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Raw Data Analysis Of Deep Learning Possibilities For Breast Cancer Detection

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Abstract. Breast cancer is the most common and rapidly developing disease in the world. Breast cancer is most commonly detected in women. Breast cancer can be controlled if it is detected early. Many instances are addressed by early detection, which reduces the death rate. Many studies on breast cancer have been conducted. Machine learning is the most commonly utilised technique in research. There have been numerous previous studies conducted using machine learning. Machine learning techniques such as decision trees, KNN, SVM, nave bays, and others provide superior performance in their respective fields. However, a newly established approach is being utilised to classify breast cancer. Deep learning is a newly developed method. Deep learning is used to compensate for the shortcomings of machine learning. Convolution neural network, recurrent neural network, deep belief network, and other deep learning techniques are commonly utilised in data science. When compared to machine learning, deep learning algorithms produce greater results. It extracts the images' greatest features. CNN is employed to classify photos in our study. Our research is primarily image-based, and CNN is the most widely used technique for image classification. The current document includes reviews of all writers.

Keywords. Breast Cancer, Machine Learning, Deep Learning, Convolutional Neural Network, SVM.

1. Introduction

Cancer develops when aberrant body cells begin to split and come into contact with regular cells, causing them to become malignant. Breast cancer is the most common and dangerous disease in the world. Breast cancer is classified as invasive or non-invasive. Invasive cancer is invasive and aggressive, and it spreads to other organs. Non-invasive pre-cancerous cells remain in their original organ. It will eventually progress to aggressive breast cancer. Breast cancer is found in glands and milk ducts, which transport milk throughout the body. Breast cancer frequently spreads to other organs and causes them to become malignant. It also spreads to other organs via the circulation. Breast cancer comes in a variety of forms, each with its own pace of progression. Breast cancer claimed the lives of 627,000 women in 2018, according to the World Health Organisation. Breast cancer is the most common cause of death worldwide, but it is most common in the United States of America. Breast cancer is classified into four types. The first type of cancer is Ductal Carcinoma in Situ, which is pre-stage breast cancer that is detected in the coating of the breast milk ducts. The second most common kind of breast cancer is diagnosed in 70-80% of cases. The third form of breast cancer is inflammatory breast cancer, which develops rapidly and strongly. In this condition, cells infiltrate the skin and lymph veins of the breast. Metastatic breast cancer, which has spread to other areas of the body, is the fourth kind of breast cancer.

Many diagnostic tests, such as mammograms, ultrasounds, MRIs, and biopsies, offer images for classification. Mammograms are used to detect breast cancer using X-rays. If any questionable results are identified during mammography screening, the doctor is notified and the tissues are tested. Following the mammography, an ultrasound is performed. When a suspicious location in your breast is discovered, your doctor will order an ultrasound. If the tests during the symptomatic assessment are inconclusive, the doctor will order a breast MRI. It depicts the picture and perspective of your illness. A biopsy is the primary symptomatic approach for determining whether a suspected location is cancerous. Fortunately, 80% of women who receive a breast biopsy do not have cancer.

Machine learning is helpful in the classification of breast cancer. There are numerous diagnosis techniques that have been covered above that provide images. These types of diagnosis images are employed in machine learning categorization. Machine learning is a subfield of artificial intelligence. Many developers utilise machine learning to retrain existing models and improve performance. For linear data, machine learning is employed. Machine learning produces better outcomes when the data is tiny, but it does not produce better results when the data is vast. The model is trained using one of three types of machine learning. Supervised machine learning operates on known data with the assistance of a supervisor. Unsupervised machine learning is performed with no supervision. Reinforcement machine learning is becoming less popular. These algorithms use the best information from previous knowledge to make the best decisions.

Deep learning is a branch of machine learning. Deep learning is an unsupervised learning method that learns from data. The information could be unstructured or unlabeled. When a deep neural network has more than two hidden layers, it is referred to as a deep network. The first layer is the input layer, while the second is the output layer. The intermediate layer is known as the hidden layer, and it contains more layers than a neural network. The neurons refer to the node that contains the layer. The distinction between machine learning and deep learning is that deep learning is closer to achieving its goal than machine learning. Convolution Neural Network is utilised to classify the breast cancer dataset. To classify the photos, a Convolutional Neural Network is used. It accepts photos from the breast cancer dataset as input. CNN uses images as input, along with their associated weights. The weights are changed to reduce mistake and improve performance. CNN has numerous levels, including a convolution layer, a pooling layer, a ReLU layer, and a fully linked layer. A feature map is used in the convolution layer to extract the features of the given image and compress the original image. The pooling layer is used to minimise the image's size. The ReLU layer is utilised as an activation function, determining whether the value of the activation function is within a given range. The model's final layer is the fully connected layer. It aggregates the results of all layers and uses the softmax function to assign probability to each output class.

The review paper is broken into sections, which are listed below. Section 1 provides the introduction, Section 2 the associated study, Section 3 the conclusion, and Section 4 the references.

2. Literature Review

This section contains information on previous research work that has been completed. Breast cancer is detected primarily using two approaches. The first is machine learning, and the second is deep learning. Many studies are carried out with the help of machine learning. However, machine learning techniques have some flaws that are addressed by deep learning. This section discusses machine learning and deep learning techniques.

Megha Rathi et al. [1] The model was presented utilising a hybrid technique based on machine learning. It used MRMR feature selection with four classifiers to find the best results for this method. The author employed four classifiers, SVM, Nave Bays, Function Tree, and End Meta, and compared them all. It discovered that SVM was an effective classifier. To obtain the best outcomes, **M. Tahmooresi et al. [2]** Another hybrid model based on machine learning was proposed. According to it, SVM was a good classifier with the highest accuracy of all. It had made a comparison of SVM, KNN, ANN, and decision tree. It was tested on photos and a blood dataset. As a result of this, **Muhammet Fatih Aslan et al. [3]** offered a machine learning model, but utilised a different classifier. The author employed Extreme Learning Machine, SVM, KNN, and ANN classifiers. To achieve better results, the classifier was tweaked slightly. According to this, the Extreme Learning Machine produced the best outcomes. **Anusha Bharat et al.[4]** Machine learning was used to develop the model. It employed four classifiers: SVM, decision tree (CART), KNN, and Nave bayes. According to the author, KNN provided the best accuracy. SVM has certain limitations. For binary variables, SVM produced the best results. As a result, Multi-SVM was employed. **Ebru Ayndindag Bayrak et al. [5]** The comparison of machine learning techniques has been completed. The comparison was carried out using WEKA and the dataset was the Wisconsin breast cancer dataset. According to the author, SVM performed best in performance matrices. Deep learning techniques were developed after machine learning to answer the difficulty of machine learning. **Shewtha K et al. [6]** The model is built on a deep learning-based convolution neural network. There were

various models that were under the CNN umbrella, but the ones that were used were Mobile Net and Inception V3. The author compared the two models and discovered that Inception V3 provided superior accuracy. However, there was still hope for using machine learning to treat breast cancer. **Ch. Shravya et al. [7]** The model was based on supervised machine learning. This study used classifiers such as Logistic Regression, SVM, and KNN. The dataset was obtained from the UCI repository, and performance analysis was performed. According to this, SVM was an excellent classifier with an accuracy of 92.7% on the Python platform. **Sivapriya J et al. [8]** proposed the model on machine learning but on different classifier. The Random Forest, SVM, Logistic Regression, and Nave Bays methods were used by the author. The implantation was carried out on the Anaconda Python Platform. Random Forest was determined to be a good classifier in terms of performance, with 99.76% accuracy. When there was a bit alteration in the network with the classifier, the accuracy may be improved. In this paper, **Kalyani Wadkar et al. [9]** The model was proposed using ANN, and its performance was evaluated using an SVM classifier. According to the author, ANN had a 97% accuracy rate while SVM had a 91% accuracy rate. The author also said that without SVM, it provided greater accuracy. **Vishal Deshwal et al. [10]** SVM based on models and Grid search were proposed. The author conducted the investigation using SVM first, and subsequently SVM with Grid search. The author conducted the comparison and determined the best option. The new model was constructed in comparison. The grid search produced higher precision. **S. Shamy et al. [11]** The model based on k-mean GMM and CNN was proposed. The author initially determined the ROI before employing the texture feature extraction method. Finally, He used the CNN algorithm to find the best results. The author's accuracy rate was 95.8%. The author's use of the MIAS dataset. **V Sansya Vijayam et al. [12]** Deep learning-based model was proposed. The author concentrated on Lloyd's clustering technique and CNN classification. The proposed methods attained a 96% accuracy. It employed histopathological pictures to make the diagnosis. Image processing and deep learning were also discussed in this work. **Puspanjali Mohapatra et al. [13]** suggested a deep learning-based algorithm for improving histopathology pictures. Many approaches for feature extraction were utilised in this paper, including PCA and LDA. The author also mentioned machine learning approaches, but because the dataset was vast, machine learning techniques did not produce improved results. That is why deep learning was applied in this case. It scored 81% accuracy using CNN. However, when the images were trained on GPU, the accuracy increased to 89%. **Chandra Churh Chatterjee et al**. **[14]** The deep residual neural network-based technique for IDC prediction was proposed. The author used histopathology pictures as a dataset. The author's accuracy was 99.29%, with an AUROC score of 0.9996. **Canh Phong Nguyen et al. [15]** developed a deep learning model in which the dataset was expanded to get the best accuracy. **R.Divya et al**. **[28]**] used a neural network to conduct a poll on breast cancer detection. She explored several strategies during the survey and discovered that the machine learning algorithm boosted the system's accuracy level. **Ayush Dogra et al. [29]** Based on the feedback, presented the model. The model was built using computer-assisted deep learning approaches. This study provided a concise overview of all recent deep learning trends. [29]. **M. Sornam et al. [30]** I conducted a poll on picture identification using a deep learning algorithm. It highlighted the most important aspects of the deep learning application. It provided crucial information about all subjects and demonstrated why deep learning algorithms produced better results. **Andrik Rampun et al. [31]** Using a diagnosis method such as a mammography, classify the breast lump. It classified using a convolution neural network. It worked on AlexNet's adjustment, and according to his research, a small modification could yield greater results. It used the activation function PReLu, which produced better results than Relu. The author focused on previous and current outcomes for breast cancer decision support and information management systems. The author used the CBISDDSM dataset. **Ahmet Kadir Arslan et al. [32**] The work on breast cancer classification was completed. It compared all CNN models and found the one with the highest accuracy. According to this, the Inception Recurrent Residual Convolutional Neural Network performed best. It also made use of the internet as an interface. The task was completed using R programming. **Yawen Xiao et al. [33]** The research was proposed based on an unsupervised feature extraction approach based on deep learning. This method was only used for feature extraction. Another tool utilised by the author was a stacked auto-encoder, which decreased the dimensions and provided more compact representations of the original data. The author employed SVM as a classifier. The University of California got the analysed data. **Alokkumar Jha et al. [34]** Genes were used to conduct research. It employed gene signatures to predict relapse in breast cancer. The author employed the GCNN (Graph Convolution Neural Network) model. In comparison to the previous algorithms, GCNN produced the best results. **S. Srirambabu et al. [35]** SVM classifier-based model was proposed. This study included numerous procedures such as picture improvement, segmentation, feature extraction, and finally the application of the SVM classifier. For that model, the MIAS database was employed. For noise reduction, a median filtering strategy was applied, while thresholding was used for segmentation. **Seyyid Ahmed Medjahed et al. [36]** The model based on k-nearest neighbours was proposed. The study used the Wisconsin Breast Cancer dataset to evaluate performance based on their distances. The author employed two distance formulas and obtained the accuracy based on their distance formulas. It achieved 98.70% accuracy for Euclidian distance and 98.48 accuracy for Manhattan distance. **BASAVRAJ HIREMATH et al. [37]** SVM classifier-based model was proposed. This model was built using mammography pictures and the difference

between Gaussian and Gaussian filters for detection. Only 75 mammographic pictures from the mini-mias dataset were used. This approach yielded an accuracy of 89.33%. **Varsha J. Gaikwad et al. [38]** SVM classifier was used to suggest a mammogram-based model. This research was carried out in stages. The first step was preprocessing, followed by ROI segmentation, feature extraction, and classification. The MIAS dataset was employed for this purpose, and the SVM provided the best accuracy. It attained an accuracy of 83%. **Tina Elizabeth Mathew et al. [39]** On breast cancer, a model based on a Decision Tree classifier was proposed. A decision tree was used to implement the Wisconsin breast cancer dataset. The article also discussed the nave Bayes tree and rotating forest for classification. The study was conducted on the WEKA environment. It also investigated and demonstrated the accuracy of adaptive boosting, bagging, boosting, and REPtree. **Deepa B G et al. [40]** presented a model based on classifier augmentations. The author used a breast cancer dataset and applied classification techniques to that dataset. The five classifiers were applied with and without the feature selection approach by the author. These feature selection approaches are primarily focused on correlation and information. Finally, it demonstrated the accuracy of these five classifiers when using and without feature selection approaches. **Badal Soni et al. [41]** The model was proposed based on classification techniques. On the Wisconsin breast cancer dataset, it used the random forest and support vector machine. Based on the train-test ratio, the acquired accuracy was 99.714%.. **Amandeep Kaur et al. [42]** The model was proposed using the Gene-Back propagation neural network algorithm. It also uses KPCA to extract features. The dataset was retrieved from the UCI Repository. The results were acquired using performance indicators such as sensitivity, specificity, and so on. Their true positive and true negative parameters were used to calculate their performance.

Table 1 Existing Related Work

Author & Ref.	Method	Findings	Dataset
Shubham Sharma et al. [16]	Random Forest, KNN and Naïve Bayes.	KNN was a good classifier in terms of accuracy.	Wisconsin Breast Cancer dataset from UCI Repository.
R. Preetha et al. [17]	Data Mining techniques	Detect the hidden cancer associated for classification.	Wisconsin breast cancer dataset.
Majid Nawaz et al. [18]	Deep Learning Convolution neural network	It got 95.4% accuracy when compared with state-of-art models and DenseCNN model used for this.	BreakHis Dataset is used
NareshKhuriwal et al. [19]	Deep learning	It achieved 98% accuracy by using CNN.	Mammogram MIAS database.
Ajay kumar et al. [20]	Classification techniques like SVM, KNN, Naïve Bayes and Decision Tree.	By using BCDW11, it gave 97.13% accuracy and using WBCD32, SVM gave 97.89% accuracy.	BCDW11 and WBCD32 dataset from UCI Repository.
Sri Hari Nallamala et al. [21]	Machine learning techniques	It achieved the 98.50% precision.	Wisconsin Breast Cancer dataset.
R.Chtihrakkannan, P.Kavitha et al. [22]	Machine learning techniques	It achieved 96% accuracy by using DNN.	Mammogram images.
Weal E.Fathy et al. [23]	Deep learning	It achieved 96% area under ROC and 99.8% sensitivity and 82.1% specificity.	Digital Database for Screening Mammography dataset.

Nikita Rane et al. [24]	Machine learning techniques	According to this, enhancement in machine learning gave better results.	Wisconsin Breast Cancer Dataset.
PanuwatMekha et al. [25]	Deep learning	The author compared the machine learning techniques and deep learning. It achieved the 96.99% accuracy with deep learning.	Breast Cancer Wisconsin dataset.
Mahmoud Khademi et al. [26]	Probabilistic Graphical models and deep belief network	It used the graphical model and deep belief network with manifold learning to find out the better accuracy.	Netherlands Cancer Institute dataset, METABRIC breast cancer dataset, Ljubljana breast cancer dataset and WDBC.
HUNGLE MINH et al. [27]	Deep feature fusion method	It achieved 95% accuracy in comparison of 4 cancer classes and 97.5% for differentiating two combined groups of classes.	Histopathology images dataset.

2.1. Discussion of Findings from Literature

From the table 1, It has been determined that the deep learning technique outperforms machine learning. The outcomes are calculated in various datasets with varying outputs. The machine learning algorithms produce superior results for the tabular dataset, but not for the pictures dataset. The research is carried out with the aid of some augmentation, which is a method for improving performance. Some enhancements to the dataset can also lead to improved performance. The research effort in this part is carried out via dataset enhancement and augmentation. It concluded from the [1] SVM was a good classifier when compared to hybrid approaches.. It concluded from [3] Among all the machines used, the extreme learning machine performed the best. From [4], It demonstrated that SVM does not perform better on many data sets. It performed better on binary data. From [6], The author analysed the two CNN models and discovered that Inception 3 outperformed Mobile Net. In paper [7], The author investigated supervised machine learning and discovered that SVM was an excellent classifier in terms of performance. From [8], The author experimented with various machine learning approaches and discovered that the Random Forest technique produced the best results. It obtained 99.76% precision. The author of [9] worked on two approaches, ANN and SVM, and discovered that ANN outperformed CNN. In paper

Application of Deep Learning

- Automated speech recognition
- Object detection
- Handwritten digit recognition
- Recommendation system
- Cancer detection
- Image recognition

4. Conclusion

Breast cancer identification is a difficult problem because it is the most common and dangerous disease. Breast cancer is becoming more common, and there is less possibility of recovery. Machine learning and deep learning techniques are utilised to diagnose breast cancer. According to prior studies, machine learning techniques produce better results in their respective fields. The prior research was carried out using a variety of machine learning approaches, with some enhancement and augmentation in the dataset for improved performance. However, it has been determined that machine learning produces better outcomes on linear data. Previous research has also indicated that when the data is in the form of images, the computer fails. An new technique is employed to overcome the problem of machine learning techniques. Deep learning is a relatively new approach that is widely employed in data science. CNN, a deep learning-based technique, is utilised to classify breast cancer imaging data. CNN mostly operates on picture datasets. Previous research has also indicated that CNN produces superior results than machine learning techniques.

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