

Deep Learning Based Breast Cancer Detection-A Survey

K. Sai Krishna¹

Research Scholar, Dept.of.ECE

Sathyabama Institute of Science & Technology, Chennai - 600 119

Dr. P. Grace Kanmani Prince²

Assistant Professor, Dept.of.ECE

Sathyabama Institute of Science & Technology, Chennai - 600 119.

Abstract: Now a days, Breast Cancer is a dangerous disease for women's and it is rare in case of men's. Day by Day the death rates also increasing due to non-availability of technology as well as lack of knowledge in people. As per the reports of World Health Organization in India, during the year 2019 total population was 1,366,417,756. Among this 1,157,294 people suffered with cancer in that 784,821 people dead with cancer. Consider Global Wide World Health Organization report it shows that total population was 7,676,965,500 and deaths due to cancer were 9,555,027. It is estimated that Global wide 2,778,850 people will be effected for Breast Cancer during the year 2040. As in case of India it is estimated that 261,850 people will be effected for Breast Cancer during the year 2040. This paper provides different Algorithms based Breast Cancer detection survey using both Deep Learning and Machine Learning technology. Among all Machine Learning Algorithms RVM produces more accuracy than SVM. As per the study Deep Learning Algorithms produces more accuracy than Machine Learning Algorithms. Out of all Deep Learning Algorithms AUC produces accuracy of 98%.

Keywords: Breast Cancer, Deep Learning, AUC, RVM, SVM.

I. INTRODUCTION

Now a day's many women's are suffering with breast cancer. Normal hospitals also providing good facilities to diagnose the breast cancer. First of all, every woman must aware regarding breast cancer. There by they can reduce the disease at initial stage itself so that death rates due to Breast Cancer will be also reduce. After treatment or operation some of the women were neglected the future checkups so that there will be a chances of spreading the cancer to other parts of their bodies. It's a dangerous signal for their life. We hope that it won't happen to any women. In some of the hospitals for getting reports or diagnose they taken more time. For reducing the time taking for generating the reports, the computerized Breast Cancer diagnosis was implemented. This paper presents a summary about different techniques for detecting the breast cancer. For detecting Breast Cancer many techniques are developed apart from that we took some papers which can detect Breast Cancer using Machine Learning based algorithms as well as Deep Learning based algorithms.

We mainly focusing on papers which are related to Deep Learning and Machine Learning technologies for detecting the breast cancer. Based upon papers we mentioned some key points also. Section I describes about introduction of the paper and survival rates using different parameters. Section II describing about literature survey based on Deep Learning and Machine Learning technologies. Section III describing about Performance Analysis. In that we mentioned key points that are help us for completion of this survey.

Treatment for Breast Cancer depends upon the type of stage. According to ACS there are 5 stages are there starting from stage-0 to stage – IV. According to ACS survival rate of the woman who completed the treatment in Stage-II is 93%. Survival rate for the woman who completed the treatment in stage-III is 72%.

II. LITERATURE SURVEY

In this section we are discussing about Breast Cancer statistics provided by popular standards such as Indian Council of Medical Research (ICMR) and American Cancer Society (ACS). Along with statistics we are also discussing about some previous work related to Breast Cancer detection using Deep Learning and Machine Learning Algorithms. According to prediction of Indian Council of Medical Research (ICMR) [14] during the year 2020 in India 17.3 Lakh new cancer cases and 8.8 Lakh deaths are expected due to Breast Cancer, Lung and Cervix. Among this only 12.5 percent of patients come for treatment in early stages of the disease. Next consider American Cancer Society statistics [15] during the year 2020 they are estimating that in US 276,480

new cases in woman and 2,620 cases in men will be suffered with breast cancer. In addition, they are expecting deaths as 42,170 women's and 520 men deaths in the year 2020.

Naresh Khuriwal [1] focused on CNN algorithm which detects Breast Cancer because it's a widely used best algorithm in Deep Learning method. For pre-processing the dataset of a Breast Cancer they used histogram equalization method and median filter. MIAS dataset contains 200 images. In that they extracted 12 features. they implemented algorithm on that features so that they achieved 98% accuracy.as compared to other implemented Algorithms their system got good accuracy. In future they want to implement with more number of features for getting best results to diagnose Breast Cancer accurately.

Prajakta Khendad [2] proposed in his paper that many Medical imaging techniques was used for diagnosis and detection of the breast cancer. For professional radiologists only it consumes lot of time to diagnosis each image pattern. It's a drawback in that. So to overcome that drawback they used Deep Learning based Neural network (NN) technique for detecting of the breast cancer. We already know that many advanced technologies come into existence such as Deep architecture and ANN by which as compare to human machines are more likely to be intelligent. In addition, computational costs and power was reduced for low cost, unlimited storage is also available.

Abien Fred M. Agarap [3] described a paper which is based on Machine Learning (ML) Algorithm. It compares several algorithms on Wisconsin Diagnostic Breast Cancer (WDBC) dataset related to ML those are GRU-SVM, Linear Regression, MLP, NN, Softmax Regression, and SVM. They measured for all this classifications test accuracy. Based upon breast mass they did FNA test so that they mentioned features based on the results of the test. Their research work is divided into 2 parts which are dedicated to 70% implementation and remaining for test purpose. Finally, their results presented that mentioned Algorithms got accuracy more than 90%. Out of that MLP algorithm got a test accuracy of $\approx 99.04\%$. They proposed GRU-SVM model for diagnosing breast cancer.

Simon Hadush Nrea [4] research discussed that in Ethiopia among all the people nearly 34% women were cancer patients. Their technique was manual only. Now a day there is a huge demand for Deep Learning methods, so that they proposed CNN algorithm for detection of breast mass to avoid manual headache analysis. In this technique they adopted RPN and ROI methods for detecting the breast mass. By using these methods, they detected mass regions based on mammogram images. They collected images from near hospitals etc. here features are extracted after pre-processing stage. In pre-processing stage first images are send to different filters. Their experiment results shown that accuracy of AUC-ROC is 92.2%.

R. Chtihrak kannan [5] mentioned in his paper that due to cancer death rates were increased day by day. One of many reasons are due to lack of knowledge for detection of the cancer in early stage. Analysis shown that only 60% patients are diagnosed in advance stage. The objective of his paper is to detect Breast Cancer earlier. They used images of X-ray mammograms for their experiment. Based on Gaussian Filter and Edge detection techniques pre-processing was carried out to enhance the quality. For identification of first order features they used Wavelet Transform and from pre-processed images they extracted GLCM based second order features. They used Multilayer supervised classifier. After completion of Pre-processing and extraction of features the image taken from the patient is applied as input to the classifier. The output of the classifier contains two types of classes such as normal class and abnormal class. They implemented algorithm in Python Language. Their system took less time for testing and all and also they reached nearly 92% accuracy.

Dina A. Ragab [6] introduced Deep Learning and some segmentation techniques for early detection of breast cancer. A CAD system was proposed for classifying mass tumors in breast mammography images. In this system they used 2 segmentation process one is done by manually and another one by using threshold and region based. For feature extraction CNN method is used. They used 2 types of datasets one is used for mammography screening in online and another is CBIS-DDSM. By using CBISDDSM, the accuracy of the DCNN is improved to 73.6%. At the same time SVM accuracy becomes 87.2% and AUC to 94%.

Shwetha K [7] proposed in his paper that reduction of the death rates due to Breast Cancer depends upon early detection. They proposed convolution neural network (CNN) based classification technique in Deep Learning. Here for classifying the mammogram images they used methods of Mobile Net and Inception V3, because these methods are preferred for detecting early stage breast cancer easily compared to other methods. Compared to Mobile Net, inception V3 got 83% accuracy.

Habib Dhahri [8] used GP technique for best feature selection. It's a combination of pre-processing methods and classifier Algorithms. They did 3 experiments in that first one proved that 3 most popular Algorithms achieved

the same performance. Their second experiment mainly focused on combining the features for getting the best results. They stated that proposed algorithm is an appropriate algorithm from among the various configurations. They did all experiments in Python library.

M. Tahmooresi [9] proposed a hybrid model which combines popular Machine Learning Algorithms such as SVM, ANN, KNN and DT for effective Breast Cancer detection. Not only detection they mentioned datatypes such as image, blood etc.in their paper. It's mainly depends on ML based Algorithms. Their research method shown that among all mentioned algorithms SVM is the best and efficient for detection of the breast cancer. They mentioned that SVM can alone use as for detection. For better results we may combine this with another algorithm. SVM alone can achieve 98% accuracy. If it is combined with another algorithm means its accuracy was improved to 100%.

Natalia Pirouzbakht [10] developed a cancer detection system which helps for radiologists in cancer detection. They used architecture containing network of Deep Learning. This research work contains total 4 layers to get the desired output. For detection of breast cancer. They used an innovative algorithm. For removal of artifact, and contrast by using NSCT they pre-processed the mammogram image to after that they fed that to deep neural network. Thus, this pre-processing facilities Filters to adapt characteristics to classify the correct images in convolutional layer.

Li Shen [11] described a best method for screening the mammogram is convolutional method. It achieves per-image AUC of 0.88 by using four-model it improved the AUC to 0.91. By using FFDM images it achieves AUC of 0.95, and by using four-model it was improved the AUC to 0.98.

B.M. Gayathri [12] performed survey on Machine Learning Algorithms. In this survey they mainly concentrated on SVM algorithm and RVM algorithm. Many researchers have applied the algorithm of neural networks for predicting cancers, especially the breast cancer. By going through various articles, RVM is applied for detecting optical cancer, ovarian cancer etc. Overall, if studies on RVM continues, then it is likely that the use of RVM will become much more useful in diagnosing breast cancer.

Hiba Asri [13] presented data mining methods for classifying data in medical field for making the decisions. In their paper they discussed about different Machine Learning Algorithms on Wisconsin Breast Cancer dataset like SVM, DT C4.5, NB and k-NN. The main aim of this paper is it classifies all mentioned Algorithms so that results of their experiment shows all Algorithms gave best results out of that SVM produces 97.13% accuracy with lowest error rate.

III. PERFORMANCE ANALYSIS OF DIFFERENT METHODS

Based on the survey performed on many papers related to Deep Learning and Machine Learning technology which detects the Breast Cancer we found some key points that are shown in the below Table-1

Table-1 Key points in our survey

S.No.	Paper Published Month-Year	Corresponding Author Name	Technology	Algorithm/Techniques	Dataset	Accuracy
1.	November-2018	Naresh Khuriwal	Deep Learning	Convolutional Neural Network	MIAS	98%
2.	September-2018	Prajakta hendad	Deep Learning	Comparison of different neural network techniques	-	-
3.	Feb 2019	Abien Fred M. Agarap	ML	Compares 6 ML Algorithms such as GRU-SVM, Linear Regression, MLP, NN, SR, and SVM	Wisconsin Diagnostic Breast Cancer (WDBC) dataset	Highest accuracy produced by MLP≈99.04%.
4.	Mar 2020	Simon Hadush Nrea	Deep Learning	CNN	AUC-ROC	92.2%.
5.	September 2019	R.Chtihakkannan	Deep Learning	CNN	Dataset Images are created from the training phase	92%
6.	January 2019	Dina A. Ragab	Deep Learning	DCNN.	DDSM, CBIS-DDSM	AUC equalling to 0.94
7.	2018	Shwetha K	Deep Learning	CNN	MIA's mammograms	83%

8	2019	Habib Dhahri	ML	GP	Wisconsin Breast Cancer dataset	98.24%
9.	September 2018	M. Tahmooresi	ML	Combination of SVM, ANN, KNN and DT	Healthcare Related Dataset	SVM (single or hybrid) was 99.8%
10.	2017	Natalia pirouzbakht	Deep Learning	DNN	Mammography platforms	-
11.	August 2019	Li Shen	Deep Learning	Deep Learning	Mammography platforms	AUC to 0.98
12.	May 2013	B.M.Gayathri	ML	ANN, SVM and RVM	Wisconsin diagnostic breast cancer	RVM gives the result more accurate than SVM
13.	2016	Hiba Asri	ML	SVM, DT , NB and KNN	Wisconsin Breast Cancer	SVM gives the highest accuracy (97.13%)

IV. CONCLUSION

Deep Learning Based Breast Cancer Detection-A Survey successfully completed. In this survey, we assessed different types of Deep Learning Algorithms and Machine Learning Algorithms. As per the survey among all Machine Learning Algorithms RVM produces more accuracy than SVM. Out of all Deep Learning Algorithms AUC produces accuracy of 98%. So we conclude that by using AUC we can detect Breast Cancer earlier then patient can go for treatment in early stage itself. There by we can reduce death percentage by breast cancer.

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