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A Breast Cancer Detection using Image Processing and Machine Learning Techniques

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***Abstract*: Routine breast cancer screening allows the disease to be diagnosed and treated prior to it causing noticeable symptoms. During the diagnosis process there are chances of wrong detection hence a less human interfaced system has to be developed, hence the goal of breast cancer detection using machine learning techniques is used to find it before it spreads to the larger extent. Screening refers to tests and exams used to find a disease in people who don't have any symptom. Early detection means finding and diagnosing a disease earlier than waiting for symptoms to start causing the effect on the neighboring cells.**

The breast cancer is the second most death causing cancer in humans, one in every ten women are affected by the breast cancer. Breast cancer is not only affecting the women. Men are also prone to get affected by the breast cancer but in smaller rates because of the absence of milk ducts and other lobules related to women. Early detection of the breast cancer helps in reducing the death rates if treated earlier and by proper diagnosis.

In this paper the discussion of the various image processing technique done on the image and the CNN, SVM algorithm implementation on dataset images for the classification of malignant and non malignant cells are used and various tests were performed using different other machine learning algorithms and there level of accuracy and difference of various parameters are discussed for image processing MATLAB coding is used.

Keywords: reoccurrence, prediction, classification, breast, non reoccurrence, SVM, ANN, RNN ,CNN.

I. INTRODUCTION

A cancer is multiplication of the cells in an uncontrolled manner (mutation) which is abnormal in the condition and this multiplication is known as mutation. When the malignant cells multiple and increase, lymphatic system or bloodstream can carry cancer to various parts of the body. Multiplied cells can develop and group together and form the new tumors. One of the principal puts a disease regularly spreads is to the lymph hubs.

ymph hubs are minor, bean-formed organs that assistance battle contamination. They are located in Clusters in different parts of the body, such as the neck, groin area, and under the arms. Malignancy may likewise spread through the circulation system to far off pieces of the body. These parts may incorporate the bones, liver, lungs, or mind. Regardless of whether the malignancy spreads, it is still named for the zone where it started. For instance, if bosom disease spreads to the lungs, it is called metastatic bosom malignant growth, not lung malignant growth cancer can recur at any time after the treatment or not at all, but recurrences happen in the first 5 years after breast cancer treatment. Bosom malignancy can return as a nearby repeat/territorial repeat and the inaccessible metastasis. Probably the most widely recognized locales of repeat outside the bosom are the lymph hubs, bones, liver, lungs, and cerebrum. In this manner it is a most imperative research to anticipate the bosom malignant growth repeat.

II. PROCEDURE FOR DIAGNOSING CANCER

Data processing techniques are extensively used for carcinoma identification. Identification is employed to predict the presence of cancer and differentiate between the existence of malignant and nonmalignant tumor.In this study machine learning Algorithms are discussed which are used to predict whether or not there is malignancy in the cells. Carcinoma can reoccur the information obtainable in manual identification is rip-roaring and raw that will increase the value of management of knowledge. So there's a desire of correct parameter and have choice in order that the error rate and price is minimized. Often, identification begins once an individual visits a doctor concerning associate uncommon symptom.. The doctor can speak with the person concerning his or her case history and symptoms. The various tests are performed to search out the explanation for these symptoms. For these patients, cancer is diagnosed throughout a medical check for an additional issue or condition; samples of screening tests embrace endoscopy, diagnostic procedure, and a Papanicolaou test. An individual might have further checks to substantiate or confute the results of the screening test.

III. LITERATURE REVIEW

The Analysis and Classification of the cancer involves two important stages in the identification: Image Processing and Machine Learning. The Acquired image from the process of scanning and mammography has to undergo various processing techniques as listed below once these images are processed they have to be classified into the categories such as malignant (cancerous) and non malignant (non cancerous)to do these

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classification there are various methods and techniques involved they are explained in the section.

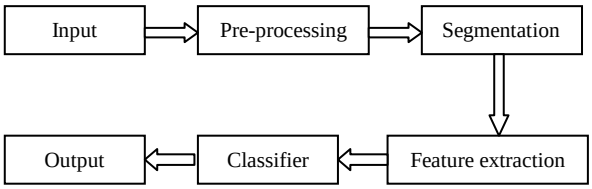


Fig 1: Block Diagram of Image Processing

A.Image Processing

Acquired images are in the form of a matrix this matrix has to be enhanced by the factors of 1280*1280 initially to check the difference in the normal and abnormal cells. When this enhancement happens there is degradation of the image quality,

Hence there are various processes which need to be implemented before processing the images to the machine learning. Biopsy is the standard technique which is followed in order to diagnose the cancer in the breast tissues there are various Image Processing Techniques which are used in order to extract the features of the scanned images [8].

1. **Acquisition of Image**: It is the fundamental step of digital image processing. A image obtained by the process of scanning, x-ray , mammography etc., are to be subjected to the preprocessing where the images are scaled to the different sizes to obtain the clarity in the images captured. This image should be a high quality image with greater resolution, which helps in proper image analysis.

2. **Preprocessing :** The important features of the image has to be analyzed removing the unwanted distortion and enhance the important features of the image to do this operation there are Some preprocessing operations which are needed to be performed on the input image. once process high resolution pictures, the image size is required to be reduced attributable to the explanation that process on high resolution pictures takes a extended time.

Then once the color image is converted into gray scale image, as a result of less info is required to be provided for every element. Indeed gray color is that the one within which the red, blue and inexperienced parts contain equal intensities; so it's necessary to specify one price of magnitude for every element. Noise results in the variation within the price of the element.

The objective of noise removal is to find and removed unwanted noise from digital image. The problem is choose that options of a picture are real and that are caused by noise. Noise is random variations in element values. Median filter is used to get rid of unwanted noise. Median filter is nonlinear filter, it leaves edges invariant. Median filter is enforced by window of strange length. Every sample price is sorted by magnitude, the centermost price is median of sample inside the window, could be a filter output.

3. **Edge Detection and Segmentation:** To identify the important properties of the image it is necessary to segment the images into multiple segments. Using edge segmentation some points is identified to note the changes in the properties of the image. After segmentation the analysis of the image is done pixel by pixel and each pixel is labeled depending on whether the grey level pixel is greater or less than the threshold value. The segmented image is easy to analyze [8].

4. **Image Restoration:** Image restoration is a region, in which the presence of an image is improved. Image restoration strategies depend on scientific models or probabilistic investigation of a picture. There are different channel accessible or can be intended for the reclamation and to improve the nature of an image.

5. **Output Image:** After passing the image through the various image analyses technique the image obtained is analyzed for the malignancy.

B.Machine Learning

Machine learning is a subset of Artificial Intelligence where the problem is analyzed from data samples which are collected in the database. Many biomedical application problems are trying to be resolved using the ML algorithms and techniques [3].

There are two Techniques which are used:

1) Determining the unknown dependencies in the given set of data which is known as estimation
2) Using the estimated dependencies the new outputs of the system are predicted

C. Artificial Neural Network

(i) Supervised learning: where the trained data set are labeled .these data are used to map the input to the desired output. Supervised learning classifiers; such as Naïve Bayes, SVM-RBF kernel, RBF neural networks, K- Nearest Neighbor (K-NN), Decision trees (J48) and simple CART are the various types of classifiers which are used in order to increase the accuracy and reduce the time and cost .

(ii) Unsupervised learning: In unsupervised learning methods no labeled examples are provided and there is no notion of the output during the learning process.

(iii) Reinforcement learning: Reinforcement learning though seems similar to supervised learning it varies when it comes to trained data set as in supervised learning the decision is dependent on the trained data set here the trained data set does not have a important role to be played The brain process the information using nervous system present. Similarly the mathematical models are processed using artificial neural network The process of information for computation is through the networks of neural which are interconnected ANN can also be used to find out the patterns and clusters.

Network structures are formed between layers of neurons based on their arrangement and connection patterns. In supervise learning is like in presence of teacher or a supervisor learning is performed similar to which a trained set acts like a teacher using which the error is minimized. There are various supervised networks such as Preceptor networks, Time delay neural networks so on, and the feed forward neural network with back propagation method or technique is used in order to minimize the error [9].

In unsupervised learning the analysis is performed in the absence of a supervisor or instructor , some of the techniques are like learning vector quantization, adaptive resonance theory network etc.,

A novel approaches can be obtainable by combining two or more Neural network technique in order to increase the accuracy. Machine Learning has two tasks namely regression and clustering. Based on these tasks the data are grouped as Supervised or unsupervised. Subsequently, for each new example the estimation of a prescient variable can be assessed, in light of this procedure.

Bunching is a typical unsupervised assignment where one attempts to discover the classifications or groups so as to portray the information things. In light of this procedure each new example can be allocated to one of the recognized groups concerning the comparable attributes that they share. Another sort of ML techniques that have been broadly connected is semi-directed realizing, which is a mix of regulated and unsupervised learning. It consolidates named and unlabeled information so as to build an exact learning model. Generally, this sort of learning is utilized when there are more unlabeled datasets than marked. While applying a ML strategy, information tests comprise the fundamental segments.

Each sample is portrayed with a few highlights and each component comprises of various kinds of qualities. Besides, knowing ahead of time the particular sort of information being utilized permits the correct choice of instruments and procedures that can be utilized for their investigation. A few information related issues allude to the nature of the information and the preprocessing ventures to make them increasingly appropriate for ML [10].

Table I: A simplified hierarchy of classification [22].

Learning technique		Algorithm	
Supervised	Conventional	(a) Logic based	(1) ID3, (2) C4.5, (3) bagging, (4) random trees, (5) Random Forest, (6) boosting, (7) advanced boosting, (8) Extreme Boosting (XGBoosting) .
		(b) Bayesian	(1) Naive Bayes (2) Bayesian Network
			(c) Conventional Neural Network (d) Support Vector Machine
	DNN-based		(a) Convolutional Neural Network (CNN), (b) Deep Belief Network (DBN), (c) Generative Adversial Network (GAN).
Unsupervised	Conventional		(a) K-Means Clustering (b) Self-Organizing Map (SOP) (c) Fuzzy C Means Clustering (FCM)
	DNN-based		(a) Deep Belief Network (DBN)
Semi supervised	Conventional		(a) Self-training (b) Graph Based (c) S3V3 (d) Multiview (e) Generative model

IV. ANALYSIS

There were two phases of experiment for this study. They are

(1) Training phase
(2) Test phase

The dataset was partitioned by 70% (training phase) and 30% (testing phase). The parameters considered in the experiments were as follows:

(1) Test Accuracy
(2) Epochs
(3) Number of data points
(4) False Positive Rate (FPR)
(5) False Negative Rate (FNR)
(6) True Positive Rate (TPR) and
(7) True Negative Rate (TNR)

The accuracy and the analysis also depends on the data sets the batch size refers to the size of the images which are present as a data input for the analysis using the algorithms, Cell size refers to the infected or the normal size of the breast cell which is processed for testing, epochs refers to the Division of the dataset of training samples into batches and the completion of testing of these batches one round completes 1 epoch.

A dropout refers to the samples which are removed from the training dataset from both hidden and visible layer of the neural network.

Single class classification using support vector machine (SVMC). False rate and true rate are the amount of the datasets which fall into either of the categories cancerous or non cancerous which defines the rate. False negative rate and True negative rate are the data which are false falls into wrong category example the cancer cell in non cancer.

Table II: Parameters used in Machine Learning

Hyper-parameters	GRU-SVM	LR	MLP	NN	SR	SVM
Batch Size	128	128	128	N/A	128	128
Cell Size	128	N/A	[500,500,500]	N/A	N/A	N/A
Dropout rate	0.5	N/A	None	N/A	N/A	N/A
Epochs	3000	3000	3000	1	3000	3000
Learning Rate	le-3	le-3	le-2	N/A	le-3	le-3
Norm	L2	N/A	N/A	L1,L2	N/A	L2
SVMC	5	N/A	N/A	N/A	N/A	5

The below table shows the various classifiers and the machine learning algorithm combination data and their related parameters analyzed and obtained as result in the previous works of the researchers comparing this we can select the best method of classifiers and algorithm combination.

GRU-SVM: Gated Recurrent Unit Support Vector Machine LR: Linear Regression

MLP: Multi Layer Preceptor NN: Nearest Neighbor

SR: Soft max Regression

SVM: Support Vector Machine

L1 and L2 regularization, dropout, and artificial expansion of the training data.

Table III: Various algorithms with parameter

Parameter	GRU-SVM	LR	MLP	L1-NN	L2-NN	SR	SVM
Accuracy	93.75 %	96.093 75%	99.038 44958 %	93.567 252%	94.736 844%	97.656 25%	96.093 75%
Data points	384000	384000	512896	171	171	384000	384000
Epochs	3000	3000	3000	1	1	3000	301020
FPR	16.666 667%	10.204 082%	1.2670 42%	6.25 %	9.375 %	5.7692 31%	63829
FNR	0	0	0.7861 57%	6.5420 56%	2.8037 38%	0	2489136%
TPR	100%	100%	99.213 843%	93.457 944%	97.196 262%	100%	97530
TNR	83.333 333 %	89.795 918 %	98.732 958 %	93.75 %	90.625%	94230 769%	967123

Literature review of various algorithms based on their performance, though the table states that there are more accuracy of the algorithms that does not implement that the advancement ends because accuracy is only related to the test datasets which are been used, so accuracy must be tested with more data sets and collection of these datasets should be made with utmost care, Table IV shows the literature review and the year of publication of the implementation to overcome the drawbacks of the below mentioned algorithms a new algorithm has to be made use.

Table- IV: Performance of algorithms for breast cancer detection [26]

SI. No.	Year	Author	Algorithm/Techniques used	Result Obtained
1.	2010	F.Paulin ,Dr.A.Santhakumaran	Back propagation algorithm used for training Multilayer Perceptron(MLP)	99.28%
2.	2010	Dr.K .Usha rani	Feed forward, Back propagation.	92%
3.	2011	F.Paulin, Dr.A.Santhakumaran	Back propagation, Quasi newton, levennberg Marquardt algorithm.	99.28%
4.	2011	Yao ying huang,wang sen li ,Xiaojiao ye	Genetic algorithm, feature selection	99.1%
5.	2012	JR Marsilin	SVM	78%
6.	2011	Li Rong Sunyuan	SVM – KNN Classifier	98.06%
7.	2011	F Eddaoudi	SVM	95%

8.	2011	S Aruna Dr. S P Rajagopalan	SVM	98.24%
9.	2002	Balaji Krishnapuram,Lawrence Carin,Alexander J. Hartemink	RVM(linear kernel)	90%
10.	2003	Balaji Krishnapuram,Lawrence Carin,Alexander J. Hartemink	RVM	92.34%
11.	2004	Balaji Krishnapuram,Lawrence Carin,Alexander J. Hartemink	RVM	94.35%
12.	2005	Shovan K. Majumder	RVM	97%
13.	2005	L Wei, Y Yang, RM Nishikawa	RVM	91.25%
14.	2007	Wen Zhang Liu, J	RVM	94.85%
15.	2009	S Ozer, MA Haider, DL Langer	RVM	95.34%

Following graph shows the various algorithms used in the machine learning and there accuracy in detecting the cancerous tissues.

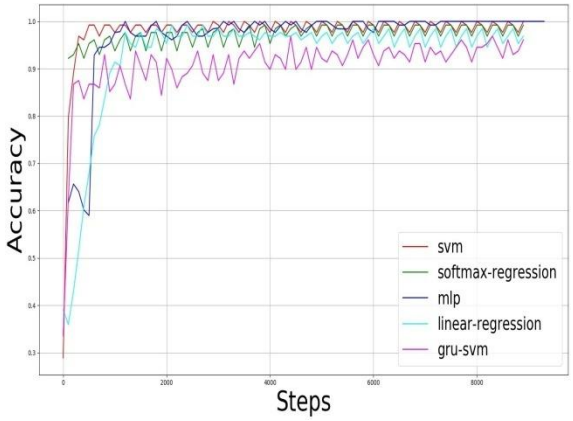
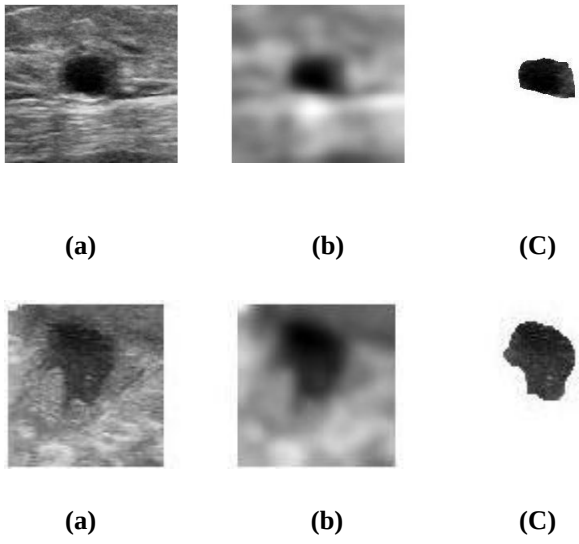


Fig 2: Machine learning algorithms on Breast Cancer [24].

V. RESULT AND DISCUSSION



(a) (b) (C)

(a) (b) (C)

Fig 3: (a) Original image , (b) processed image and (c) final segmented image

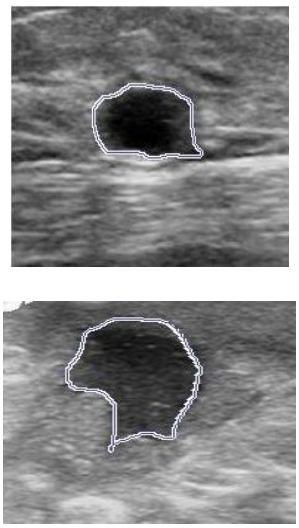


Fig 4: suspected regions (Classifier Ouptput)

Table V: Experimented Results
(Performance analysis of the algorithm)

Item	Proposed Method
Accuracy	92.00
Sensitivity	94.736
Specificity	83.34

VI. CONCLUSION

In this work various breast cancer Data mining process for the raw image is discussed and the various types of Machine Learning techniques were discussed to compare the different learning algorithms to classify a benign cancer from malignant cancer in various dataset. The comparison was done to estimate the error using an estimation procedure such as cross-validation for each learning algorithm and choose the algorithm whose estimate is smaller. This is still reasonable, if one algorithm has a lower estimated error than others in one dataset, then this algorithm can be consider as the model for this dataset.

After the processing of the image in these two techniques there is possibility of reducing the reoccurrence of the cancer and to avoid the cancer to spread to other parts of the body by early detection. In the next stage of the work the significant test are to be used to determine whether one learning algorithm outperforms another on a particular learning task.

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REFERENCES

1. LG*, Eshlaghy AT, Poorebrahimi A, Ebrahimi M and Razavi AR - Using Three Machine Learning Techniques for Predicting Breast Cancer Recurrence, J Health Med Inform 2013.
2. Using Three Machine Learning Techniques for Predicting Breast Cancer Recurrence Ahmed LG,Eshlaghy AT, Poorebrahimi A, Ebrahimi M and Razavi.
3. W. Schulz, Molecular Biology of Human Cancers. NewYork, USA: Springer, 2007.
4. M. P.Sampat, M.K.Markey, and A.C.Bovik, Computer-Aided Detection and Diagnosis in Mammography, Handbook of Image and Video Processing. London, U.K.: Elsevier, 2003.
5. M. F. Akay, Support vector machines combined with feature selection for breast cancer diagnosis, Expert Syst. With Applicat., vol. 36, no. 2, pt.2, pp. 32403247, Mar. 2009, 10.1016/j.eswa.2008.01.009, 0957-4174.
6. J. Eric, L. M.Wun, C. C. Boring,W. Flanders, J. Timmel, and T. Tong, The lifetime risk of developing breast cancer, JNCI J. Nat. Cancer Inst.,vol. 85, no. 11, pp. 892897, 1993, 10.1093/jnci/85.11.892.
7. B. E. Sirovich and H. C. Sox, Jr., Breast cancer screening, Surgical Clinics N. Amer., vol. 79, no. 5, pp. 961990, Oct. 1, 1999, 10.1016/S0039- 6109(05)70056-6, 0039-6109.
8. T.M. Deserno (ed.), Biomedical Image Processing (Springer, Berlin, 2010).
9. Y. Yang, Wei, L. Nishikawa, Micro calcification Classification Assisted by Content Based Image Retrieval for Breast Cancer Diagnosis, IEEE International Conference on Image Processing, Vol. 5, pp. 1-4, 2007.
10. Dr.Santhosh baboo, S.Sasikala "A Survey on data mining techniques in gene selection and cancer classification"-April 2010 International journal of Computer science and information technology.
11. A. Bharathi and A.M. Natarajan "Cancer Classification using Support Vector Machines and Relevance Vector Machine based on Analysis of Variance Features"- Journal of Computer Science 7 (9): 1393-1399, 2011.
12. Fatima Eddaoudi , Fakhita Regragui , Abdelhak Mahmoudi , Najib Lamouri "Masses Detection Using SVM Classifier Based on Textures Analysis"- Applied Mathematical Sciences, Vol. 5, 2011, no. 8, 367 – 379.
13. Guoqiang Peter Zhang "Neural Networks for Classification: A Survey" IEEE TRANSACTIONS ON SYSTEMS, MAN, AND CYBERNETICS—PART C: APPLICATIONS AND REVIEWS, VOL. 30, NO. 4, NOVEMBER 2000.
14. S. Aruna, Dr .S.P. Rajagopalan " A Novel SVM based CSSFFS Feature Selection Algorithm for Detecting Breast Cancer" International Journal of Computer Applications (0975 – 8887) Volume 31–No.8, October 2011.
15. Ahmed M. Abdel-Zaher* , Ayman M. Eldeib , Department of Systems and Biomedical Engineering, Cairo University, Giza, Egypt "Breast cancer classification using deep belief networks", Expert Systems With Applications 46 (2016) 139–144 .
16. M. Ngadi, A. Amine, and B. Nassih, "A robust approach for mammographic image classification using NSVC algorithm," in Proceedings of the 1st Mediterranean Conference on Pattern Recognition and Artificial Intelligence (MedPRAI '16), vol. Part F126741, pp. 44–49, Algeria, November 2016.
17. Maryellen L.GigerPhD , "Machine Learning in Medical Imaging", Journal of American college of Radiology, Volume 15, Issue 3, Part B, March 2018, Pages 512-520.
18. Alexander Rakhlin,Alexey Shvets, Vladimir Iglovikov, Alexandr A. Kalinin, "Deep Convolutional Neural Networks for Breast Cancer Histology Image Analysis", International Conference Image Analysis and Recognition, ICIAR 2018: Image Analysis and Recognition pp 737-744.
19. Morteza Heidari, Abolfazl Zargari Khuzani, Alan BHollingsworth, GopichandhDanala, Seyedehnafiseh Mirniaharikandehei, YuchenQiu, Hong Liu1 and Bin Zheng, "Prediction of breast cancer risk using a machine learning approach embedded with a locality preserving projection algorithm", Published 30 January 2018 • © 2018 Institute of Physics and Engineering in Medicine.
20. DaisukeKomura, ShumpeiIshikawa, "Machine Learning Methods for Histopathological Image Analysis", Computational and Structural Biotechnology Journal, Volume 16, 2018, Pages 34-42.
21. D. DouglasMillerMD, CM FACPaEric W.BrownPhDb, "Artificial Intelligence in Medical Practice: The Question to the Answer?", The American Journal of Medicine Volume 131, Issue 2, February 2018, Pages 129-133.
22. Abdullah-Al Nahid and Yinan Kong, "Involvement of Machine Learning for Breast Cancer Image Classification: A Survey", Computational and Mathematical Methods in Medicine Volume 2017, Article ID 3781951, 29 pages.
23. Shahnorbanun Sahran, Ashwaq Qasem, Khairuddin Omar, Dheeb Albashih, Afzan Adam, Siti Norul Huda Sheikh Abdullah, Azizi Abdullah, Rizuana Iqbal Hussain, Fuad Ismail, Norlia Abdullah, Suria Hayati Md Pauzi and Nurdashima Abd Shukor, "Machine Learning Methods for Breast Cancer Diagnostic", January 29th 2018 Reviewed: June 11th 2018Published: November 5th 2018 DOI: 10.5772/intechopen.79446.
24. Abien Fred M. Agarap, "On Breast Cancer Detection: An Application of Machine Learning Algorithms on the Wisconsin Diagnostic Dataset", arXiv:1711.07831v4 [cs.LG] 7 Feb 2019.
25. Wenbin Yue 1 ID , Zidong Wang 1,* , Hongwei Chen 2 ID and Annette Payne 1 and Xiaohui Liu 1, "Machine Learning with Applications in Breast Cancer Diagnosis and Prognosis", Designs 2018, 2, 13; doi:10.3390/designs2020013, 2 February 2018; Accepted: 23 April 2018; Published: 9 May 2018.
26. B.M.Gayathri. ,C.P.Sumathi and T.Santhanam , "BREAST CANCER DIAGNOSIS USING MACHINE LEARNING ALGORITHMS –A SURVEY" International Journal of Distributed and Parallel Systems (IJDPS) Vol.4, No.3, May 2013.

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