Detect the Breast Cancer by Using the Deep Learning with CNN

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Abstract:- Breast cancer is world second most occurring cancer an all type of cancer. Breast cancer is cancer that develop from breast tissue. Breast cancer may take in a lump in the breast, a change in breast shape, dimpling of the skin, and fluid coming from the nipple, a newly inverted nipple, or a red or scaly patch of skin. In those with distant spread of the disease, there may be bone pain, swollen lymph nodes, shortness of breath, or yellow skin. There is always require of improvement when it comes to medical imaging. Early detection of cancer followed by the proper treatment can reduce the risk of deaths. The deep learning is an important role for bio-medical imaging and gains the approaches for human beings. To analysis the differentiation of benign and malignant tumor by used the di-electric properties. Further investigate the result by apply the deep learning and convolutional neural network to the dataset of Finite Difference Time Domain(FDTD) is numerical simulation of the tumor model. We proposed the image reconstruction algorithm for localize the tumor and Adam rule for getting accuracy. The principal component analysis (PCA) is used for feature extraction and reduces the dimensionality of the tumor model. This network are performs the good

Keywords- deep learning, microwave imaging, image reconstruction algorithm, principal component analysis(PCA), tumor classification, Deep Neural Network(DNN) and convolutional neural network(CNN).

I. INTRODUCTION
Now days, the worldwide many more threatening diseases are affected by human beings, especially, cancer. The cancer may cause a large number of deaths in human beings. We are discussed about to analysis the breast cancer. The breast cancer is only affected by married women and it may cause among death. When we are identified the early stage, it will be curable disease. The breast cancer is differentiated Benign and malignant tumor. The benign tumor is early stage. The tumor is developed without pain after it will develop preliminary malignant and malignant tumor. In worldwide there are 20\% of women’s are dead affected by breast cancer and died every year.

X-ray mammography is present the most effectual imaging method for detecting clinically occur breast cancer. Still, even though significant progress in improving mammographic techniques for detecting and characterizing breast tissue, mammography report high false-negative rates and high false-positive rates. These difficulties are recognized to the fundamental contrast between benign and malignant tissues at X-ray frequencies. In X-ray tomography analysis the tissue is differentiated based on density. However in most cases, tissue density does not depend on tissue physiological position. Significant tissue individuality such as temperature, blood content, blood oxygenation cannot be differentiated by X-ray tomography. For soft tissues like human breast, X-ray cannot image the breast anomaly at an early stage, as there is no important distinction in density between normal and malignant breast tissues the disadvantage of these techniques is given an approximate screening and affected the side effect and possible diagnosis. The X-ray and mammography technique uncomfortable and paining screening and it reduce the patient convenient. It’s giving a high false positive and negative rate. It is arises the difficulties of intrinsic contrast between affected tissue and normal tissue at X-RAY.

The innovative techniques for developing a medical microwave images. The microwave images are an important dissimilarity of benign and malignant tumor. It is detected by the rooted in the healthy tissue. Microwaves can be used effectively and detection of biological anomaly like tumor, an early curable stage itself. At microwave frequencies the sensitivity, specificity and the ability to detect small tumor is the dielectric contrast between benign and malignant breast tissues. The backscattered signals are used to identify the tumor and benign and malignant tumor. There are locate the disperse using a many more antennas to focus the microwave images by using deep Learning. The Deep learning is a new evolution in the machine learning and its improved or given a high performance of a recent approach. In bio-medical, the deep learning is used to analysis the medical images in layer by layer for segmentation, classification and pattern recognition. It is easily identified the classification for cancer in computer topographic images and medical microwave images.

Deep learning has brought a revolution in the field of machine learning, viewing enhanced performance over the approach. The dataset of
finite difference time domain (FDTD) is the numerical simulation of the tumor model and the analysis the performance and classification result obtained with convolutional neural network. The image reconstruction algorithm is used for finding location and size of the tumor. The network was trained by using the Adam rule with linear constant rate. The Coarse shape classifier (CS) and Fine shape classifier (FS) are classifying the tumor like benign and malignant. The classification of both Deep Neural Network and Convolutional Neural network has shown the out coming performance of the approaches.

II. EXISTING METHOD

A. Computer Aided diagnosis (CAD) classifier:

Devinder Kumar et al [6] (2015), explain the Computer Aided Diagnosis (CAD) classifier is used for early detects the lung cancer classifying the benign and malignant tumor. The lung cancer data consortium (LIDC) dataset having the patient information and rating the module. It is performed to get the accuracy and consider the clinical treatment for biopsy. The feature extraction is used by an auto encoder. It is given an input to transformation (linear and non-linear) to encode the data. The output layer is extracting the data and decoding the transformation data. The binary tree decision is used for classifier were it is given an input and classify the malignant. The deep features as the input to the binary decision to perform the classification of the tumor and obtained the accuracy is 75.01%.

B. Region based edge acutance approach

Rangaraj M Rangayyan et al. [7] (1997), explain the region based approach is analyses the tumor boundary and transition of affected tissue in a region of interest (ROI) along with the normal tissue of region of interest (ROI). It is discriminate the benign and malignant tumor. The Mammography shape analysis society (MIAS) database are considered the circumscribed benign, circumscribed malignant and spiculated benign, spiculated malignant. The segmentation algorithm is used for getting the approximation boundary (i.e. polygonal approximation boundary) in tumor region by draw using the XPAINT. The pattern classification is measure the complement shape factor and classifies the four categories (circumscribed and spiculated). The jackknife method are applied the pattern classification to classify the tissue using the acquaintance and shape factor as various combination. Compactness is along with classified the circumscribed/speculated the rate is 92%.

C. Multiple instance learning (MIL) approach

Yan xu et al [8] (2014), explain the multiple instance learning approach for framework in classification training with deep learning features. The effectiveness and accuracy or accomplishing the high-level task with minimum of manual annotation representation of medical images. The Histopathology dataset is used and select the colon cancer. Each image is 1000 x 1000 pixels due to computing the power of single machine. All images are patches. Then feature learning is implemented the three method is fully supervised, unsupervised learning. The fully supervised learning is based on deep learning consider a set of linear filter encoder and decoder. The unsupervised learning framework is a method to conduct without the manual annotation. It learns intrinsic and feature from the real data the next one is feature extraction is to extract the features for each pixel. The patch level classification algorithm is used to predict the cancer or non-cancer and to outline of the cancer. Compared the feature representation of dataset colon cancer consisting the dataset. The performance of unsupervised learning is 91.52% and fully supervised learning is 87.28%.

D. Multiple Input Multiple Output (MIMO) Approach

Yifan Chen et al [9] (2010), explain the MIMO radar system to enhance the resonance of scattering phenomenon in breast tissue. This work are performed the classification of tumor like benign and malignant, the breast and lesion data model are used for the backscatter signal. In this data model contain ultra wideband waveforms and it is recorded the signals and detect the cancer with various co-ordinates. The detection algorithm are used to identified the considered to localize the hypothesis is benign and malignant tumor shape and its boundary. There are two fusion schemes are used selection combining (SC) and log-likelihood ratio (LLR) for discriminating between benign and malignant tumor. These scheme analysis the target shape classifier with 86.7% accuracy an over 60 target.

E. Mass detection approach

Dan C Ciresan et al [10] (2013), explain the Mass detection approach is used the x-ray with mammography technique. The Histopathology dataset are used for Screening of mammography is one the most effective method to detect the cancer. The segmentation algorithm are used to analysis the segmentation and make the pixels and easily study the mammography is less sensitive in women with radio-graphically with dense breast tissue. This approach for image processing such as average and thresholding functions is used. This approach may leads to the better performance. The
main drawback of this approach including the tolerance of compression. Variability of radiological interpretation and radiation dose. The breast compression is giving the uncomfortable feeling and may lead to lack of compilation with screening. Another disadvantage of this method is physical selection of threshold limitation and size of averaging filter.

III. PROPOSED METHOD

We proposed the deep learning for tumor classification and Analysis the benign or malignant tumor by using Deep Learning. There are the two different architects to used for detect the breast cancer is Deep and Convolutional Neural Network. Deep learning is the multi level help to make the sense of the data such as images, text and sound etc. the deep learning the another one aspect of the artificial intelligence. And it’s equipped the certain knowledge. The deep learning is the state of art in the trained the approaches of the performance of the human levels. It is allowed the computational architecture that are multiprocessing layer to learn the representing the data with multilevel of abstraction. We are evaluated the numerical approach for microwave signals of generated the 3D tumor model.

The architecture explains signals received from finite difference time domain (FDTD). Preprocessed is analysis the signal and feature extracted from the reduce the dimension. the deep learning for classification and the output is making the decision for classification.

A. Analysis the signal: preprocessing

The shape of the breast cancer and its properties by using medical microwave imaging system. The breast is composed the adipose and granular tissue is called cooplaner’s ligament. In every women’s are vary from persons for different categories like menstruation, pregnancy time and menopahase. The adipose tissue is present in below of the skin. The innermost tissue is containing of the breast’s mammary gland. It is contain the lot of thin tubes, it is connected the reservoir and it’s connected the nipple. There are two different approaches for detecting breast cancer in Microwave imaging: topographic and radar based Images. In microwave images we constructed the dielectric properties of non-linear in scattering problem. We fix the antenna in a breast. Each antenna has contained the minimum distance. The parameter has been set each antenna and also connected the transmission signal to every antenna for finding the affected tissue. The clinical antenna is hardware device are connected to the each antenna or either transmit receive and output signals to maximize the measurement of the data. This type of technique that is more applicable for clinical images. The flexible antenna is one of the ultra wideband is touch the breast are constraint to make designed. Constraints are foot print, high bandwidth, and light weight to place in it. The circuit is transmission line to impedance the frequency.

The image reconstruction algorithm for detect the breast cancer and analysis the different view of tumor. This algorithm is easily identified the size and localize the tumor.

Steps for image reconstruction algorithm
• Obtain the signals and received the antenna from the angular position.
• Removed the background and different signals from adjacent antenna.
• Extract the positive value from the target.
• Estimate the relative dielectric constant and thus the propagation constant in the image body to achieve transformation of the obtained signals from the time domain to the space-domain.
• Finally get the image in the form of signal intensity and identify the target by the large image intensity.

B. Feature Extraction

The feature extraction is done by the principle component analysis (PCA). In order to record the

Figure 1. Architecture of the proposed system for classification of tumor type

Figure 2: a) planer view b) cylindrical view

• Planer view, the patient is oriented on the suspine position loaded the bowtie antenna and scan over the surface of the flattened in the breast tissue.
• Cylindrical view, the patient is prone position with the naturally extending thought the hole on the position.
backscatter signals of each tumor for the classification and more efficiently this method is called principle component analysis (PCA). It reduces the dimensionality multivariate data. The principle component analysis (PCA) is reducing the variant and relative important to measure the each dimension. It will represent the data are considered the minimum number of component and create a problem with the least number of dimensional possible. The process is a linear value. The PCA has stores the original dataset has followed by the orthonormal method. It has decreased the variance and each dimension of the each picture and possible dimension. To obtain the principal components of a matrix $X$ represented by $(m \times n)$, where $m$ is the number of size and $n$ is the number of samples, the mean of the sample for each the measurement is subtracted and finally the basis vectors. Which are the eigen vectors of the covariance matrix $C = E\{X X^T\}$, are calculate. The centered data is represented, for each it size, by its Karhunen-Loève expansion is represents the full dimensionality of the problem

$$\bar{X} = X - E\{X\} = \sum_{m=1}^{N_m} \theta_m h_m.$$  

C. Deep and convolutional neural network (DNN & CNN)  

A deep neural network is a feed forward and successive pair of convolutional and maxpooling layer and followed by several fully connected layers. Raw pixel intensities of input image are passed through the several layers and hierarchal feature extractor. All weights are optimized through minimization of the classification error over the training set.

A convolutional neural network is a particular for processing data. It is known as grid like topology. The CNNs include a number of convolutional layers are succeeded by fully connected layers. There were more than a few layers and widths in both architectures. The CNN contains the several architectures. CNN contains the number of filters for getting a good dimensionality of the originality images. Filter is applied for every image as an input position and is passed to the layer and then output position we use the proposed data set for FDTD is the algebraic imitation for tumor model of affected tissue.

D. Classification of tumor  

Tumors are having the various characteristics and based on their types i.e. benign and malignant. The benign tumors are smooth surface an its spherical, oval and well- circumscribed. The malignant tumor is rough and complex surface with microlobules and its shape are irregular. The important role of development tumor at a particular period of times it indicating the malignancy.  

Gaussian random sphere(GRS) is modified the mathematical model for benign and malignant tumor and contain the different radius and the covariance function. The several of tumors are the different size is considered by spiculated and microlubulated, the benign tumors are modeled with macrolublated and smooth.

$$r(\theta, \phi) = \alpha e^{s(\theta, \phi)} - \frac{1}{2} \beta^2,$$

where $\theta$ and $\phi$ are the spherical coordinates, $\alpha$ is the mean radius, $s$ is the logradius and $\beta$ is its standard deviation.

The spiculated models were generating with different numbers of spicules: 3, 5 and 10. The four types are illustrated in Fig. 4 for two radii. In total ten variations were generated for each combination resulting in a set of 10 variations id one by 240 models.

![Figure 4: difference between benign(smooth) and malignant tumor(spiculated).](image)

IV. EXPERIMENTAL RESULT  

We set the antenna from the cancer affected area. The distance of antenna is 10 mm the antenna is identified the location of cancer tissue and adipose tissue. After getting the cancer region and apply the image reconstruction algorithm to getting the location to the tumor region secondly, we use the Adam rule for getting validation. The Adam was the default parameters is 0.001 learning rate. And exponential decay is estimates for 0.9 and 0.999. The concluding rate is creating to the 500 epoch training. Validation performance of evaluated the every epoch and training is stopped the after no
improvement were seen the 300 epoch. The deepness of the DNN architecture was different in the range 2 – 10. The amount of neurons per layer was various in the series 10 – 1000, the amount of convolutional layers different between 3 and 5, and the number of filters per layer from 10 to 100. Principal component analysis were extracted the backscatter signals and reduce the dimension. To reduce the dimensionality of their output, each convolutional layer was succeeding by a maxpooling layer with a step of 1 x1 pixels. The number of fully connected layers of the CNN was set in the range 3 – 9, with: 100 – 1000 neurons each. Examine the model parameter that performed the validate set. The original result is obtained from the sampling and training the dataset. Here coarse shape and Fine Shape classifier are used to find the tumor either as malignant or benign. The first classifier is coarse shape is split the tumor of two shape groups i.e. malignant or benign. In correspondingly, Fine shape (FS) is initially classifiers the shape categories as the coarse shape.

V. CONCLUSION

The optimizing of the hyper parameter is getting the performance and using the 10 fold cross validation in random division of the whole dataset. The parameter can be change the ranges and without keeping the data from the tumor model. The hyper parameter were changed the following the ranges. The time taken of the backscatter signal is extracted by using the principal component analysis (PCA) as various ranges; the fusion approaches are diagnosing the type of breast cancer (benign and malignant). This result to detect the cancer at early stage and it’s given the treatment with context the medical imaging. In particular we use Deep and Convolutional Neural Networks and achieve an accuracy of 92.33% which outperforms conventional machine learning earlier used on the analyses the dataset. In future work use cascade classifier to analysis the cancer.

REFERENCES