BREAST CANCERS DETECTION USING DEEP LEARNING ALGORITHM

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ABSTRACT

Deep learning method is the process of detection of breast cancer, it consist of many hidden layers to produce most appropriate outputs. This paper shows how to detect breast cancers at a very early stage using this algorithm that mostly uses computer vision, image processing, medical diagnosis and neural language processing. As like supervised learning method, it maps the input data-mammogram scanned image to a certain trained data to produce a proper result that classifies the output as benign or malignant type of tumor present in breast else it is normal. A cluster of 400 women were recruited for this research with proper ethical approval and consents from the concerned authorities. The study has succeeded in achieving its overall aim. Along with the main objective, this research has also differentiated the type of tumor that has been diagnosed.

KEYWORDS

Breast cancer, Deep learning algorithm, Relu, Sigmoid function, Softmax

1. INTRODUCTION

Cancer is one of the leading causes for deaths among women globally and breast cancer is among the four leading cancers in women worldwide. The World Health Organization agencies for cancer research (i.e., International agency for cancer research (IARC) and American Cancer Society) has reported that every year 17.1 million new cancer cases were being recorded globally. And WHO estimates that cancer incidences might increase to 27.5 million by 2040, with an estimated deaths of 16.3 million expected as a result of cancer alone [14]. The IARC statistics have shown that breast cancer accounts for 25% of all cancer cases diagnosed in women worldwide. More than 53% of these cases come from developing countries like India. And these 53% of cases represents about 82% of the world population.

Breast cancer is the leading cause of cancer death among women in developing countries and the second leading cause for cancer death among women in developed countries. In India, more than 1,157,294 cases of cancer had been reported according to the most recent IARC report (2018). Among this, more than 162,468 i.e., 14% of the cases were diagnosed to be breast cancer, this records to be second most commonly occurring cancer in India [14].

The cancer cells may spread to lymph nodes in the breast or even cause damage to other parts of the body such as lungs. Breast cancer more often starts from the malfunctioning of milk-producing ducts also called invasive duct. It may also begin in glandular tissue called lobules or other cells, tissues within the breast. It has been found by the researchers that hormonal changes, environmental changes and even lifestyle changes can also contribute hugely for increasing the risk of breast cancer. Due to alteration in DNA function the mutation-change is occurred in DNA can affect the cell division and growth. Due to irregular function and massive growth of abnormal cell, it leads to cause tumor in breast and results in death [14].

Most number of deaths is due to diagnostic failure or delayed diagnosis of the condition. The number of deaths can be prevented if the diagnosis of the cancer is performed and identified before it attains the severe stage. In recent years, machine learning has become a vital part of medical image processing [2]. To control this we have to pre diagnose accurately in early stage without any false prediction, to rectify this we are using deep learning algorithm for accurate prediction of result. Scanning through digital mammogram, it’s a method that can be used to find depth, area, volume and severity of the tumor site present in the breast. Before diagnosing the digital mammogram, the data should undergo preprocessing methods for the flawless prediction. Mammography is a procedure to visualize the internal breast structure, a lose-dose x-ray of the breast will be performed. It is one among the best and suitable

technique to detect the cancer in the breast [5]. This procedure involves exposure of very lower dose of radiation compared to other devices used decades back. This technology is a proven method for the best way of earlier detection of breast cancer. Despite the benefits, this method is highly associated with a high risk of false positives as well as false negatives. To fill in this gap, deep leaning would be an alternative for screening earlier breast cancer cases.

The rapid advancement of machine learning and especially deep learning continues to be the best fuel for medical imaging community's interest in applying these methods to improve the accuracy of screening cancer. Deep learning algorithms usually run data through several layers of neural network algorithm, each of which passes a simplified representation of the data to the next layer. These deep learning algorithms learn progressively more about the image as it goes through each neutral network layer. Early layers learn to detect low-level features like edges and subsequent layers combine features from early layers into a more holistic representation [10]. Using this technique of layer by layer detailed representation of cancer cells, breast cancer can be easily detected at a very earlier stage, which turns out to be the ultimate aim of this current research mentioned in this paper.

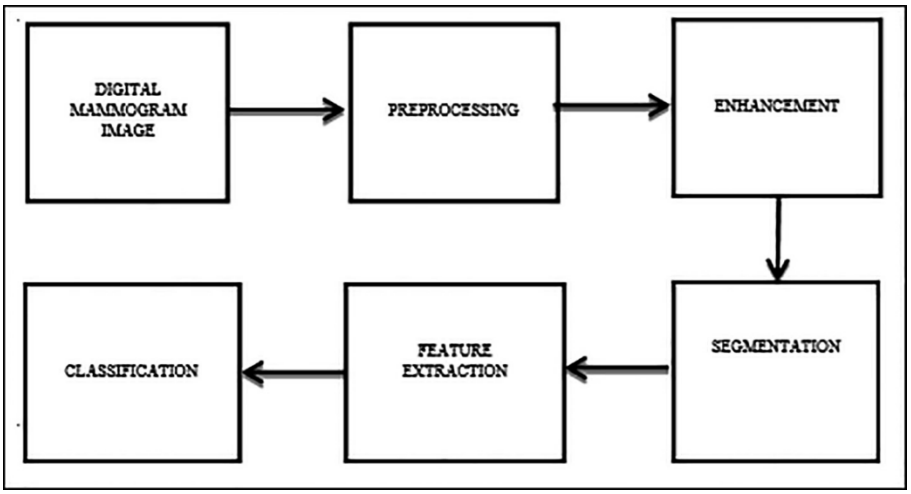


Figure 1: Block Diagram of Digital Image Processing

Figure 1 represents the digital image processing of mammogram data. It consists of preprocess is the stage that increases the quality of image by removing unwanted data with improve wanted features. Enhancement is the process used to improving key feature for analysis easier by removing the noise, brighten or sharpen the image. Segmentation is the process of dividing image parts by set of pixels used to locate the object present in the image in boundaries. Feature extraction is the main process of extracting needed features present in

the digital image [7]. Classification is the finial process of identifying the abnormality present in the digital mammogram image like classifying benign or malignant condition of tumor present in the breast.

1.1 ACTIVATION FUNCTION:

1.1.1 Relu-rectified linear unit function

a. It is used to map a particular input to the particular output, it play a major role in accuracy and result of the output in classification.
b. If the input is less than zero it maps the output at zero else if the input is greater than zero the value of output remains same [3].

1.1.2 Soft-Max function

c. If we pass certain input into this function it gives the probability distribution of each input.
d. It is used in classification where the probability of occurrence is maximum or useful to finding out most probability occurrence value.

1.1.3 Sigmoid function

e. It uses to map whatever the input only in between zero to one, if the input value goes beyond one also in maps the output value as in the limit of zero to one [4-6].
f. This way of classification is good because if the input value even goes beyond zero it may increase exponentially.

2. METHODOLOGY

In detecting the breast cancer, relu-rectified linear unit function in input layer and hidden layer is used here in this study; and also this study uses softmax function as activation function and mean square error function for predict loss. Deep learning neural network brings up a solution for diagnosis the breast cancer from anywhere in GUI by giving the input parameters. Detecting of breast cancer using deep learning neural networks using software packages python, Google colab, mat plot, panda, scikit and numpy [4].

2.1 Sample collection

We collected 400 training sets sample for deep learning purpose by comparison with training sample the machine can intelligently produces the output.

2.2 Preprocessing

It is the stage of removing artifacts, enhancing the image quality, segmentation is done to get edges and bounders of the carcinogenic cells by the way detecting important features [8-9].

2.3 Screening

Screening is the stage of classifying the sample data into benign or malignant based on the important features in comparison with training sets of data [1].

2.4 Identification

If carcinogenic cell present in the sample data for targeted treatment like removing and treating procedure we identify the x , y coordinates and radius of the cancer cells.

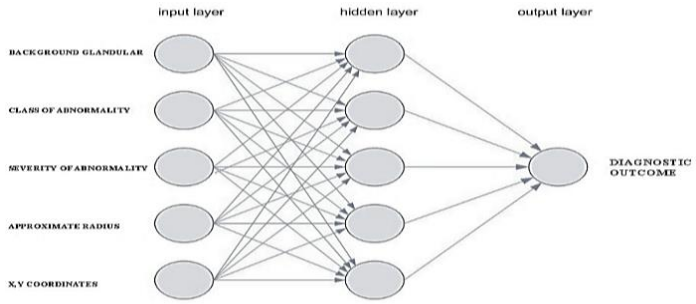


Figure 2: Deep Learning Network For Diagnosing Breast Cancer

Figure 2 represents the deep learning algorithm network it has 1 hidden layer 5 input layers, 5 nodes in hidden layer and 1 output layer. Parameters of 5 input layers background glandular, class of abnormality, severity of abnormality, approximate radius and x, y coordinates of tumor. Background glandular (fatty or dense glandular), class of abnormality [12-13] (CALC-Calcification, CIRC-Well-defined/circumscribed masses, SPIC-speculated masses, MISC-Other/ill-defined masses, ARCH-Architectural distortion, ASYM-Asymmetry and Normal), severity of abnormality (Benign or Malignant), approximate radius of abnormality (in pixels) circle enclosed to abnormality and x, y coordinated of center to abnormality [11]

Using softmax, relu and sigmoid activation function with deep learning algorithm we can classify the benign or malignant type of tumor present in breast.

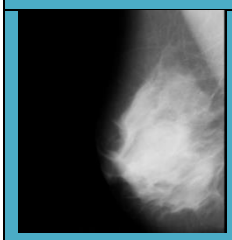
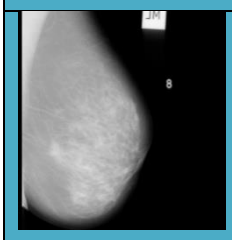
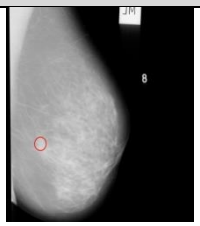
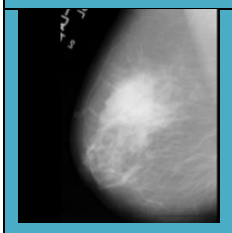
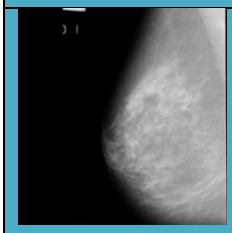
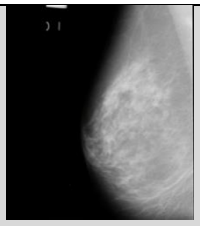
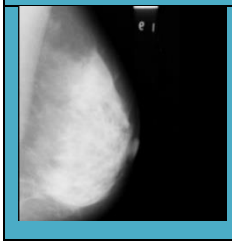
3. RESULTS AND DISCUSSION

The uniqueness of this research is that, this findings have not just identified the presence of cancer cells in the breasts, the algorithm has also have successfully identified the type of cancer present in the screened area i.e., the algorithm has detected whether the identified cancer cells are benign cells or malignant cells In deep learning algorithm the oncologist detect the breast cancer with high accuracy with parameters like approximate radius of abnormality (in pixels) circle enclosed to abnormality and x, y coordinated of center to

abnormality by adding more parameters in this deep learning algorithm the quality of accuracy prediction will be more.

This research has tried to reduce the false negative and false positive prediction due this if we test for 450 women's, 90 women due to false positive result going for further imaging, 11women going for biopsy, 2 women are unwantedly removing their breast and 1 women due to false negative facing cancer death by *http://www.canadiantaskforce.ca* using deep learning algorithm we can rectify the above problem with good accuracy.

In many of the previous researches, biopsy microscopically image-based screening on the anatomy of the carcinogenic cells were done. It is comparatively a very painful process

ORGINAL DATA	BACKGROUND GLANDULAR	CLASS	SEVERITY	DIAGNOSED TUMOR SITE	RADIUS	X,Y COORDINATE
	FATTY	CIRC	BENIGN		197	[535,425]
	DENSE	MISC	MALIGNANT		27	[318,359]
	FATTY	ASYM	BENIGN		131	[492,473]
	FATTY	NORM	NORMAL		-	-
	DENSE	NORM	NORMAL		-	-

because of pricking the breast cells for identification of the abnormal cells.

Table 1. Table of Identification of Tumor sites with Coordinates

In our algorithm, there are no such painful procedures to be undergone and also the results give a much better solution in predicting the breast cancer. The results were also found to have a very decent accuracy which was diagnosed by deep learning algorithm, Support Vector Machine (SVM) using Multilayer perceptron.

4.

CONCULSION

The results of the current research are well represented in table 1. The results show that the clear and accurate identification of the breast cancer through deep learning algorithm has been successfully achieved. These results can lead to a significant solution for screening and identifying the presence of cancer cells or any abnormality in the cells and tissues of breast, which will eventually widen the path for reducing the cancer deaths especially breast cancer deaths among women. This achievement is made with a very modification made to the existing algorithms, the accuracy achieved here in this research has been proven to be a best alternative for any false negative and false positive prediction. Adding a few more advancements as the technology takes us in the coming future; this algorithm can be further improvised to produce a much-advanced solution for identifying and destroying the detecting cancer cells in the detected area.

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