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Heart Attack Risk Prediction Using Retinal Eye Damage in Deep Learning

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ABSTRACT : Heart disease increases the mortality rate in recent years across the world. So, it is necessary to develop a model to predict heart disease occurrence as early as possible with a higher rate of accuracy. Till now the detections are gone through blood tests, ECGs, and invasive stress tests. In this project, heart disease is predicted by a non-invasive method with the retinal image data. A Chase image dataset is considered, as the health of our eyes is connected to the health of our heart. Here, Heart problems can be detected from the changes in the microvasculature, which is imaged from the retina. The prediction of disease is by considering features like the size of blood vessels, non-uniform background illumination, etc. We use Image processing for identifying patterns in images and the Efficient Net algorithm for classification. The main objective of the proposed system is to predict the occurrence of heart disease from retinal fundus images with a higher rate of accuracy.

KEYWORDS Eye Disease,Retinopathy Identification, Intelligent Deep Learning, Modified Learning, Prediction, EfficientNet algorithm, Support Vector Machine .

I. INTRODUCTION

Heart disease is one in each of the key causes of to increase in the fatality rate at intervals in the developed world. Therefore, the prediction of heart conditions is unbelievably necessary and up to decrease the fatality rate. There area unit many techniques on the market to sight the prevalence of heart conditions. Yet, they are expensive to sight the unwellness and to boot take longer. The relation between heart and eye is high. The membrane is one in each of the required choices that facilitate direct microcirculation. The membrane provides a window for the detection of changes in the microvasculature in the event of a heart condition. throughout this project machine learning, classification algorithms unit of measurement was involved in a method of structure photos. As the health of our eyes is connected to the health of our heart. The upset area unit is usually detected from the changes in blood vessels, that are imaged from the membrane. The prediction of unwellness is completed by extracting the choices like the size of blood vessels, non-uniform background illumination, etc. from the retinal image.

In the recent years, the image method that deals with extracting useful data from a digital image play a unique.

II. RELATED STUDY

` A study undertaken and enhanced by Melillo et al. [1]; have used a machine learning algorithm named CART which stands for Classification and Regression in which sensitivity and specificity are achieved at 93.3 percent and 63.5 percent respectively. Then to improve performance, an electrocardiogram (ECG) approach which was suggested by Rahhal et al. [2] in which deep neural networks are used for choosing the best features and then using them. Then, to detect heart failure, a clinical decision support system by Guidi et al. [3] for preventing it at an early stage. They tried to compare different machine learning models and deep learning models, especially neural networks such as Support Vector Machine, Random Forest, and CART algorithms. An accuracy of 87.6 percent was achieved by Random Forest and CART, which outperformed all used in the classification. SVM techniques are used

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for binary classification i.e., to detect the patients who already have diabetes and then predict heart disease by Parthiban and Srivatsa [4] achieved an accuracy rate of 94.60 and the characteristics collected were common such as blood glucose level, the patient's age, and their blood pressure.
Heart disease is very deadly and should not be taken lightly. According to Harvard ealth Publishing [12], heart disease is more common in men than women. For decreasing the dimensionality of the dataset, there are various feature engineering and feature selection techniques that can be used to remove that data that does not have that much importance in the dataset [6].

Harvard Medical School [12]2020Hungarian-Cleveland datasets were used for predicting heart disease using various machine learning classifiers and PCA was used for dimensionality reduction and feature selection. A common problem in machine learning is the high dimensionality of the data. The datasets that can be used contain huge amounts of data and sometimes we can't even view the data in 3D, also known as the curse of dimensionality [5].
The previous studies are mainly based on a 13-feature dataset. Classification is common in any study to predict whether or not a patient has heart disease, and the most common pattern seen is the dataset commonly used in Cleveland [6]. The results obtained achieved great accuracies like a Random forest with 89.2 percent accuracy [7]; decision tree with 89.1 percent accuracy [8]; ANN with 92.7 percent accuracy [9], 89 percent [9], and 89.7 percent accuracy [10]; and SVM accuracy with 88 percent [10]. A hybrid model is created which achieved an accuracy of 94.2 percent by GA þ NN [11].

III. METHODOLOGY

PROPOSED SYSTEM

The goal of this system is to a develop Heart Disease Prediction system that can recognize heart disease using retinal images, especially in children. In this project, a CHASE image dataset is considered for detecting heart disease via the retina. The changes in the eye can be an indication of many symptoms. The classifiers like EfficientNet algorithm are used to identify and the results are compared.

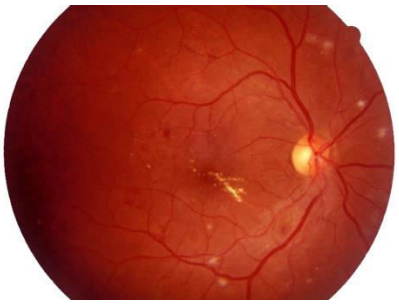

Fig.1 Retinopathy

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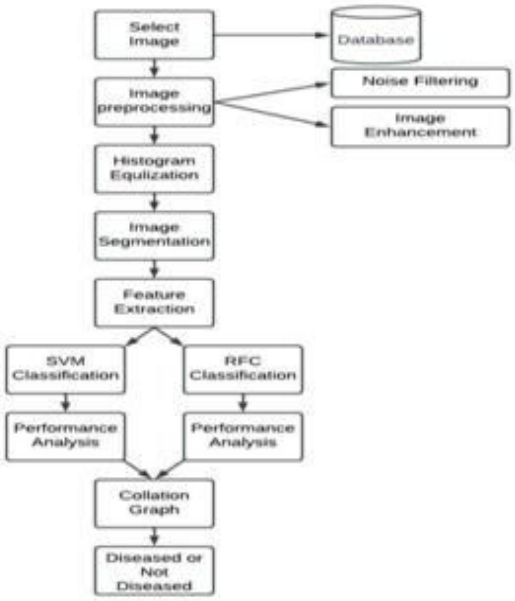

Fig.2 Proposed Block Diagram

(i) Input Database: This has taken retinal images from 14 children and prepared a dataset. It maintains 28 retinal images of children for both testing and training purposes.
The retinal image suffers from imperfections such as poor contrast and noise, that need to be reduced or eliminated before processing. The Retinal background is pre-processed with a Gaussian filter. The image dataset is input and then pre-processed by subtracting the original image with the Gaussian value to remove the Gaussian noise.
(ii) Pre-processing: When pre-processing, if the picture is meant to be three-dimensional, it is converted to gray-scale. This is done to achieve two-plane conversions.
(iii) Input Image: The first step is to snap a picture using the extension and then adjust its size to fit the needs. In order to feed the input data into the preprocessing is used to shape and modify it. Image noise is either eliminated or significantly reduced. A few things have been improved. Lastly, the picture has been gray-scaled.
(iv) Enhancement: If the source took the photos, you should make them seem better. The goal of picture filtering is to reduce the signal-to-noise ratio by converting the original image to a grayscale version while extracting certain characteristics. For example, by applying a sharpening or smoothing effect, the goal of the image enhancement approach is to render the digital picture look better. In the field of digital image processing, this is a crucial subject. Computer vision algorithms and people alike may benefit from this as it improves the quality of the improved photos. As a result of the improvement, the picture's clarity, color correctness, contrast, resolution, edge sharpness, as well as signal-to-noise ratio were all increased. Improving gray-scale pictures via histogram transformation is a cornerstone procedure that paves the way for more advanced operations like detection and identification. While there are a number of well-known techniques for improving a picture's contrast, such as histogram equalization and contrast modification, the vast majority of these approaches rely on heuristics grounded in extensive expert knowledge in image processing. The domains of robotics, AI, operational research, and related ones all rely heavily on improvisation. The goal is to discover the optimal solution to an optimization issue as quickly as feasible.
(v) Thresholding: Cell segmentation is used for thresholding, which may provide precise outcomes. One method of picture segmentation is image thresholding, which separates an image's foreground and background. The pixels' values are allocated according to the given threshold values in the applied technique. Grayscale pictures are used for thresholding in computer vision. All pixel values over a certain threshold are set to a default value in basic thresholding. It checks the values of the pixels against a predetermined threshold. The gray-level spatial dependency matrix (GLCM) is a statistical tool for the texture analysis that takes pixel spatial relationships into account. To

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describe an image's texture, the GLCM functions first determine the frequency of certain pixel pairings with certain values and spatial relationships, generate a GLCM, and subsequently extract statistical metrics from this matrix.

(vi) Feature Extraction: The purpose of feature extraction is to identify melanoma by extracting picture attributes that describe its dermatological characteristics. Characteristics of melanoma are relied upon by clinicians. It is critical to choose the characteristics based on the technique of diagnosis that is used.

(vii) Segmentation: When describing or classifying images, segmentation comes into play as a crucial challenge in digital image processing. Skin lesion segmentation may be aided by using a variety of form, brightness, color, and texture features. Damage to the optic nerve, located in the back of the eye, may lead to loss of vision and eventual blindness in a variety of eye illnesses collectively known as glaucoma. Sometimes the onset of symptoms is so gradual that they go unnoticed. A thorough dilated eye exam is the only approach to diagnose glaucoma. Damage to the optic nerve causes the gradual loss of visual field in glaucoma, a chronic and progressive eye condition. Eye pressure is one of the main causes for concern. When there's a problem with the way fluid drains out of the eye, it may lead to a buildup of pressure that can harm the optic nerve. The following figure Fig.3 shows the glaucoma

Fig.3 Glaucoma

IV. RESULTS AND DISCUSSIONS

In this paper, we can survey multiple classification algorithms for disease prediction in retinal images. Retinal images are collected from STARE and Drive Datasets. Different performance measures such as accuracy, sensitivity, specificity, error rate and precision can be derived for analysing the performance of the system.

V. EFFICIENTNET ALGORITHM

EfficientNet is an algorithm for neural network architecture optimization developed by Google researchers. It aims to achieve better performance and efficiency by scaling the network's depth, width, and resolution in a balanced manner. The key idea behind EfficientNet is to find an optimal balance between model size and accuracy, taking into account computational resources and memory constraints.

EfficientNet achieves this by using a compound scaling method that uniformly scales all dimensions of depth/width/resolution using a compound coefficient. This coefficient controls how many resources are allocated to each dimension, ensuring that the model is scaled efficiently without sacrificing performance. By doing so, EfficientNet achieves state-of-the-art performance on various image classification tasks while being more computationally efficient compared to other models

EfficientNet has gained popularity in the machine learning community due to its effectiveness in balancing model size and performance, making it suitable for a wide range of applications, especially on devices with limited computational resources such as mobile phones and IoT devices.

Width: The number of channels in each layer of the neural network is referred to as width scaling. By enlarging the width, the model may capture more complicated patterns and characteristics, resulting in higher accuracy. Reducing the width, on the other hand, results in a more lightweight AI model that is ideal for low-resource applications.

Depth: The total number of layers in the network is referred to as depth scaling. Deeper models can capture more complex data representations, but they also need more computing resources. Shallower models, on the other hand, are more computationally efficient but may forfeit accuracy.

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Resolution: Resolution scaling entails changing the size of the input image. Higher-resolution images give more detailed information, which may result in improved performance. They do, however, need larger memory and processing power. Lower-resolution images, on the other hand, use fewer resources but may lose fine-grained information.

$$\text{Depth} : d = \alpha\varphi$$
$$\text{Width} : w = \beta\varphi$$
$$\text{Resolution} : r = \Upsilon\varphi$$
$$\text{s.t. } \alpha.\beta^2.\Upsilon^2 \approx 2$$
$$\alpha \geq 1, \beta \geq 1, \Upsilon \geq 1$$

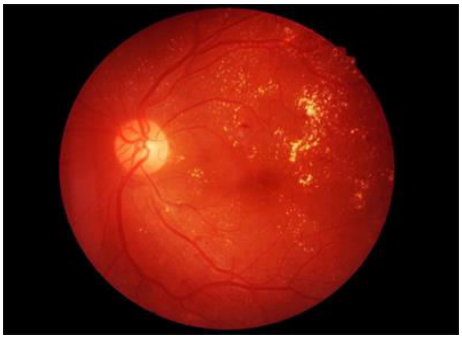

Fig.4 Input Image

Fig :5 Gray color image

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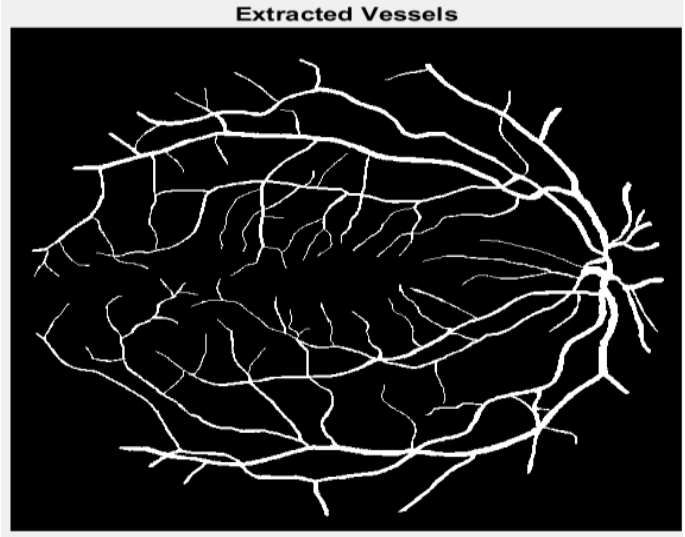

Fig :7 Extracted Vessels

Fig :6 Non Diseased Input Image

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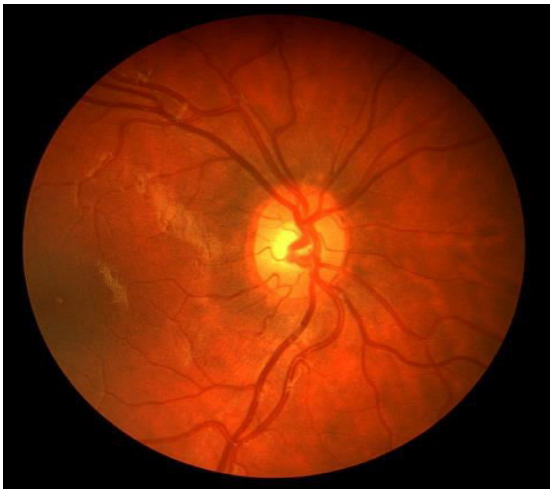

Fig 8: Diseased Input Image

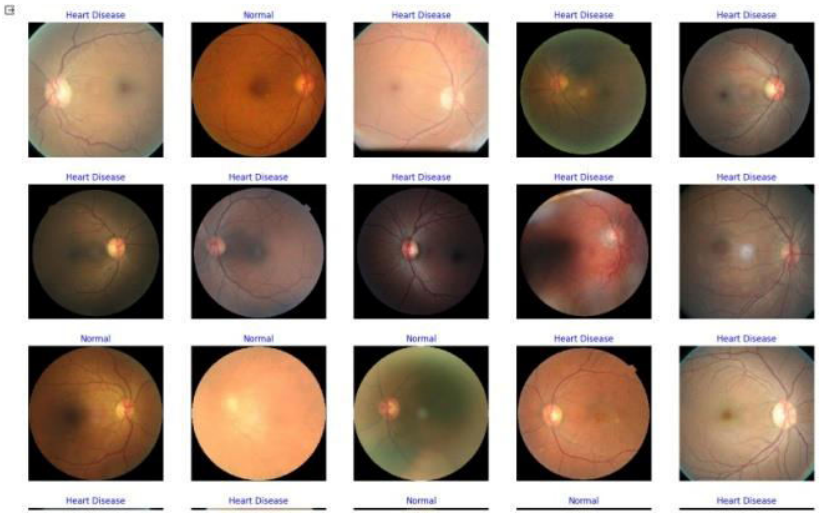

Fig :9 Data Set

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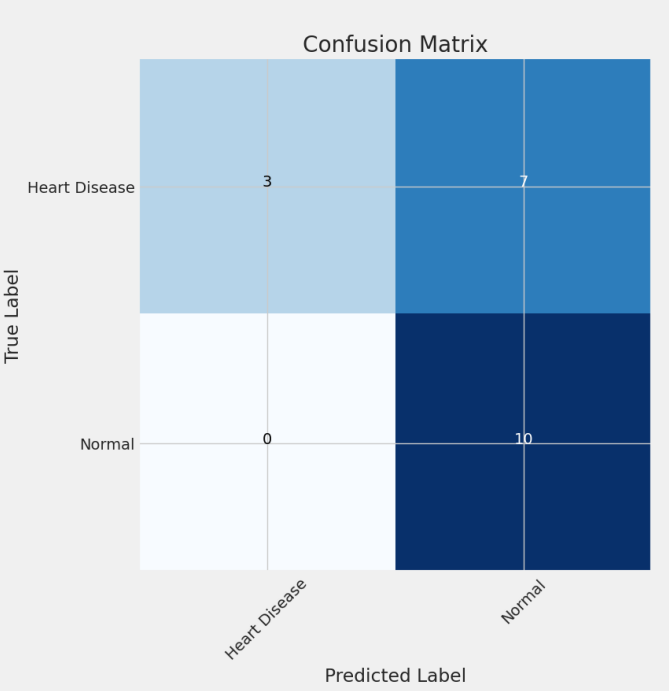

Fig :10 Confusion Matrix

VI. FEATURE WORK

Deep Learning-based Smart Healthcare is getting so much attention due to real-time applicability in everyone life's, and It has obtained more attention with the convergence of IoT. Diabetic eye disease is the primary cause of blindness between working aged peoples. The major populated Asian countries such as India and China presently account for millions of people and at the verge of an eruption of diabetic inhabitants. These growing number of diabetic patients posed a major challenge among trained doctors to provide medical screening and diagnosis. Our goal is to leverage the deep learning techniques to automate the detection of blind spot in an eye and identify how severe the stage may be. In this paper, we propose an optimized technique on top of recently released pre-trained EfficientNet models for blindness identification in retinal images along with a comparative analysis among various other neural network models. Our fine-tuned EfficientNet-B5 based model evaluation follows the benchmark dataset of retina images captured using fundus photography during varied imaging stages and outperforms CNN and ResNet50 models.

VII.CONCLUSION

Prediction of heart disease occurrence for a patient by a non-invasive method is very essential with the increased population and to reduce the mortality rate in the developing world. Prediction of risk for the occurrence of cardiovascular disease from the given input of retinal dataset with high accuracy is developed in this study. The classifiers like SVM and RFC are used for the identification of heart disease. The results are compared using both the classifier, in which RFC is shown to be good in identifying the heart disease. In this work, a Chase image dataset is considered for detecting heart disease via the retina. The changes in the eye can be an indication of many symptoms.

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