the teaching method of a neural network gathers data from an external source (supervised learning) [5,6]. Feed-forward neural networks are trained using Back Propagation Neural Networks (BPNN). In feature space, it produces complex classification boundaries. In some cases, the output of BPNN resembles Bayesian Posterior Probabilities. These requirements, as well as the choice of parameters such as training dataset, hidden layer nodes, and activation functions, are required to ensure low error performance for a specific collection of features.

Neural networks (NN) have been increasingly used to solve artificial intelligence problems. The diagnosis of breast cancer is an example where NN have been widely used. Neural networks are machine learning techniques that simulate the learning mechanism in biological organisms and are networks of interconnected artificial neurons. The main advantage of neural networks is that they are data-driven and do not require restrictive assumptions about the shape of the basic model. In addition to this advantage, NN allow detecting complex nonlinear relationships between independent and dependent variables and to identify all possible interactions between predictor variables, having the ability to store information on the network (memory capacity). In addition, NN can work with incomplete knowledge and in parallel processing. However, NN also have disadvantages, such as hardware dependency, the lack of determination of the appropriate network structure, more computational resources requirements and limited ability to identify possible casual relationships. In this research, the ANN is used to classify the breast cancer samples in the WBCD into either benign or malignant. ANN was used intensively in the diagnosis and classification of many medical conditions such as leukemia, prostate cancer, lung cancer, liver cancer and many others. There are various ANN architectures. However, one of the most widely used is the multilayer feed-forward neural network (FFNN) with a back-propagation learning algorithm.

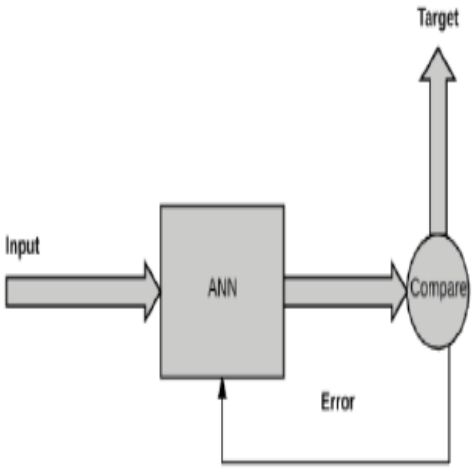

Figure 4: Working of artificial neural network.

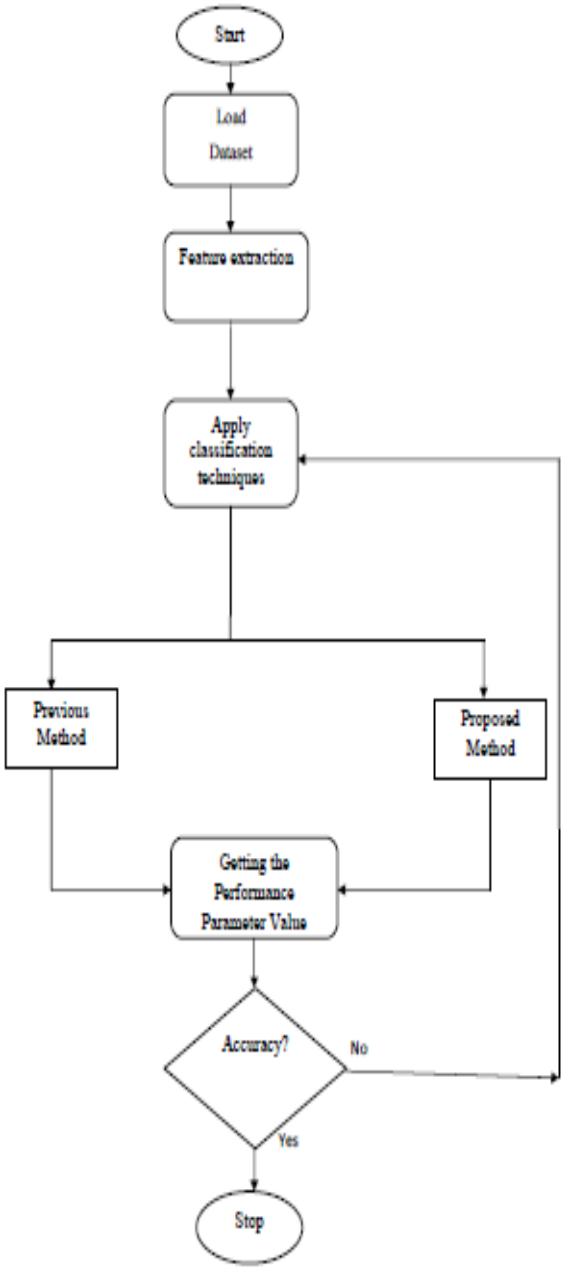

Figure 5: The above flow graph shows the proposed work simulation model.

4. EXPERIMENTAL RESULT

In this section, experimental process of we show that the comparative result analysis study for the detection of breast cancer using machine learning based model i.e. support vector machine and neural network techniques. Here for the evaluation of performance parameter we used matlab software for the authenticity and effectiveness of results; results are measured with performance parameters like accuracy using existing and proposed technique.

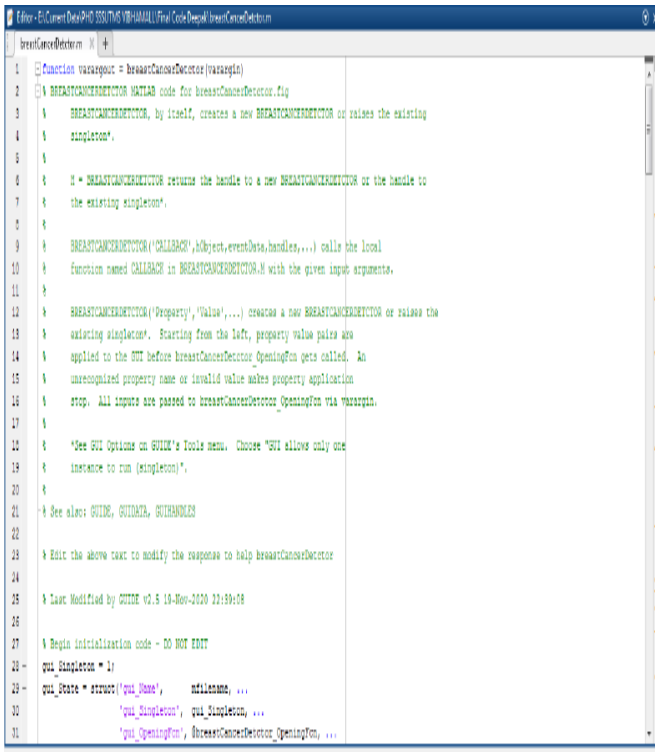

Figure 6: This picture represent code window for the experimental work.

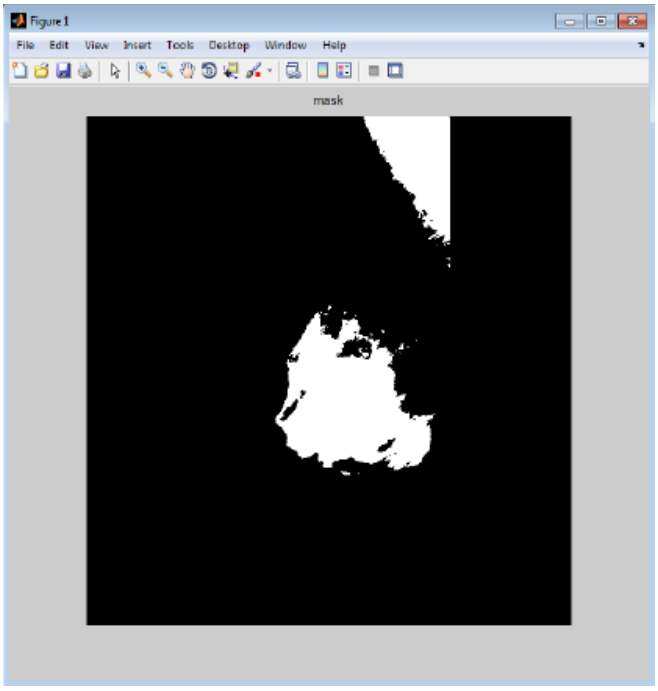

Figure 7: This picture represent mask image for the experimental work.

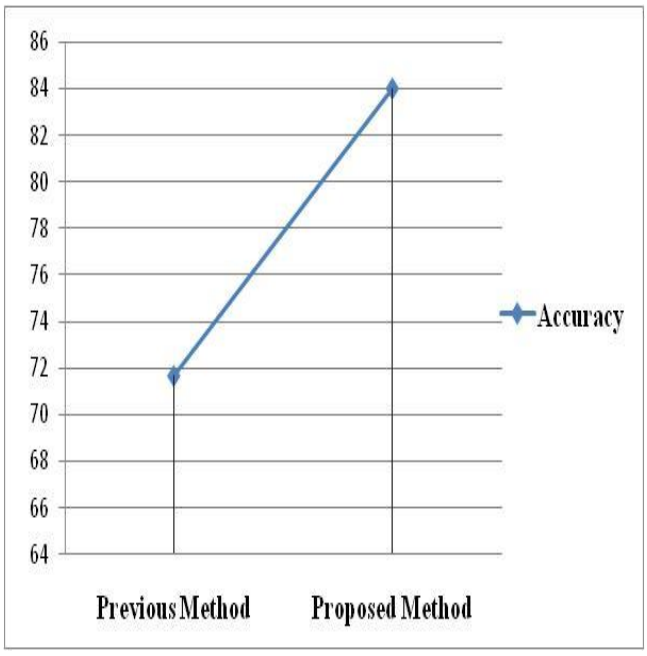

Figure 8: This picture represents accuracy for the breast cancer detection using the previous and proposed method.

5. CONCLUSION

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. Breast cancer is the second leading cause of death for women, so accurate early detection can help decrease breast cancer mortality rates. The aim of this research work is to develop a feed forward neural network based model that can classify breast cancer images in a normal and abnormal form, our proposed model shows that better accuracy i.e. 84 % and other performance parameters values than previous method.

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