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Multiple critical disease detection using deep learning model

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ABSTRACT
Diseases become critical diseases when we do not take care of them in the very primary stage. There are several critical diseases all can be detected in an automated way using different deep learning models with the help of the flask web app. Out of that this research studies 10 diseases like Pneumonia, Malaria, Alzheimer's, Covid, Brain tumour, Heart disease, Diabetes, Breast cancer, kidney disease, and Dengue. Pneumonia & Alzheimer's disease is detected using Dense Net model with accuracy of 95.67% and 97.77% respectively. Malaria, Covid, Brain tumour disease are detected using Resnet 50 model with accuracy of 99.60%,95.57%,96.69% respectively. Heart disease, Diabetes, Breast cancer, kidney disease detected using deep ANN model and accuracy got is 85.54%,78.86%,96.49% and 85.09% respectively. Dengue disease is detected using deep CNN model and accuracy got is 99.75%.

KEYWORDS
Driver smoking; feature selection; logistic regression; support vector classifier

1. INTRODUCTION

Critical diseases are the most hazardous diseases if we do not take attention to the disease at an early stage then that becomes very complex, and the patient may not survive, or some parts of the body are badly affected due to the disease and that body part can be permanently damaged.

There are near about 32 critical diseases available that are categorized as critical diseases but there are some diseases that we do not take care of at the very beginning then that become critical diseases. This research uses both types of diseases that are already known as critical diseases and other diseases which become critical if not taken precautions at a primary stage.

In an existing study, doctors check the patients physically according to their timing, and if the doctor feels some critical symptoms present in the patient's body, then the doctor sends the patient to the pathology lab or diagnostic centre. The patient gets the report from the lab and again patient goes to the hospital. Due to distance, the time required, and a lot of rush in the hospital patient avoids going to the hospital. Sometimes patient also does not get appointment according to their timing so patients avoid going to hospitals.

This research may be useful to detect the disease at anytime and anywhere using the flask web application with the help of different deep learning models. This application can be used to detect the 10 diseases like Pneumonia, Malaria, Alzheimer's, Covid, Brain tumour, Heart disease, Diabetes, Breast cancer, kidney disease, and Dengue currently.

If you want to add any disease that can be added int this web application. There are a number of research done so far before this web application but no there is no application that detects 10 diseases at the same time using a deep learning model. There are some applications like multi diseases, but these applications use machine learning techniques and only 4 to 5 diseases are detected using these applications.

Machine learning application has accuracy, but it needs to select input features that are most important manually. Machine learning uses fewer layers to train the network so accuracy may get affected that's why deep learning models are used to train the network automatically using CNN models and use more layers as we go deep more, we get the accuracy in the deep learning model.

Currently, some doctors or diagnostic centres, etc. use Computer-aided systems to diagnose the patient correctly. Doctors use computer-aided systems to confirm the disease if they feel the patient may suffer from the disease, they give instructions to do some kind of tests based on that test and the CAD system doctors confirm the disease. But doctors use only one application for one disease which is also costly. If any patient wants to diagnose many diseases at the same time it is not possible to use these kinds of applications.

This research detects 10 diseases at the same time using a single platform. This works like a super specialty hospital in which patients get the facility of treating many diseases under one roof. Using this web application one can detect nearly diseases neatly and correctly.

The major drawback of this web application is it only works when you have some kinds of reports like blood reports, X-Ray, MRIs, Cell images, blood reports, etc. without reports this web application has no use. Another drawback of this web application is it will be used only in the primary stage of the disease that's why if the disease becomes critical it is suggested that not to use this web application.

Many researchers work on diagnosing the diseases but they either use the image dataset to diagnose the disease or the CSV dataset, but no application will use both kinds of datasets at the same time using one application. As well, 10 diseases can be detected using a single application which saves a lot of money. So, this research produced low-cost applications using deep learning methods.

This research will be beneficial for doctors, pathologists, radiologists as well as health care industries to diagnose the disease only at the primary stage. This research saves a lot of time to go to the hospital, take an appointment with the doctors, waiting time of checking and after that go to the diagnostic centre or pathology lab and after giving samples or get the reports and again go to the hospital and waiting to show the reports to doctors and get prescription from the doctors.

The main objective of this research is to develop a low-cost application that can detect multiple diseases on the same platform easily and correctly. Besides the main objective research has some other subsidiary objectives that as developing a module that will detect the disease using an image dataset. Another objective is to develop a module that will detect the disease using a CSV dataset.

2. LITERATURE REVIEW

Many researchers did research on disease detection but, none of them detects 10 critical diseases at the same time which can be run any time anywhere using the flask web app and deep learning model. Previous researchers use 4 to 5 diseases in the flask web app, and they use the machine learning model.

Yaganteeswarudu [1], detects the diabetes, heart disease, diabetic retinopathy, and breast cancer disease using a machine learning model. The author uses logistic regression, naïve bays classification, SVM, decision tree algorithm, and Random Forest algorithms are used to diagnose the disease all logistic regression gives 92% accuracy for diabetes, for heart disease random forest gives 95% accuracy and for breast cancer detection SVM gives 96% accuracy.

N. Ansari, and et.al., [2], uses Resnet 50 model to train the model and use 2 kinds of dataset namely chest X-ray dataset and RSNA dataset. Out of two different datasets accuracy of RSNA dataset is more compared to Chest X-ray dataset.

K. M. Shuaib, and et.al., [3], uses CNN model to make a web app and detects the pneumonia disease using chest x-ray dataset with 84% accuracy.

Shah and Anchor [4], uses Resnet 50 model which gives 95% of accuracy when trained on cell images dataset. Author mainly concentrated on some features such as colour, size and shape to detect the malaria disease more accurately using cell images.

P. Tambe, and et.al., [5], uses 4 different deep learning models to detect the Alzheimer disease namely CNN, VGG16, Dense net, Resnet 50 out of that VGG16 gives more accuracy. So, author uses VGG16 model to deploy into the flask web app to detect the disease accurately.

K. N. Qodri, and et.al., [6], uses 6 deep learning models like ResNet50, NASNet Large, Xception, DesNet192, VGG16 and VGG19 out of these models ResNet50 and VGG16 model gives more accuracy compared to other models so these models are used to detect the brain tumour using MRI image dataset.

V. Shah, and et.al., [7], uses CT Scan image dataset with VGG19, ResNet50, Inception V3, DenseNet169 deep learning models out of that VGG19 gives more accuracy about 94.52% to detect the covid disease accurately.

R. M. Philip and et.al., [8], uses SVM and two-layer feed forward network. This 2-layer feed forward network has more accuracy than SVM method. This research is also employed with CNN model to detect the dengue disease accurately.

I. Ibrahim Iliyas and et.al.,[9], uses deep neural network to detect the chronic disease with accuracy of 98% and author also gives information about bio carbonate and creatinine features are most important when detecting the chronic kidney disease.

S. Srivastava and et.al., [10], uses Pima Indian dataset for diabetes prediction. Author uses ANN model from machine leaning technique to detect the disease more accurately. ANN gives 92% accuracy.

A. Rufai and et.al., [11], the author detect patient's coronary artery heart disease current condition. Multiplayer perceptron is used to diagnose the patient. Author tries other techniques, but Multilayer perceptron gives more accuracy that is about 92.2%. So, author uses ANN model to detect the heart disease.

K. Wadkar and et.al., [12], uses different techniques like CNN, KNN, Inception V3, SVM and ANN for classifying the disease of that ANN model gives more accuracy amongst other so author uses ANN model to detect the breast cancer disease accurately.

3. METHODOLOGY

In the research 10, critical diseases are detected using different deep models like the deep ANN model, CNN model, pre-trained models like Resnet-50, Dense net, VGG 16, etc. Out of 10 diseases, 5 diseases can be detected using the image dataset and 5 diseases can be detected via the CSV dataset.

Five diseases that can be diagnosed with the help of the image dataset are Pneumonia, Malaria, Brain Tumour, Alzheimer & Covid [13-17]. The remaining five diseases like Diabetes, Heart disease, Chronic Kidney disease, Brest cancer & Dengue disease.

All the diseases which are having image datasets are detected using CNN pre-trained models like Resnet 50, Dense net, VGG 16, etc., and some of them are detected using transfer learning techniques. All the diseases which are having CSV datasets are detected using the deep ANN model or CNN model.

All 10 datasets which are required to detect the diseases are secondary datasets that are collected from the well-known website Kaggle. If a dataset is of image type, then all the images are reshaped or resized and the data augmentation process is used to increase the possibility of images using zooming the image, flipping the image, rotating the image, and many other views of images to detect the disease more accurately by applying training to a different view of the image[18- 23]. Images are divided into train and test folder that is splitting the folder. Train folder images are used for training the images and test folder images are used to test or evaluate the correctness of the disease that is the model gives the correct result or not. If a dataset is of CSV dataset, then data preprocessing techniques like finding missing values, duplicate values, categorical data detecting overfitting issues, up sampling and down-sampling issues, etc. are searched and solved in this research. To avoid outlier problem dropout technique is used.

After the data preprocessing technique, the dataset is split into train and test data. For training, 80 % of data is used and for testing data purposes 20% of data is used. And for image and CSV dataset disease detection Keras framework is used as a front end and Tensor flow is used as a backend. A sequential model from the Keras framework is used to create the model. The model is trained using the model fit method [24- 26]. Below figures Figure.1 and Figure.3 shows the overall architecture or flow of research work. Figure1. Shows the process flow when we use image type dataset. In that if you want to detect any kind of disease firstly you have to select the input image for training then we can apply some image preprocessing steps like resizing or reshaping the size of image or data augmentation process and after that we train the images using either DenseNet model in the Pneumonia or Alzheimer detection and ResNet 50 model in case of Brain tumour, Malaria or covid detection and trained the model and evaluate its performance and then model is saved and loaded into flask to get output.
In Figure.3 CSV dataset is used for disease detection which reads dataset and done some data preprocessing tasks and after that data is split into train and test then we select deep ANN or for dengue disease detection deep CNN model is used. That model is saved and loaded into flask app to get the output.

Fig. 1 Image dataset disease detection architecture.

4. EXPERIMENTAL RESULTS

Following figures from Fig.2, 4 to 22 shows accuracy and loss of different diseases by applying different models so accuracy and loss we got is also different which is shown in figures.

4.1 Pneumonia Detection

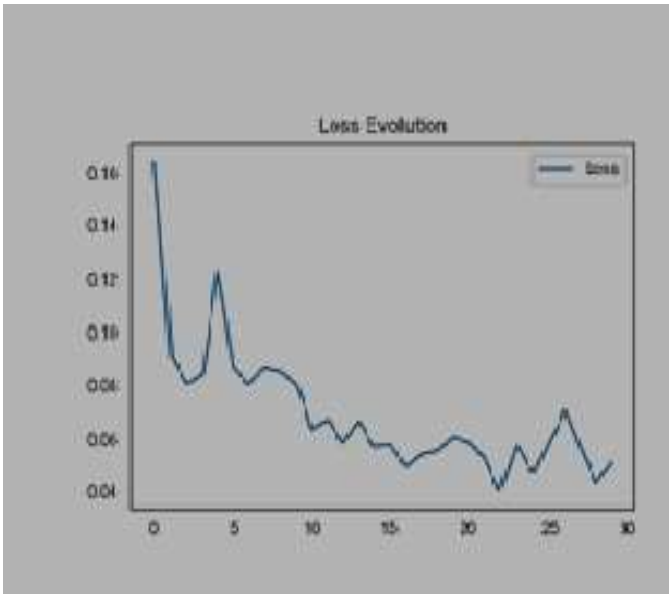


Fig. 2 Loss after applying Dense Net model.

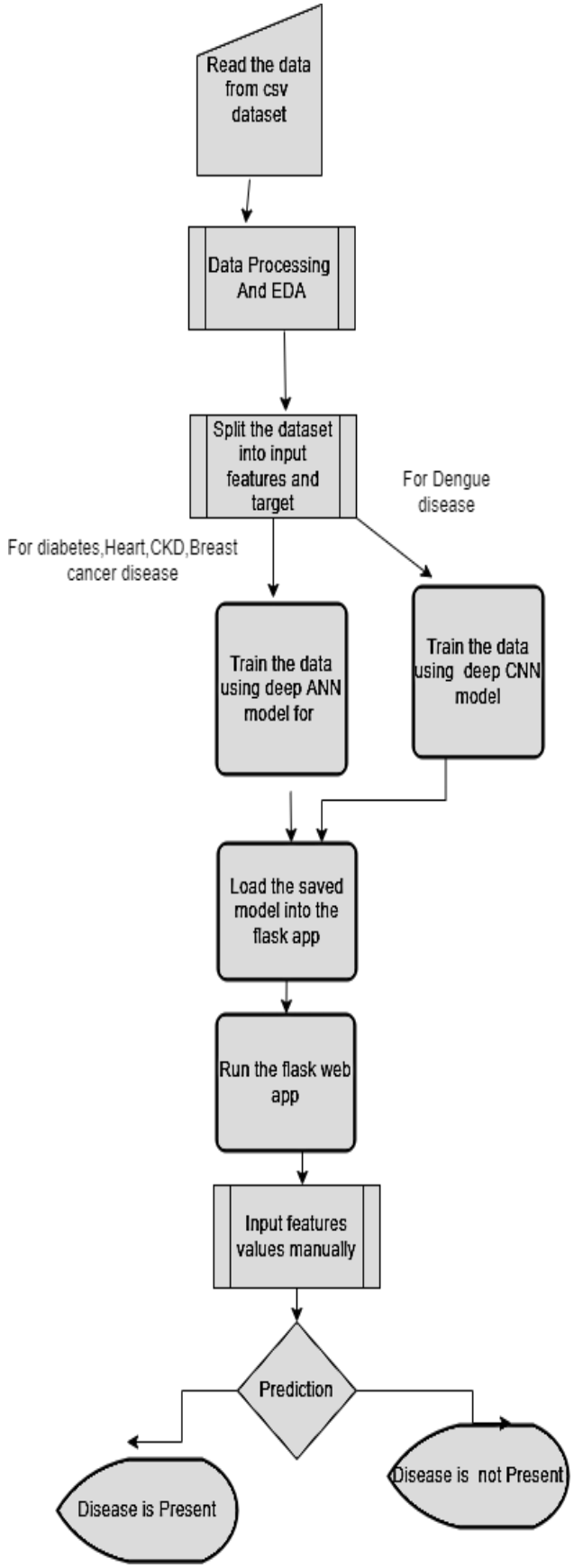


Fig. 3 Architecture for CSV dataset.

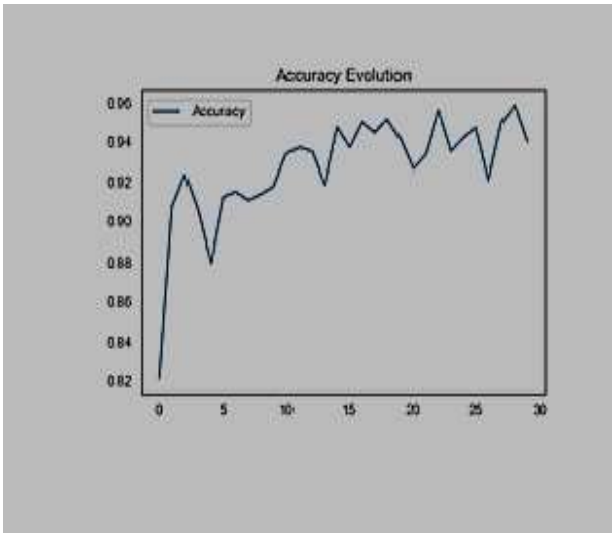


Fig. 4 Accuracy after applying Dense Net

4.2 Malaria detection

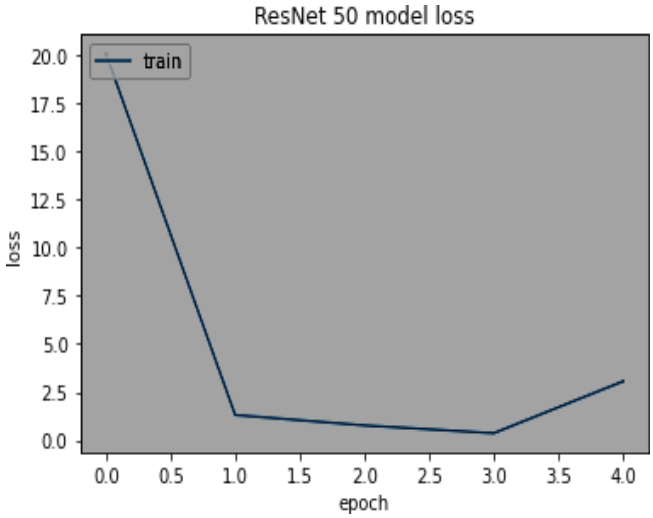


Fig. 5 Loss after applying ResNet 50 model.

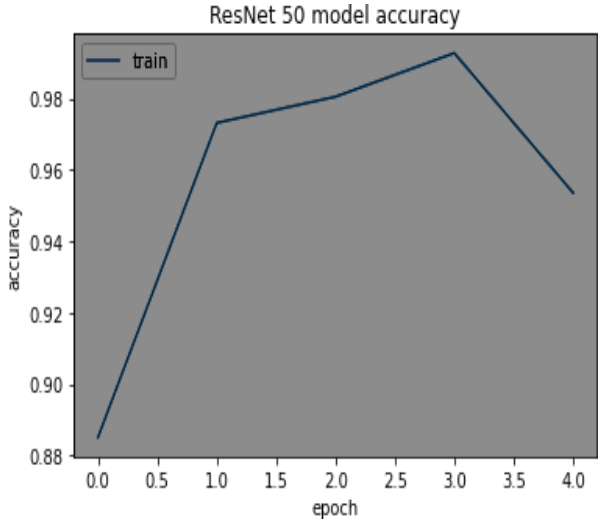


Fig. 6 Accuracy after ResNet 50 model

4.3 Alzheimer detection

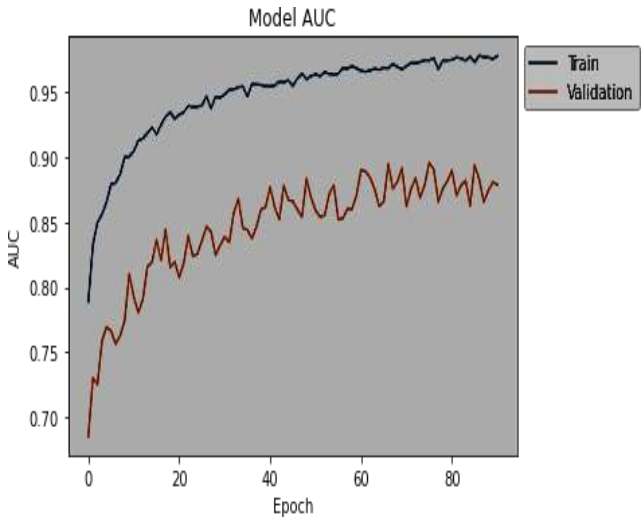


Fig. 7 Accuracy using Dense Net model.

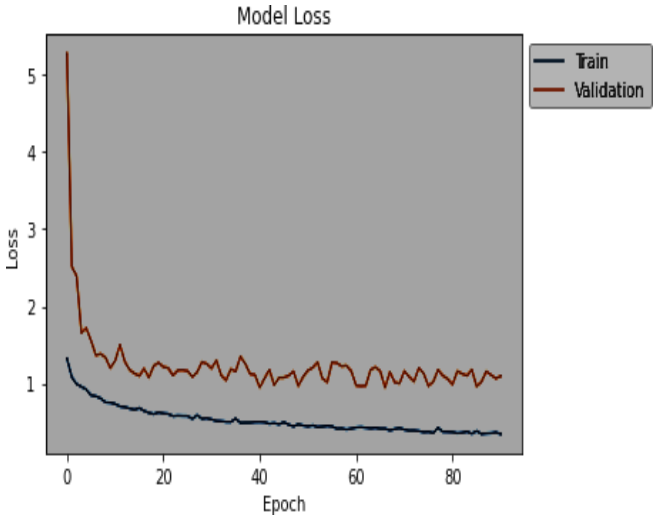


Fig. 8 Loss after applying Dense net.

4.4 Brain Tumour

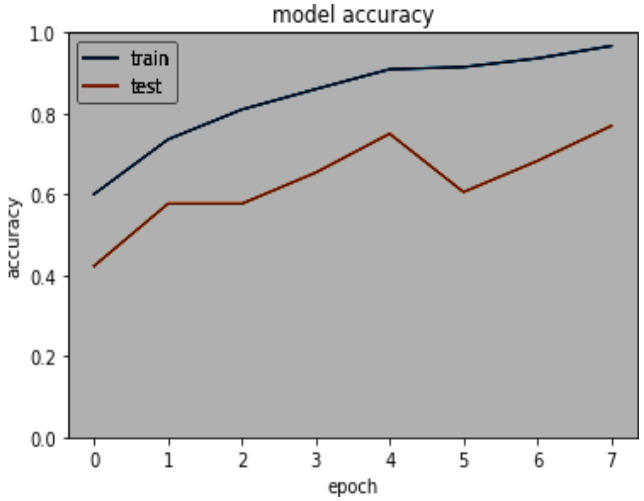


Fig. 9 Loss after applying ResNet 50 model.

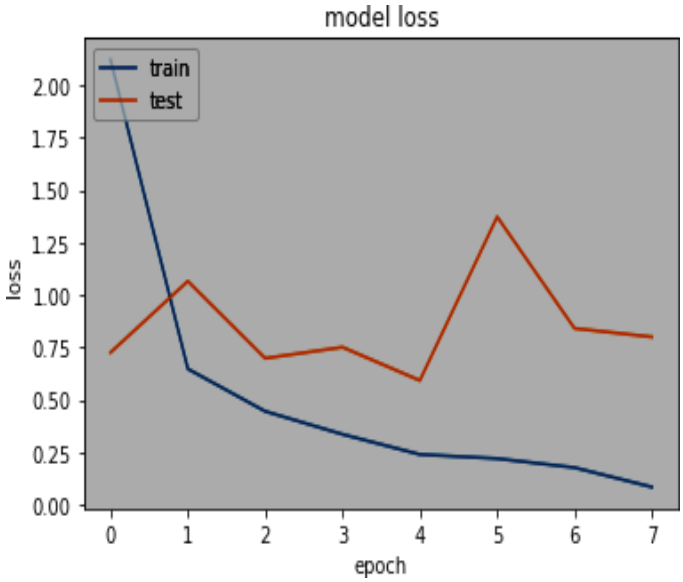


Fig. 10 Accuracy after ResNet 50 model

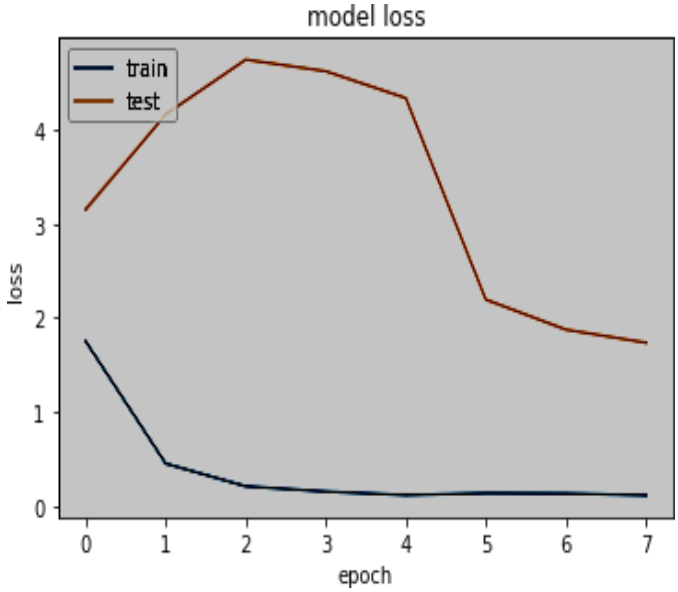


Fig. 11 Accuracy after applying ResNet 50 model.

4.5 Covid

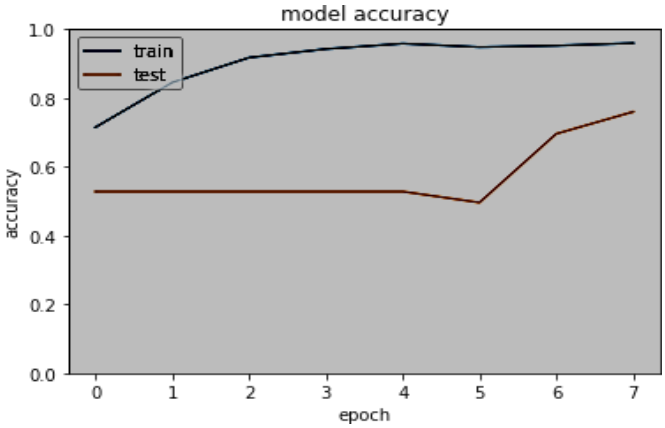
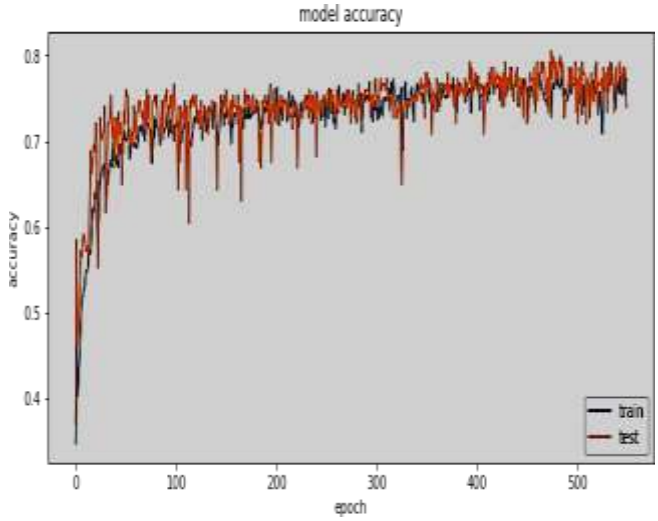


Fig. 12 Loss after applying ResNet 50 model.

4.6 Diabetes



. Fig. 13 Model Accuracy after ANN model

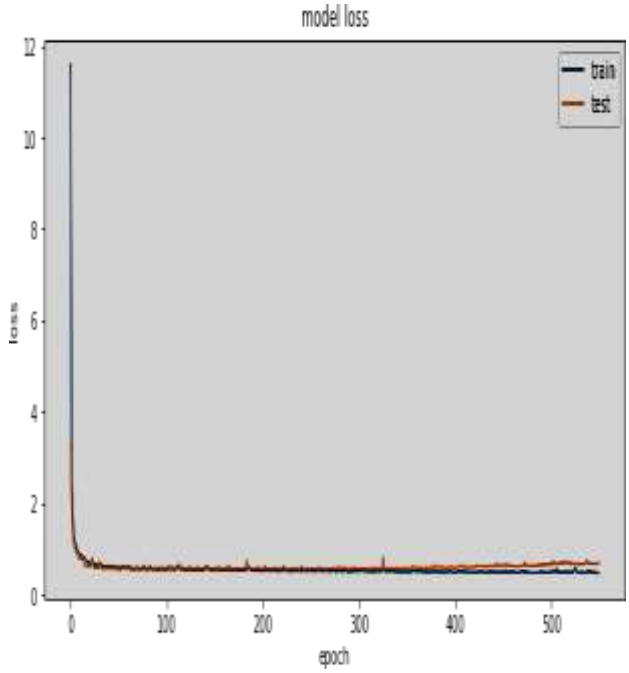


Fig. 14 Model Loss after ANN

4.7 Heart Disease Detection

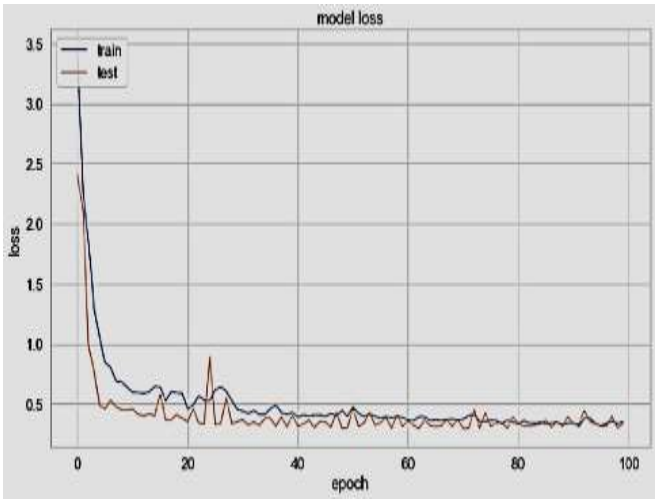


Fig. 15 Loss after applying deep ANN model

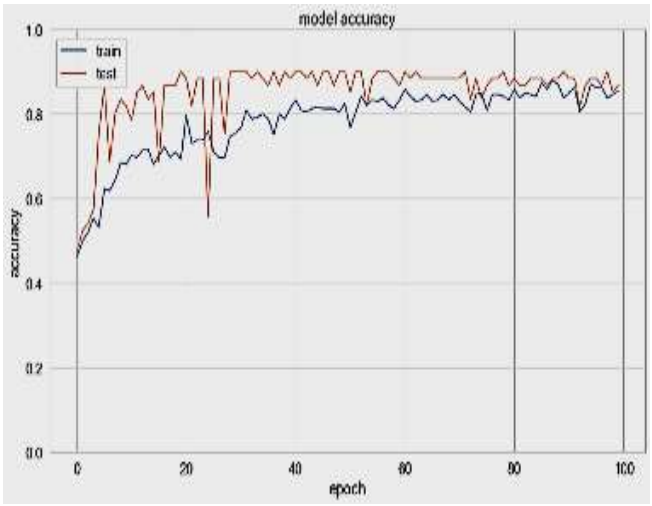


Fig. 16 Accuracy after deep ANN model

4.8 Kidney Disease Detection

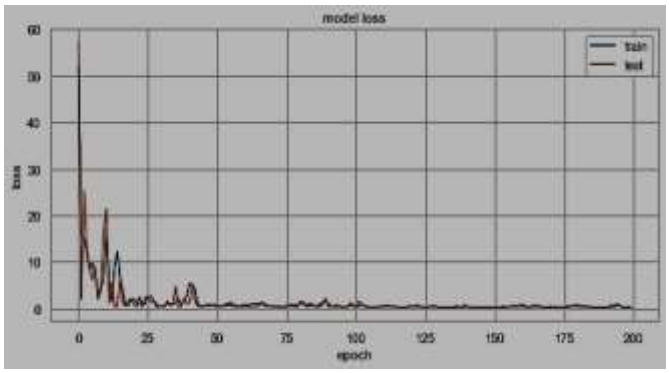


Fig. 17 Loss after applying deep ANN model

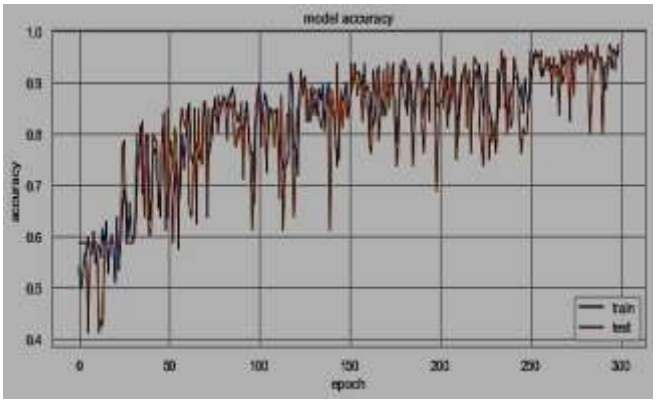


Fig. 18 Accuracy after applying deep ANN

4.9 Breast cancer disease detection

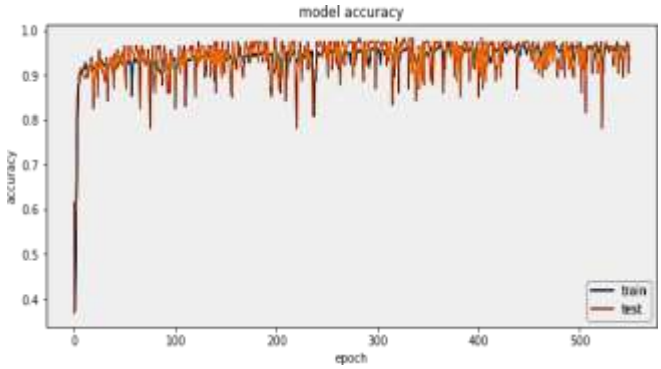


Fig. 19 Accuracy after applying deep ANN model

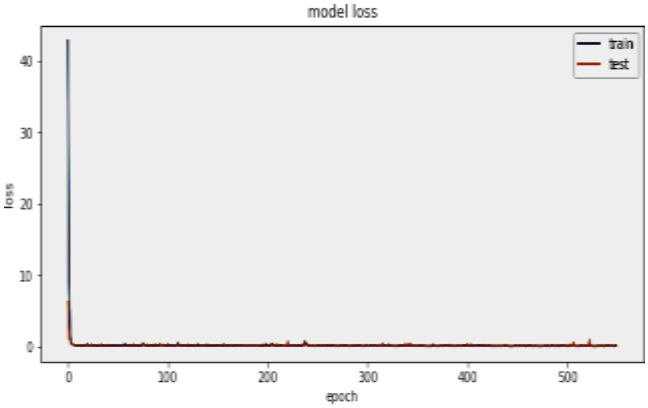


Fig. 20 Loss after applying deep ANN

4.10. Dengue disease

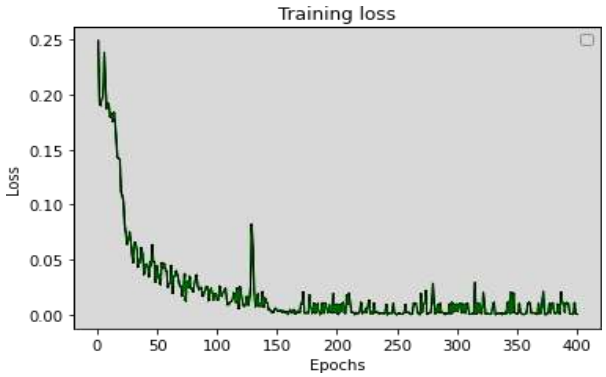


Fig. 21 Loss after applying deep CNN model

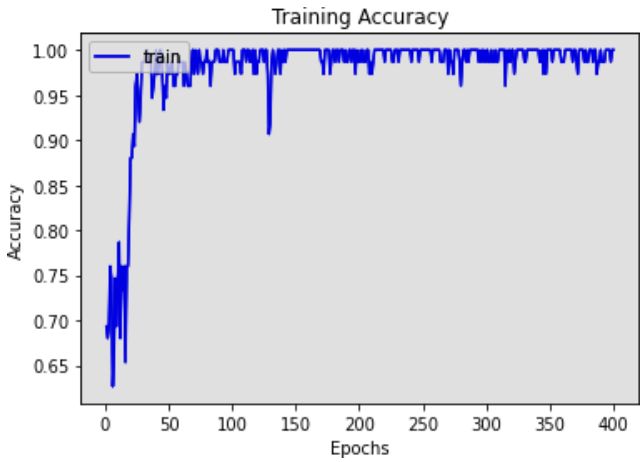


Fig. 22 Accuracy after applying deep CNN

5. CONCLUSION

In this research 10 critical disease detected at a time and run anywhere anytime using deep learning and flask web app. This research is not only useful for detecting the diseases, but it also gives information about how these diseases are caused, what are the symptoms of diseases, what are the prevention techniques available and what treatments can be used usually to treat the disease are mentioned in this research. This research uses pretrained CNN models like Dense Net and Resnet 50 model is used for detecting the diseases which has image dataset. For CSV kind of data deep ANN or CNN model is used to detect the disease. This research is useful for patients to detect the disease at home as well as pathologist, radiologist, doctors to reduce their workload and give accurate prediction.

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