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Web Application to Predict Breast Cancer Using Artificial Neural Network Back Propagation

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ABSTRACT: Since a few years ago, cancer has been regarded as the illness that kills the most people. Breast cancer has been increasing at an alarming rate in women in recent years. One of the terrible diseases and the second-biggest cause of mortality for women is breast cancer. Not all general hospitals have the necessary infrastructure for manual detection via mammography. Thus, a computerized automatic diagnosis system should be designed for early detection. To solve this issue, we turned to artificial neural networks for deep learning. We used the Wisconsin Diagnostic Breast Cancer (WBCD) dataset from the UCI repository to create a model that will predict if a person has breast cancer or not. The correctness of the system is the primary priority in the healthcare industry. Someone's death could result from an erroneous forecast. The potential for this technology to be developed as an intelligent element in medical decision-support systems is considerable.

KEYWORDS: Deep learning, Artificial Neural Network, Breast Cancer, Medical Decision Support System.

I. INTRODUCTION

One of the most prevalent illnesses that cause women to pass away is breast cancer. Tumor classification can be used to identify breast cancer. Malignant and benign tumors are two different types of tumors. To differentiate between various malignancies, doctors require a trustworthy diagnosis process. Yet even for professionals, it is typically exceedingly challenging to differentiate malignancies. In order to diagnose, a diagnostic system has to be automated. Breast cancer has always had a high incidence rate and fatality rate due to it being the most common cancer in women. According to the most recent cancer statistics, breast cancer alone is anticipated to be responsible for 15% of all cancer deaths among women globally and 25% of all new cancer diagnoses in women. Most patients contact their doctor as soon as they notice any sign or symptom, and if necessary, they may be sent to an oncologist. The oncologist thoroughly reviews the patient's medical history, examines both breasts, and checks for any swollen or hardened lymph nodes in the armpit to determine whether breast cancer is present. The Wisconsin Breast Cancer Dataset (WBCD) of fine needle aspiration biopsy was utilized for this study, and using the dataset, the deep learning algorithm was applied to determine if the patient had breast cancer or not. For the purpose of predicting breast cancer, we are using an artificial neural network technique based on the web.

II. RELATED WORK

The breast cancer data set has been developed by the UCI, and the data set is present in the machine learning repository of the UCI. The data collected by UCI has 569 instances and 32 attributes. The data has been used by various groups of people to predict breast cancer using various methods[1]. The breast cancer prediction model has been developed using deep learning algorithms and can be deployed either in a web application or a mobile application.[2]. In [3], the authors have compared the deep learning algorithms with algorithms like K nearest neighbors, support vector machines, random forests, and many more, and it is mentioned that neural networks are giving better results compared to machine learning. In [4], the authors have even compared the algorithms of machine learning with those of deep learning, and the



ANN gives the highest accuracy of 99.3%, and neural networks are performing better than the machine learning because of the activation functions. The authors in [5] have developed the web application for breast cancer prediction by comparing various machine learning models, and they have found that XGBoost Classifier has the highest accuracy. The authors in [6] have developed a model for breast cancer prediction using the artificial neural network back propagation method, and it is considered to have great accuracy. The authors in [7] have developed the prognosis and diagnosis prediction of cancer and have predicted many cancers.

III. METHODOLOGY

The procedure used in this investigation was carried out in a number of phases. The first phase of doing a literature review involves looking for sources related to artificial neural network research using back propagation techniques. The following phase is problem formulation, which is designed to describe the issues encountered as a guide for locating solutions. Data gathering and processing are done in the third step. The information used in this study may be found in the Wisconsin Breast Cancer UCI Machine Learning Data. As the data obtained from this website has been cleansed, it may be used directly without previously undergoing any pre-processing, feature extraction, or categorization. The validity and accuracy of the classifier may be impacted by these facts.

The average (mean), standard error (SE), and worst of 10 variables are used in the system design. Each variable includes the following properties: radius, texture, perimeter, area, smoothness, density, concavity, concave point, symmetry, and fractal dimensions. The output is divided into two categories: benign cancer and malignant cancer. The stages of system design are often divided into three categories: input (30 variables), use of an artificial neural network and the back propagation method, and output (benign or malignant cancer).

Backpropagation, which stands for "backward propagation of mistakes," is a gradient descent-based supervised learning approach for artificial neural networks. The approach determines the gradient of the error function with regard to the weights of the artificial neural network, given an error function and an artificial neural network. Figure 1 shows how back propagation works.

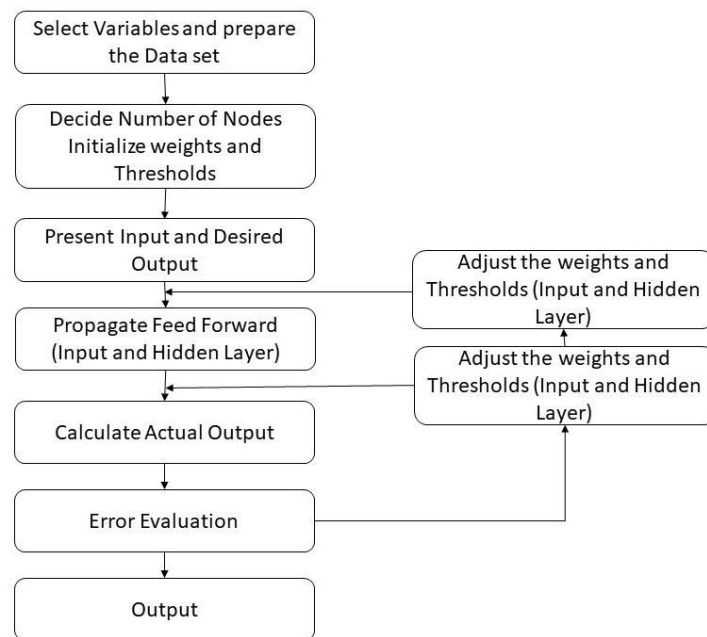


Figure 1

The neural network is constructed using two hidden layers, two activation RELUs in the hidden layers, and an activation sigmoid in the output layer. The RELU formula is $f(x)=\max(0,x)$. Typically, this is applied element-by-element to the result of another function, such as the product of a matrix and a vector. Rectifier units replace all other



activation functions in MLP implementations, with the possible exception of the readout layer. But if you wanted to, I guess you could mix and match them. ReLUs can enhance neural networks by accelerating training. Calculating the gradient is extremely easy (either 0 or 1, depending on the sign of x). Moreover, a ReLU's computation phase is simple: all negative components are set to 0.0, requiring no use of exponential functions or multiplication or division operations. The positive part of the ReLU is lower than the logistic and hyperbolic tangent network gradients. This implies that while training goes on, the positive component updates more quickly. Yet there is a price to pay for this. Modified ReLU units like ELU (or Leaky ReLU, etc.) can reduce this issue in the 0 gradient on the left-hand side, which has its own issue known as "dead neurons," in which a gradient update assigns the incoming values to a ReLU so that the output is always zero. The sigmoid function is used when there is a classification problem with two types of results. (The submax function is used for three or more classification results.)

IV. EXPERIMENTAL RESULTS

The UCI data will be used to test and train new data. The test data is 57, whereas the training data is 512. There are 357 benign cancer cases and 212 malignant cancer cases. The epoch is 150, the batch size is 100, and the model accuracy varies from 98 to 100% with this amount of training and testing the data. 90% of the data has been trained, and 10% of the data has been tested. The neural network is constructed using two hidden layers, two activation RELUs, and an activation sigmoid in the output layer. Figure 2 shows the heatmap of the test data.

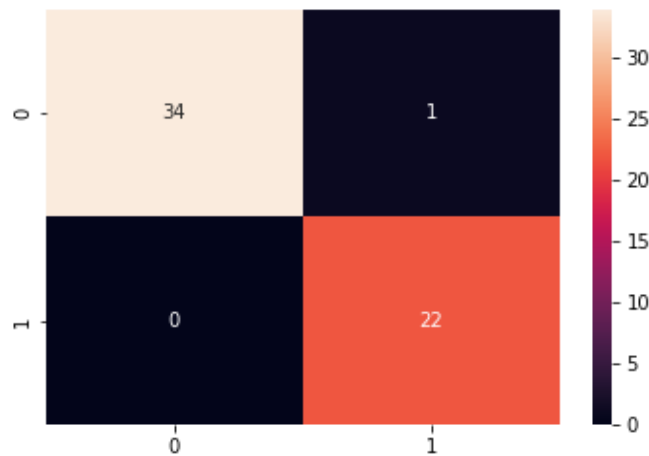
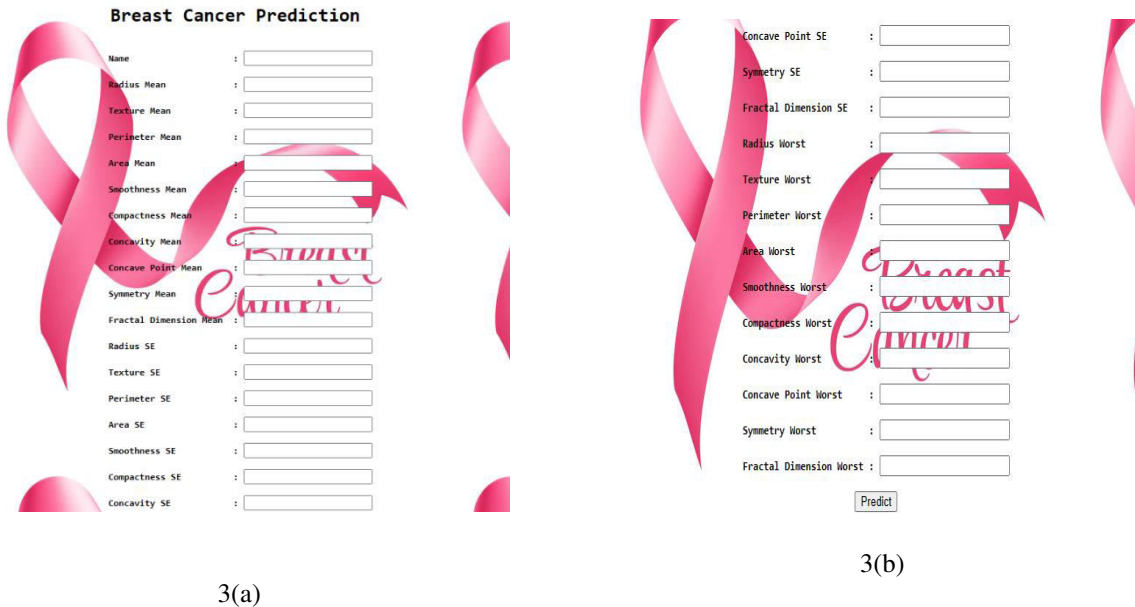


Figure 2

The model uses 30 input variables, and the 30 input variables are worst, mean, standard error of radius, texture, perimeter, area, smoothness, compactness, concavity, concave point, symmetry, and fractal dimensions. The model connects with a web page where the model is used to predict whether a cancer is malignant or benign. Flask is used to connect the model with the front end and make the web page user-friendly. The inputs are taken from the user using the webpage, and they are used to predict breast cancer (Figures 3(a) and 3(b)).



The user will enter the inputs as indicated in Figures 3(a) and 3(b), and after receiving the inputs, the user will submit the information by clicking the predict button. After the user hits the button, the model will predict the type of cancer. The outputs will show the type of cancer and its effects on a new web page.

V. CONCLUSION

Accuracy is critical in the medical domain because it saves people's lives, so we used Artificial Neural Network back propagation to achieve maximum accuracy. The conclusion of the study using the Wisconsin dataset from the UCI repository reveals that the total number of patients with breast cancer data is 569 with 30 variables, which have been divided into 212 malignant cancers and 357 benign cancers. This is consistent with the study results and discussion on breast cancer prediction via the back propagation neural network algorithm. 90% of the data is trained, and 10% of the data is tested. There are two hidden layers, and the activation of the two hidden layers is ReLU, while the activation of the output layer is sigmoid. The accuracy of the model is 98.24%, and the system is user-friendly using flask and pickle. By entering the features, we can easily predict the type of cancer. The web application helps the users to access the results from any system after the final needle aspiration method. The artificial neural network produces better accuracy using the activation functions.

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