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# Breast Cancer Detection using Deep Learning Techniques

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***Abstract*— Breast cancer is the most common form of cancer among women and the second most common cancer in the world (an estimated 1152161 new cases per year), trailing only lung cancer .The current approach to this disease involves early detection and treatment. This approach in the United States yields an 85% 10-year survival rate. Survival is directly related to stage at diagnosis, as can be seen by a 98% 10- year survival rate for patients with stages 0 and I disease compared with a 65% 10-year survival rate for patients with stage III disease. To improve survival in this disease, more patients need to be identified at an early stage.Therefore, we evaluated existing and emerging technologies used for breast cancer screening and detection to identify areas for potential improvement. The main criteria for a good screening test are accuracy, high sensitivity, ease of use, acceptability to the population being screened (with regard to discomfort and time), and low cost. We can begins by describing commonly used breast cancer detection techniques and then delves into emerging modalities.**

***Several studies addressing breast cancer using Deep learning techniques. Many claim that their algorithms are faster, easier, or more accurate than others . This system is based on thermal image processing and Deep learning algorithms that aim to construct a system to accurately differentiate between benign and malignant breast tumors. The aim of this was to optimize the learning algorithm. In this system , we applied the deep neural network technique to select the best features and perfect parameter values of the deep machine learning. The present study proves that deep neural network can automatically find the best model by combining feature preprocessing methods and classification algorithms.***

***Keywords*— Deep learning,Breast Cancer,CNN,Mamography,Thermography**

## I. INTRODUCTION

Breast cancer Data is a major concern for women in india and early detection is the only thing needed for effective diagnosis and treatment.In 2016,about 246668 women were diagnosed with breast cancer which is considered as highest level of 29% among other kinds of cancer.that is why early setection with correct diagnosis is extremely important to increase the survival rate.Currently,thermograpgy is the most widely used imaging modality for detection and early diagnosis of breast tumors.Thermal imaging has shown good results to overcome the limitations of the mamaography and emerge as adjunt method for breast cancer screening due to its low cost,non-invasive and non-ionizing nature.To correctly detect and diagnose breast (i.e normal or abnormal),radiologist facechallenges due to the large amount of breast images they have to examine daily and the difficulty of reading each images i.e detecting the breast masses and diagnosing them.

Deep learning is acurrently developing field which explores areas of arifical intelligence and machine learning to learn features directly from the data ,using multiple non-linear processing layers.Deep Learning with CNN(Convolution Neural Network)has emerged as one of the most powerful tool in image classification and surpassing the accuracy of almost all traditional classification methods.

Covolution can simplify an image containing millions of pixels to a set pf small features maps,thereby reducing the dimension of input data while understanding the most important features of image. In this study,we aim to use DCNN to detect breast cancer from large number of thermography images .Thermal images are pre-processed and classified using deep neural network.

## II. AIM & OBJECTIVE

Imaging technique based on thermography was used to detect the early changes occurring in the breast tissue and cancer cells.The thermography is used based on higher metabolic activity and blood flow in the surrounding of the cancerous tissue than the normal tissue. Infrared thermography is a promising technology for breast cancer detection.It can be used as an imaging technique to improve the efficiency of detecting breast cancer and thus to complement the results of the mammogram.

We presented the techniques most commonly used to detect breast cancer, and their strengths and weaknesses.One technique in particular appeared to have a promising future, because of its non- immersive property and the significant amount of data that needs

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to be processed with more efficient techniques.Infrared imaging coupled with an agent previously administered to a patient can lead to a very accurate tumor detector.

## III. LITERATURE SURVEY

"Whole Mammogram Image Classification with Convolutional Neural Networks" by Nathan Jacobs, Jinze Liu and Erik Y. Han, 2017. This paper reports preliminary work on developing and optimizing machine learning models for whole image classification mammograms. They evaluated 7 different CNN architectures and conclude that combining both data augmentation and transfer learning method with a CNN is the most effective in improving classification performance.

"Mass Classification In Mammograms Using Neural Network " by Effa Adrina Azli, Salina Abdul Samad and Mohd Faisal Ibrahim, 2017. Different features affects performance of the classifier so it is important to extract the useful features that are able distinguish between benign and malignant classes. Besides that the architecture of neural network affects the overall performance of the classification. The architecture with 100 hidden nodes consistently improves the classifier performance by 10% compare to the architecture with only 3 hidden nodes regardless of the input feature fed into the classifier

"Whole Mammogram Image Classification with Convolutional Neural Networks" by Nathan Jacobs, Jinze Liu and Erik Y. Han, 2017. This paper reports preliminary work on developing and optimizing machine learning models for whole image classification mammograms. They evaluated 7 different CNN architectures and conclude that combining both data augmentation and transfer learning method with a CNN is the most effective in improving classification performance.

"Breast cancer detection using deep convolutional neural networks and support vector machines"

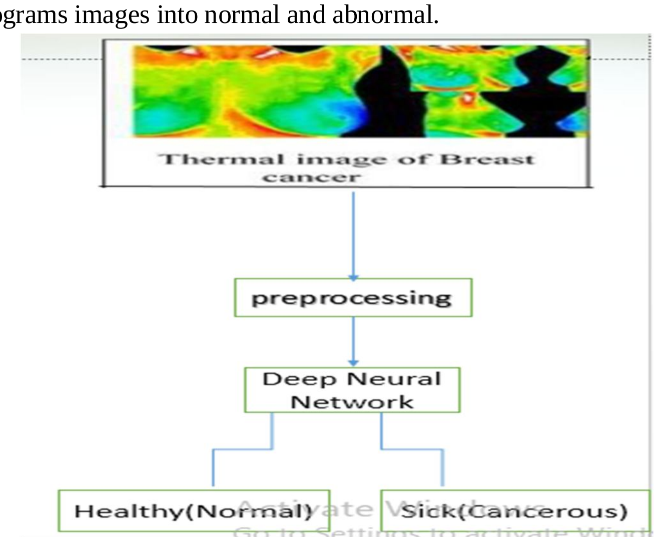
Here , data augmentation is a method for increasing the size of the input data by generating new data from the original input data. There are many forms for the data augmentation; the one used here is the rotation. The accuracy of the new-trained DCNN architecture is 71.01% when cropping the ROI manually from the mammogram. The highest area under the curve (AUC) achieved was 0.88 (88%) for the samples obtained from both segmentation techniques. Moreover, when using the samples obtained from the CBIS-DDSM, the accuracy of the DCNN is increased to 73.6%. Consequently, the SVM accuracy becomes 87.2% with an AUC equaling to 0.94 (94%).

"The role various modalities in breast imaging" by Sachin Prasad N and Dana Houserkova, 2007. Mammography is the only reliable screening test proven in breast imaging

"Identification of Preprocessing Technique for Enhancement of Mammogram Images" by Jaya Sherma, R P Tewari and J K Rai, 2014.

## IV. PROPOSED SYSTEM

Fig1. shows a typical vision of system flow which consists of different stages preprocessing step here is usually dependent on the details of input it contain a digital thermograms.Our main objective here is to tain and test our model using visual lab database.Classification of given thermograms images into normal and abnormal.



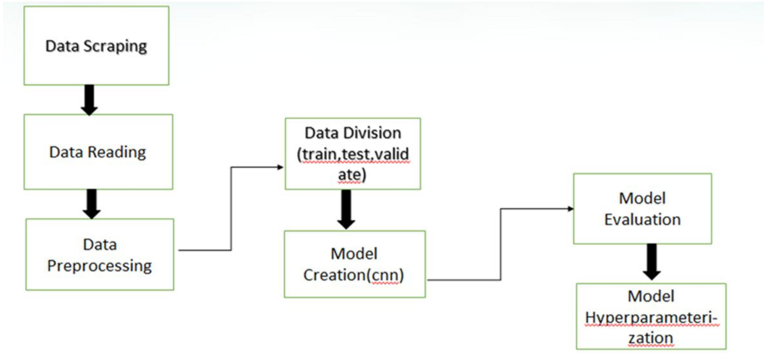



Fig 1: system flow Diagram

In this work images of the breast thermogram images database of visual lab group are used .Images were taken by SC-620 camera.Obtained images are converted into gray scale which is then pre-processed and further classified using neural network.fig 2 shows some gray scale imags fed to the network.
Following are the overall processes of the system.

*A. Pre-Processing*

The images are normalized and resized to ensure that all images are of same size.

*B. Data Division*

Our normalized and resized gray images are divided into training set and calidation sets.The developed Deep Convolution neural network is created by a sequence of layers image input layer is the input layer to the network .

*C. Model Creation(cnn)*

It's a core building block of the deep neural network .It contains a set of filters which operate on the input image.The model type that we will be using is Sequential.It allows to build s model layer by layer. Each layer has weights that correspond to the layer.The activation function we will be using is ReLU or rectified linear activation

*D. Model Evaluation*

Next,we need to compile our model .Compiling or evaluating the model takes two paeameters Optimizer and loss.The optimizer controls the learning rate .We will be using 'adam' as our optimizer.It adjusts the learning rate throughout training.For our loss function we used 'cross-entropy'

*E. Model Hyperparametarization*

Here we train our model.To train,we use fit() function on our model with following five parameters :training data(train_X),target data(train_y),validation split,the number of epochs and callbacks.
The validation splits will randomly splits the data into use for training and testing.Here epochs is the number of times the model will cycle through the data.The more epoch we run,the more the model will improve,up to a certain point.To make things even easier to interpret, use the accuracy metric to see the accuracy score on the validation set at the end of each epoch.

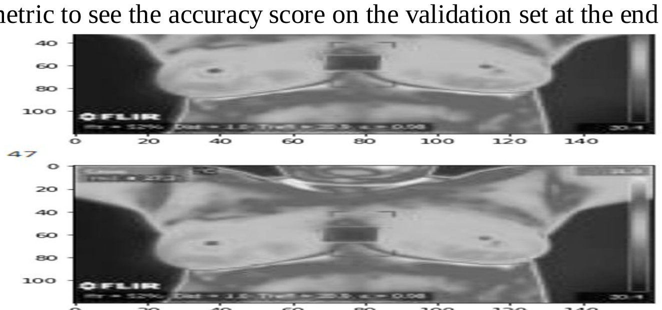



Fig.2: sample grayscale images

## V. METHODOLOGY

CNN Architecture:

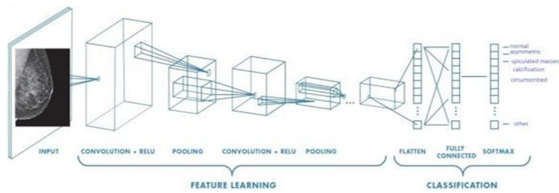



Fig 3: CNN Architecture

Convolutional neural network are the leading architecture in deep learning that are used to solve an image classification problem. The goal of this paper is to tell which class the input image belongs to. The process of building a convolutional neural network always involves 4 major steps

Convolution

Pooling

Flattening

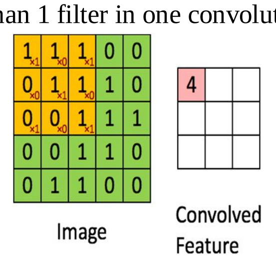
Fully connected layer

Types of layers:

All neurons in one layer, do similar kind of mathematical operations that is how that layer gets its name.

### *A. Convolution Layer*

Convolution is the mathematical operation that is used in image processing to filter signal, find pattern in signal etc. All neurons in this layer perform convolution on inputs. The most important parameter in a convolutional neuron is the filter size. We shall slide convolution filter over whole input image to calculate this output across the image and here we slide our window by 1 pixel at time this number is called Stride. Typically we use more than 1 filter in one convolution layer




### *B. Pooling Layer*

Pooling layer is mostly used immediately after the convolutional layer to reduce the spatial size(only width and height, not depth). This reduces the number of parameters, hence computation is reduced. Also, less number of parameters avoid over fitting. The most common form of pooling is **Max pooling** where we take a filter of size 3X3 and apply the maximum operation over the 3X3 sized part of the image.

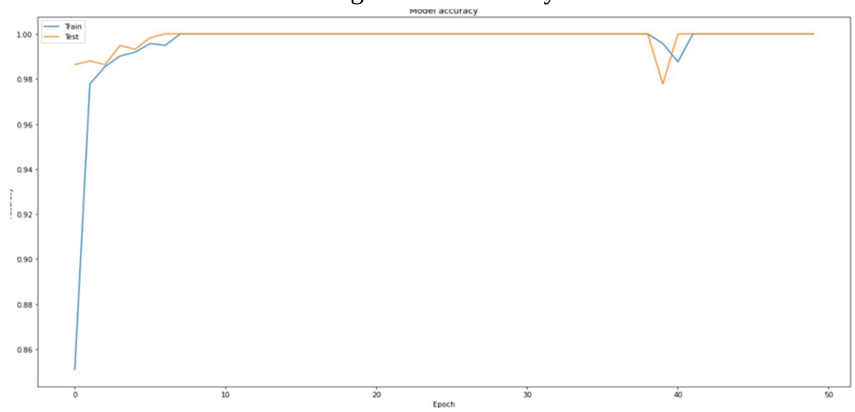
### *C. Fully Connected Layer*

If each neuron in a layer receives input from all the neurons in the previous layer, then this layer is called fully connected layer. The output of this layer is computed by matrix multiplication followed by bias offset.

## VI. RESULTS

In this paper we have used deep learning methodology to detect cancerous region in thermograms.Visual lab dataset was split into training,validation and testing datasets.A deep learning model was developed for early detection of cancer from thermal images along with its performance evaluation.Satisfactory results have been obtained using cnn Pre-processing is done to get better performance and faster learning of neural networks.Accuracy of raw images obtained by using different filter sizes in CNNs.Accuracy is determined when the model parameters are learned and fixed

Fig4:Model accuracy



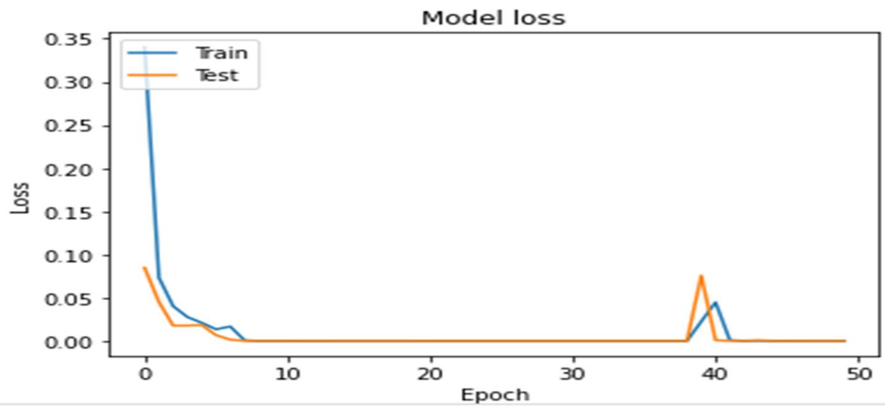



Fig.5 Model loss

## VII. CONCLUSION

In this paper we proposed a model named convolution neural network .This convolution neural network used on thermograms for detection of normal(healthy) and abnormal(sick) thermograms.As it is always preferable to detect cancer at early stage . Early stage detection not only leads to less treatment but also improves the chances of survival from breast cancer.

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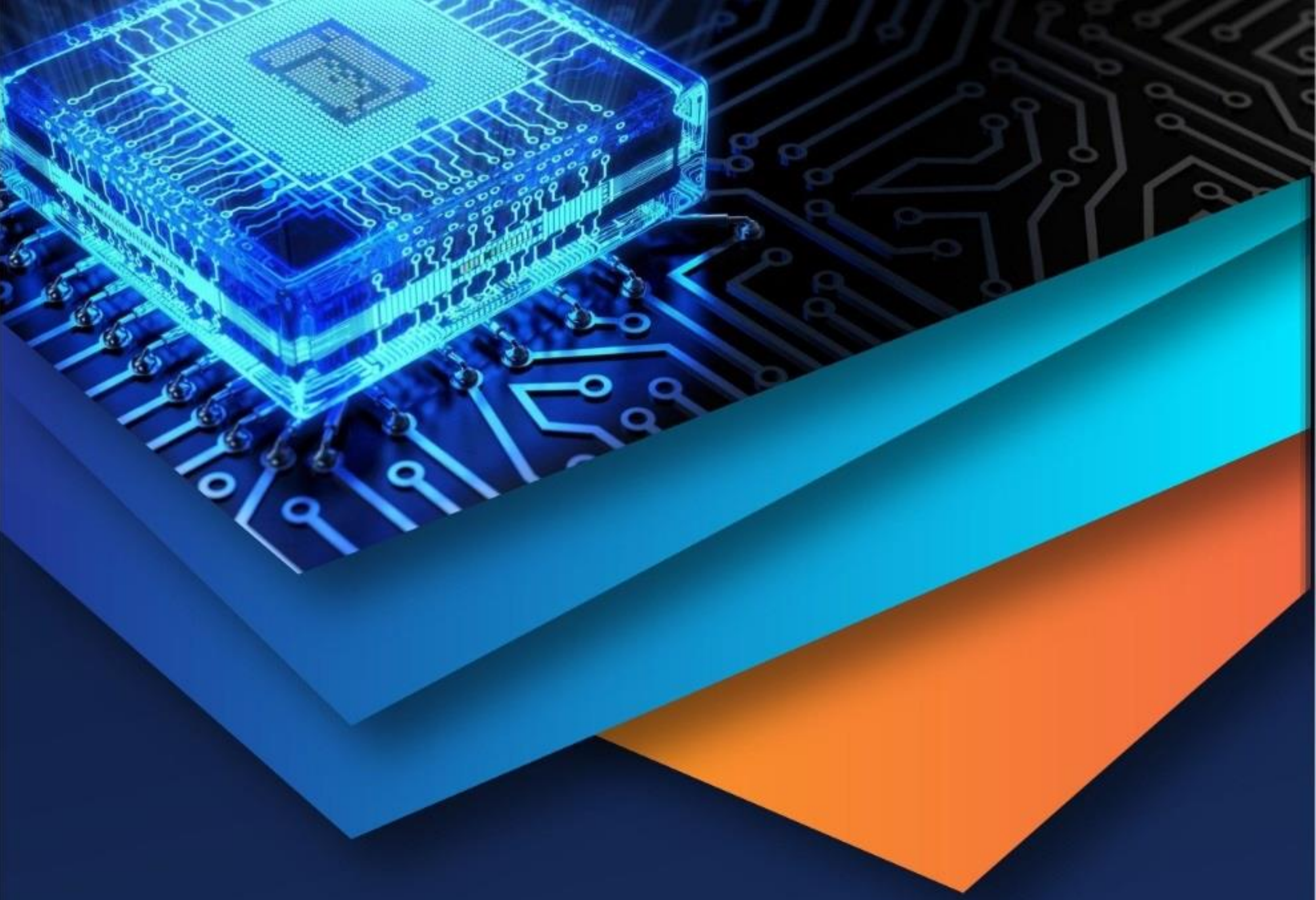


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