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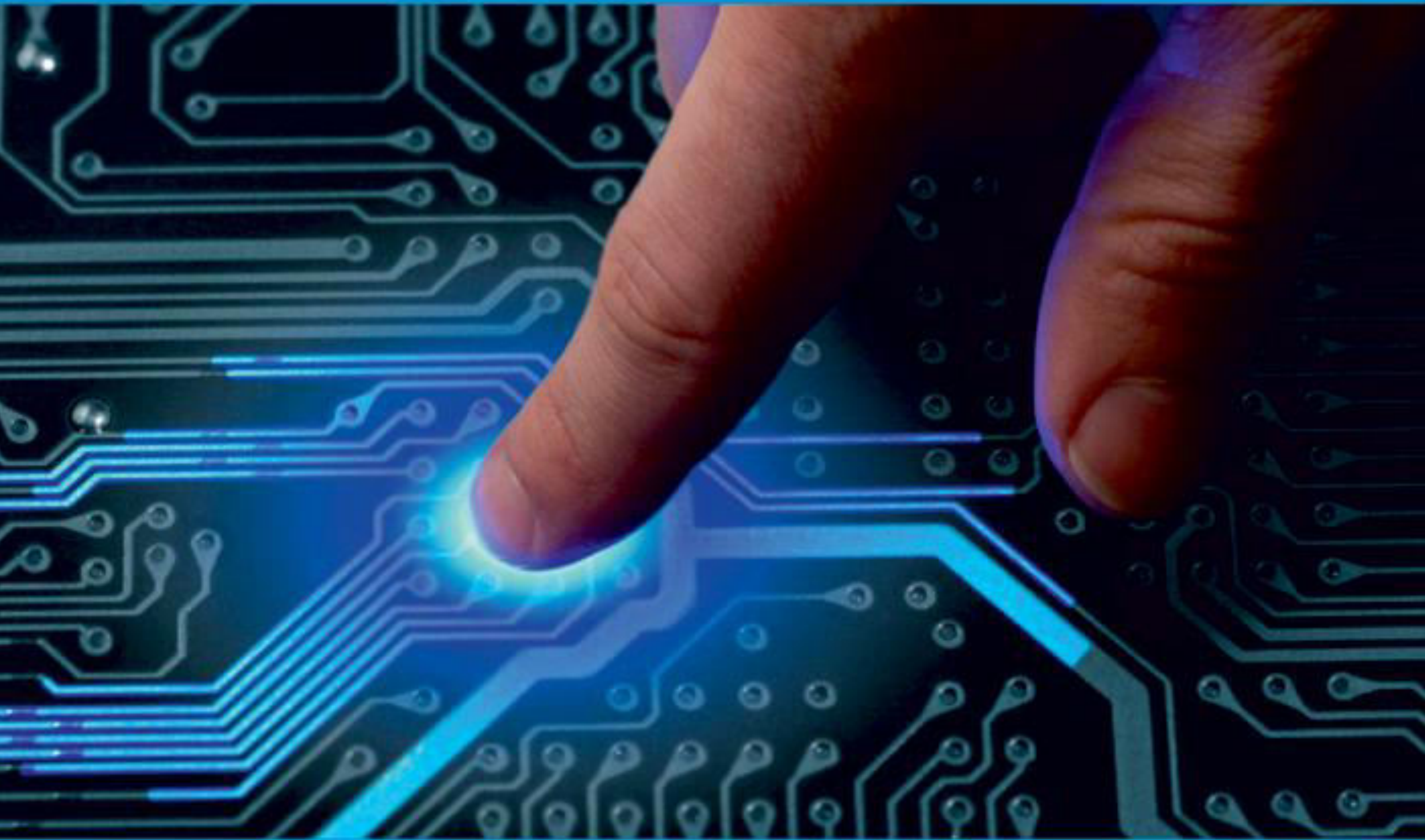

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Implementation Paper for Breast Cancer Classification using Deep Neural Network

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ABSTRACT - Millions of individuals throughout the world are affected by breast cancer, which is a dangerous and widespread illness. Effective treatment and better patient outcomes depend on early detection and precise diagnosis. Deep neural networks (DNNs) have recently demonstrated significant promise for the classification of breast cancer, particularly when trained on mammography data.We concentrate on the use of DNNs for breast cancer classification using the Wisconsin Breast Cancer (WBC) dataset in this survey report.

The WBC dataset, which includes fine-needle aspirate (FNA) samples from breast masses, is a commonly used benchmark dataset in the field of breast cancer research. We examine earlier research that employed DNNs to categorise breast cancer using the WBC dataset, and we provide an overview of the various methods that were applied. [3] Our study demonstrates that DNNs can successfully classify data from the WBC dataset, with some experiments reporting accuracy rates of up to 97%.

There are still concerns to be resolved, such as the need for more substantial and varied datasets, interpretable models, and overfitting-related problems. Overall, the WBC dataset's application of DNNs for breast cancer categorization has significant promise for enhancing breast cancer detection and care.[2]

KEYWORDS: Breast cancer, Classification, Deep neural networks (DNN), Wisconsin Breast Cancer dataset, Malignant, Benign, Early detection, Treatment, FNA fine-needle aspirate.

I. INTRODUCTION

Breast cancer is one of the most common cancers that affect women globally, and early detection is crucial to improving treatment outcomes and patient survival rates. [2] DNNs are one type of machine learning model that has demonstrated potential for improving the accuracy and efficacy of breast cancer classification, which can aid in the early detection and diagnosis of the condition.

Patient outcomes, healthcare costs, and access to breast cancer screening and treatment can all be improved by using DNNs to develop precise and efficient breast cancer classification models. Additionally, these models can help healthcare professionals make better informed decisions about patient care, which will ultimately lead to an improvement in healthcare systems.

The most common disease in women worldwide is breast cancer, which is a severe public health concern. Early detection and diagnosis of breast cancer can lead to more effective therapy and improved patient outcomes. In recent years, machine learning algorithms have been touted as an effective technique for classifying breast cancer. Deep neural networks (DNN) have excelled in this area due to its ability to discern complex relationships and patterns in high-dimensional data. The goal of this survey study is to provide a comprehensive analysis of the most recent research on DNN-based breast cancer classification.

The paper will showcase studies that used a variety of datasets, including the Wisconsin Breast Cancer (WBC) dataset, to classify breast cancer into benign or malignant categories using DNNs. The talk will cover a variety of topics, including the architecture of DNNs, feature selection, training and assessment procedures, and the performance of DNN models in contrast to other machine learning strategies. The survey article's opening will provide a broad overview of breast cancer and discuss the need for accurate and useful classification methods. The principles of DNNs

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and how they might be used to classify breast cancer will be discussed next. The report will include a critical overview of the literature, highlighting the major findings of prior studies and underlining their advantages and disadvantages.

The study will be completed by a discussion of potential directions for future research and how DNNs could improve the early identification and treatment of breast cancer. The ultimate objective of this survey work is to increase our understanding of how DNNs are used to categorise breast cancer and to offer recommendations for the development of machine learning models that are more accurate and efficient in this crucial area of research.

II. Problem Statement

Breast cancer (BC) is a serious medical issue that affects both sexes equally often around the world. Due to inexperience or insufficient review of medical information, practitioners may find it difficult to make the diagnosis of BC. False charges and inaccurate identification run the danger of having deadly effects for patients. In order to help practitioners correctly determine the presence of a malignant or benign tumour from several attributes acquired from breast tissue, precise and trustworthy prediction models are required.

However, the intricacy of the problem brought on by the diversity of tumour traits and the potential for false positives or negatives might result in erroneous diagnosis and subpar patient outcomes. Hence, the objective of breast cancer classification is to develop robust and dependable predictive models that can assist physicians in choosing the most suitable treatment approach for their patients.

Aim

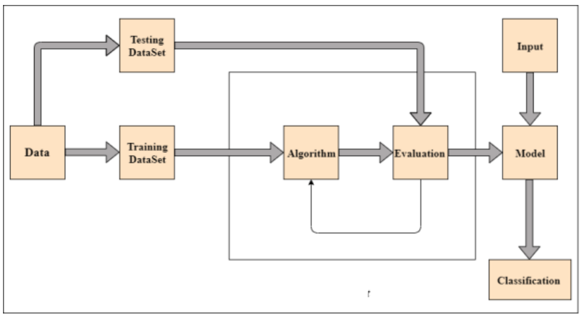
- Deep Neural Network (DNN) Objective will be used to identify and categorise Breast Cancer (BC) in this research.

Objective

- • To utilise a deep learning neural network system to identify breast cancer early.
- • To determine and use the proper BC Classification algorithm.
- • To create a methodology for identifying and categorising BC
- • To develop a GUI for BC categorization and self-analysis using DNN.

III. Related Work

One form of cancer that develops in the breast cells is breast cancer. It is the most prevalent cancer in women across the world and can also affect men. Age, genetics, family history, and way of life are just a few of the variables that might make breast cancer more likely to occur. In order to increase the likelihood of survival, early identification and treatment are essential.



radius_mean	radius_se	radius_worst
texture_mean	texture_se	texture_worst
perimeter_mean	perimeter_se	perimeter_worst
area_mean	area_se	area_worst
smoothness_mean	smoothness_se	smoothness_worst
compactness_mean	compactness_se	compactness_worst
concavity_mean	Concavity_se	Concavity_worst
concave points_mean	Concavity_points_se	Concavity_points_worst
symmetry_mean	Symmetry_se	Symmetry_worst
fractal_dimension_mean	Fraction_dimensional se	Fraction_dimensional

Fig- Working structure of our modelFig- The dataset values used as inputs in model

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This illustration shows a machine learning algorithm that can determine a breast tumour's malignancy or benignity based on the tumour's radius, texture, and perimeter. The programme uses a dataset of breast tumour sample with known diagnoses to discover patterns and connections between the characteristics and the diagnosis. Then, it is used to forecast the diagnosis of fresh, untested cancer samples.

The model goes through a number of processes to operate, including:

- The loading of the dataset of breast tumour sample data and the division of the diagnostic and characteristics into several arrays.
- The dataset was divided into a training set and a testing set.
- Normalising the dataset's characteristics to have a mean and standard deviation of 0 and 1, respectively.
- Using a machine learning algorithm (in this example, a deep learning machine), training the model on the training set.
- Comparing the model's predictions to the actual diagnosis to assess the model's accuracy on the testing set.
- Applying the taught algorithm to classify fresh, untested cancer samples.

The positive points about this code include its high accuracy in predicting breast tumour diagnoses (around 97%), its user-friendliness due to its simplicity in GUI , and its potential to aid medical professionals in diagnosing breast cancer.

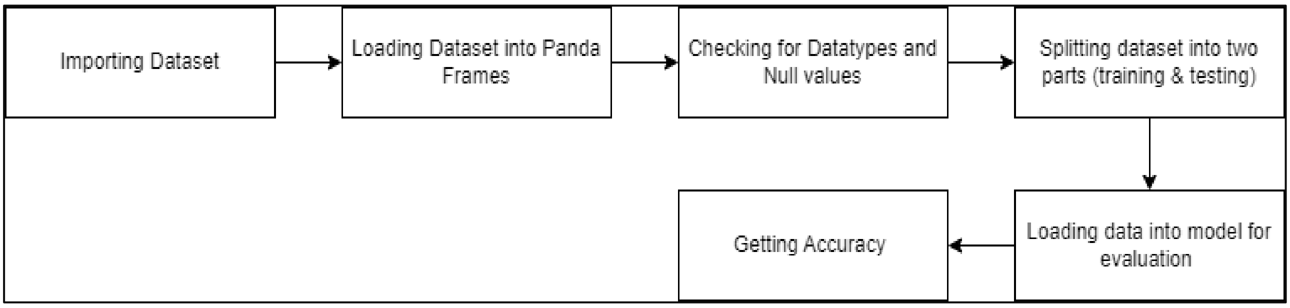

Fig - DFD for dataset

The Data Flow Diagram Level-0, where the procedure of dataset is been imported into model , loading it into frames , preprocessing the dataset , splitting the dataset into 80 – 20 splits , give the training and testing data into model for further evaluation and then getting the accuracy of the model.

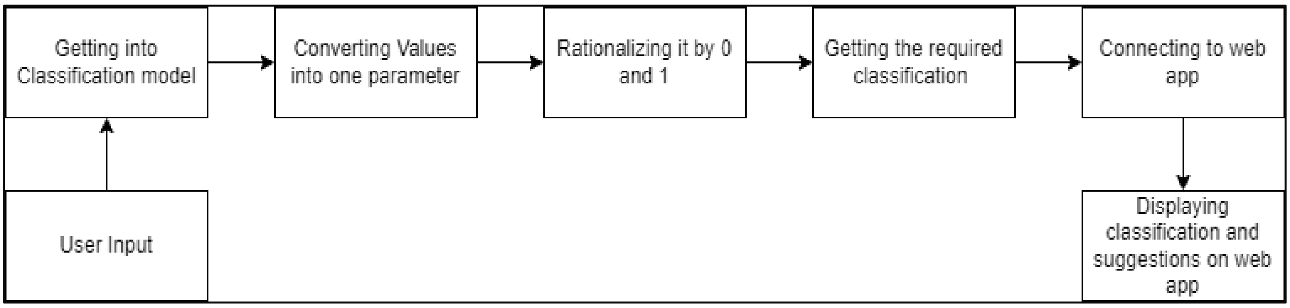

Fig - DFD for System Workflow

The above figure 9 shows that, how model will react after user input , how the data will get to classification mode , converting into one parameter with will be either 1 or 0 , then the model will be the classification and sending and displaying results on to web app

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ADAM (Adaptive Moment Estimation) Optimizer

A typical optimisation approach for updating the weights and bias in deep learning models during training is called Adam (Adaptive Moment Estimation). The stochastic gradient descent (SGD) method has been extended to employ an adjustable learning rate as opposed to a fixed learning rate.

Adam combines the advantages of the Adaptive Gradient technique (AdaGrad) and Root Mean Square Propagation (RMSProp) extensions of the SGD technique. It computes the exponential moving average of the first and second moments of the gradients to determine the adaptive learning rate for each parameter. This enables it to converge more quickly than traditional gradient descent methods and handle sparse gradients on noisy issues. Adam is an optimisation technique that is generally in use since it is effective and efficient at training deep neural networks.

Adam Optimization Algorithm Features

- The listed below are the features of using Adam on non-convex optimization issues -
- Implementation is straightforward.
- Effective in computing.
- No requires memory.
- Invariant of gradient diagonal rescale.
- Best suited for information or parameters-sized problems.
- Hyperparameter analysis is intuitive and usually requires minimal tuning.
- Adam combines the best AdaGrad and RMSProp algorithms properties to provide an optimization algorithm that can manage sparse gradients on noisy issues.
- Adam is relatively easy to customize, where the default configuration parameters cause most issues.

IV. PROJECT PURPOSE

The goal of the deep neural network project on breast cancer categorization is to create a computer-aided diagnostic (CAD) system that can automatically diagnose breast cancer. Deep neural networks (DNNs) are used by the system as a classifier model to categorise histopathological pictures of breast tissue into benign or cancerous groups. The DNNs are taught the patterns and characteristics that discriminate between benign and malignant breast tissue using a sizable collection of histopathology photos. Additionally, the project selects features using recursive feature elimination (RFE). Using RFE, the most crucial characteristics from the input data that have the greatest impact on classification accuracy are chosen. This makes the model simpler and increases its effectiveness.

This research seeks to increase the efficacy and precision of breast cancer diagnosis. Medical personnel may diagnose patients more quickly and accurately by automating the process using a CAD system, which improves patient treatment outcomes. Additionally, a more effective diagnosis procedure can ease the strain on healthcare infrastructure and increase patient access to care. Overall, the effort on deep neural network-based breast cancer categorization has the potential to completely change how the disease is identified and treated. It is a promising use of deep learning in the medical industry, and if it is successful, millions of women's lives throughout the world might be significantly improved.

V. EXPERIMENTAL RESULTS

Step 1: Enter the FNA values obtained from breast clot into the web application
Step 2: Model process values as input and then classify the values using model evaluation.

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Fig. 15: Dashboard

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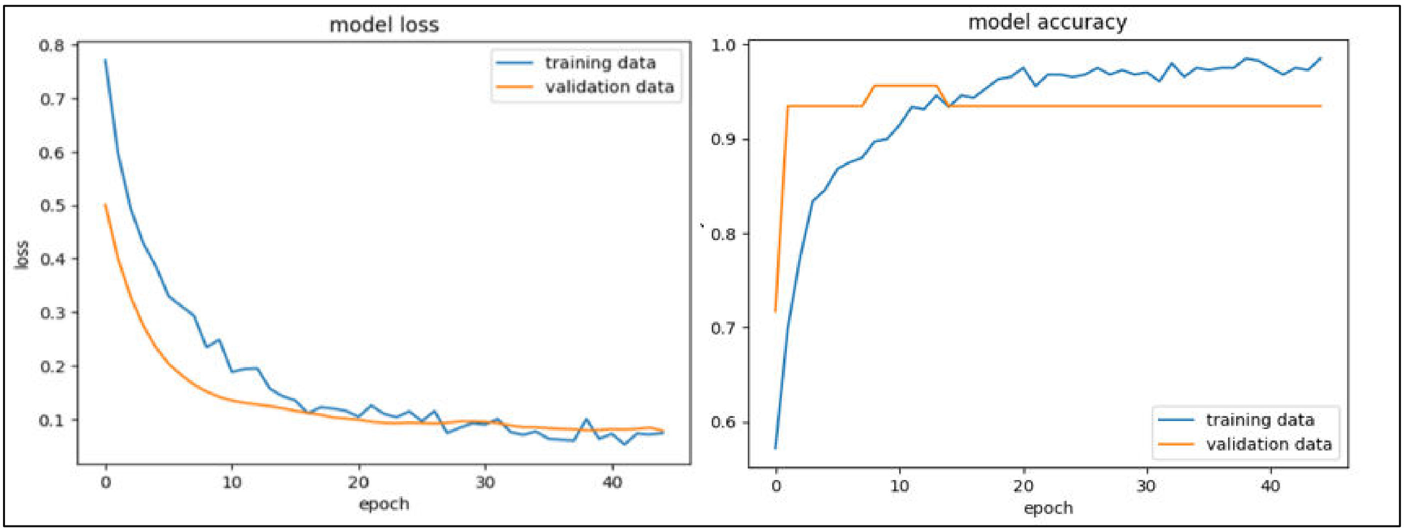
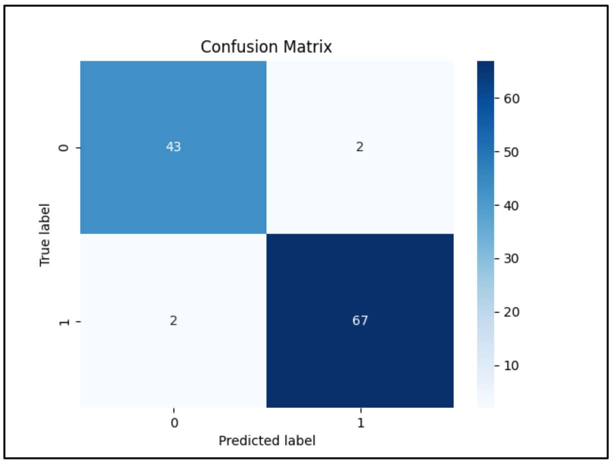


Fig – Loss and Accuracy Metrics for our Model

The loss and accuracy denote the loss and the accuracy of our model while testing model using testing dataset and shows the accuracy of the model which in this case it is 93.07 percent. It also shows the efficiency of the model and how it is responding while training of epochs.



The confusion matrix denotes the accuracy of model on the basic of TP (True positive) ,FP (False Positive) , FN (False Negative) , and TN (True Negative).Here in our case the confusion matrix displays the higher number of TP and TN which shows the Positive working of the model .

VI. Future Scope

The future scope for breast cancer classification using deep neural network is vast and promising. Here are some potential avenues for further research and development:

- Integration with other diagnostic tools: To give a more thorough and precise diagnosis, deep neural networks may be combined with other diagnostic methods, such as genetic testing.
- Deep learning algorithms may be used to create personalised treatment regimens that are adapted to the particular features of each patient's cancer by analysing genetic and molecular data.

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- Early detection: By using deep neural networks to examine mammograms and other medical pictures for the earliest indications of breast cancer, the disease may be discovered and treated sooner.
- Mobile and telemedicine apps: By using deep learning algorithms, these applications might provide rapid and accurate breast cancer diagnosis to patients in rural or underserved locations.
- Multi-class classification: While current research focuses on binary classification (malignant vs. benign), there is scope for deep neural networks to be developed and trained to classify tumors into multiple categories, such as ductal carcinoma in situ, invasive ductal carcinoma, and invasive lobular carcinoma.

VII. CONCLUSION

In conclusion, the use of deep neural networks for breast cancer classification shows great promise in improving diagnostic accuracy and patient outcomes. By analyzing large datasets of medical images, these networks can learn to identify patterns and make accurate predictions, potentially assisting radiologists in making more efficient and accurate diagnoses. Ongoing research in this area is exploring the use of deep learning for predicting breast cancer risk and analyzing genetic and molecular data to inform personalized treatment plans. With continued advancements in this field, we can hope to see even greater progress in the fight against breast cancer.

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