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OPHTHALMIC DISEASE DETECTION USING DEEP LEARNING

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ABSTRACT:
Manual detection of eye conditions is labor-intensive, challenging, and prone to mistakes. In order to detect different eye problems using fundus pictures, an automated method for identifying ocular diseases with computer-aided tools is required. Due to deep learning algorithms' enhanced capacity for picture classification, such a system is now feasible. This study offers a deep learning-based method for focused eye recognition. The dataset for this research, which contains numerous categories of the fundus, was categorized using cutting-edge image classification methods like Deep algorithms. The different eye diseases are represented by these categories. The population for these categories is incredibly unrepresentative, though. In order to address this problem, both classes must be used, and the multiclass classification issue must be reduced to a binary classification issue. Then, deep learning was used to present the binary classifications. Typically, changes in the retina's structure indicate the existence of an eye condition. Since imbalances in data and deviations frequently have a negative effect on fundus pictures, It's possible that performing this study using some of the existing deep learning techniques won't yield acceptable results. As a result, it is expected that research into effective and dependable deep learning techniques will help to further improve recognition performance.
Keywords: Diabetes, Ensemble Model, Classification, K-Nearest Neighbor Classifier

1.INTRODUCTION:

The retina, a structure that is located behind the eye, contains the macula, the optic disc, and arteries. Retinal fundus images, or photographs of the fundus that show the morphologies and illnesses of the retina, are used in this depiction. The signs of glaucoma, cataract, and macular degeneration brought on by ageing may be evident depending on the morphology of the retinal fundus. (AMD). Numerous things can lead to cataracts, including getting older, genetics and metabolic illnesses, accidents, electromagnetic radiation, and more. These elements may cause the lens' biochemical processes to malfunction, which might then result in lens protein denaturation and haze. Vision blurs because a thick lens blocks light from entering the eye. It displays an image of an afflicted eye's fundus. The most important aspect is that the ophthalmic illness is deadly and may leave patients permanently blind. In therapeutic settings, early detection of these illnesses can halt vision loss. Additionally, evaluating the fundus bodily is labor-intensive and highly depends on the expertise of ophthalmologists. Because of this, precise fundus monitoring is more challenging. Automatic computer-aided testing methods are therefore essential for identifying eye problems. This misinterpretation is typical.

Ocular conditions have the potential to leave patients partially or totally impaired. Scholarly and business organizations are now interested in the effective computer-assisted diagnostic (CAD) techniques for automated disease detection due to the rise in people with eye diseases. To examine biological data and find ocular illnesses, CAD has extensively used deep learning techniques. Retinal fundus color pictures are frequently used, among other types of ophthalmic data, to help physicians diagnose illness. The macula, optic disc, and vessels are parts of the retina, which is tissue that lies at

the rear of the lens. This illustration uses retinal fundus pictures, which are images of the fundus that reveal the morphologies and diseases of the retina. Depending on the morphology of the retinal fundus, glaucoma, cataract, and macular degeneration caused by age symptoms may be visible. (AMD). Cataracts can be caused by a number of factors, including aging, heredity, immunological and metabolic disorders, injuries, radiation, and more. These factors may lead to metabolic abnormalities in the lens, which may in turn cause lens protein denaturation and turbidity. Because the opaque lens prevents light from reaching the eye, vision becomes blurry. It shows the fundus picture of an affected eye.
The symptoms of glaucoma, a set of ocular illnesses, include atrophy and depression of the optic disc. The two primary dangers to the development of glaucoma are pathologic hypertension and inadequate blood flow to the optic nerve. A bright area in the optic disc's center is known as the optic cup. AMD, a structural alteration brought on by ageing in the macular region, can impair elderly people's vision. Reduced central vision, central dark patches, and visual distortion are the main signs and symptoms of macular spots. Oval haemorrhages in the macula and yellow-grey exudative lesions with unclear borders and minor uplifts are present in the fundus. The categorization tasks for AMD, glaucoma, and cataract are then discussed in here.

2.RELATED WORK:

Luo, X, et al [1] identify that in order to make it simpler to identify ophthalmic diseases, more and more deep learning methods are being developed as computer-aided diagnostic (CAD) methods become more and more common. This study examines the deep learning-based detections for a few common eye conditions, including cataract, glaucoma, and macular degeneration due to age (AMD). Changes in the shape of the retina typically signal the presence of an eye disease. Given that data imbalance and abnormalities frequently have a negative impact on fundus images, it's feasible that some of the current deep learning methods won't produce results that are satisfactory for this analytical task. As a result, it is expected that research into effective and dependable deep learning techniques will help to further improve recognition performance. We propose a deep learning model and a novel mixture loss function to autonomously identify eye diseases using the analysis of retinal fundus color pictures. Given the excellent generalization and durability of both focal loss and cross entropy-induced loss functions in dealing with complex dataset with disparities in classes and anomalies, we specifically generated a combination of those two deficits in a deep neural network model to enhance the recognition accuracy of the classifier for biomedical data. The proposed model is evaluated using a collection of actual eye cases. The effectiveness of the deep learning model with our recommended loss function is contrasted with the default while using accuracy, sensitivity, specificity, and Kappa as the evaluation metrics .Md Shakib Khan, et al [2] identify that it can be challenging for doctors to identify eye illnesses at an early stage using fundus pictures. Ocular illness detection by hand is tedious, prone to error, and difficult. Therefore, to identify different eye diseases using fundus pictures, an automated ocular disease identification device with automated tools is required. Due to deep learning algorithms' better picture categorization abilities, such a system is now feasible. This study provides a deep learning technique for ocular detection. The ODIR dataset, which contains 5000 pictures of eight distinct kinds of fundus, was classified for this research using cutting-edge image classification techniques like VGG-19. These categories cover a variety of eye conditions. The efficacy and reliability of the suggested algorithm are confirmed by the testing findings.

Jain, L., Murthy, et al [3] identify that Ophthalmologists use retinal fundus pictures as a useful tool for diagnosing retinal issues. Early diagnosis can improve the chance of a full recovery and prevent disability. Recent machine learning research has concentrated on classifying the picture after feature extraction in order to diagnose illnesses like diabetic retinopathy. Our objective in this study is to autonomously distinguish between pictures of retinal issues and those of healthy retinas without conducting any specific segmentation or feature extraction. Instead, we instantly categorize any retinal fundus picture as healthy or diseased using a deep learning algorithm. The network's design is straightforward and quick. Two datasets were taken from a nearby hospital, and were used to evaluate the model. This model's precision was determined to be between 96.5% and 99.7%.

Nazir, et al [] identify that Diabetic people run the chance of getting glaucoma, diabetic macular edema, and diabetic retinopathy, among other eye conditions. While advanced glaucoma ruins the structure of the optic disc and hinders vision, the DR is an eye condition which harms the retina. The accumulation of blood in the retina is what leads to DME. However, because the disease progresses slowly, there aren't many early symptoms, making disease discovery challenging. In order to assist the early phases of detection and filtering, a completely automated system is needed. This study presents an automatic method for illness localization and segmentation based on the fuzzy k-means (FKM) clustering algorithm and FRCNN algorithm. Since datasets don't typically contain bounding-box annotations, we created them using ground truths. After segmenting out the labelled images using FKM clustering, the annotated images are then used to teach the FRCNN for localization. The divided regions are next compared to the real world using intersection-over- union techniques. An extensive contrast with the most current methods demonstrates the strategy's efficacy in terms of segmentation and disease detection.

3.METHODOLOGY:

1. Convolutional Neural Network Step (1a): convolutional operation

It will do this by detecting the characteristics, which essentially act as filters for the neural network. It also provides information on feature maps, including information on their specifications, the layers used to identify patterns, and how the results are displayed.

Step (1b): ReLU Layer

In this, it serves the purpose of stimulation. ReLU's application aids in preventing the exponential increase of processing needed to run neural networks. It quickly teaches the network.

Step 2: Conv2D

It is a 2D Convolution Layer, which is generally used on Image data. This layer applies sliding convolutional filters to 2D input.

Step 3: Flattening

It is used to transform all of the shared feature maps' 2D arrays into a solitary lengthy continuous linear vector. The completely connected layer receives it as input and
uses it to classify the picture.

Step 4: Fully Connected Layer

This will combine everything that was discussed in the previous part. With this, a clearer picture of how Convolutional Neural Networks function and how the end "neurons" generated learn image classification will become more apparent.

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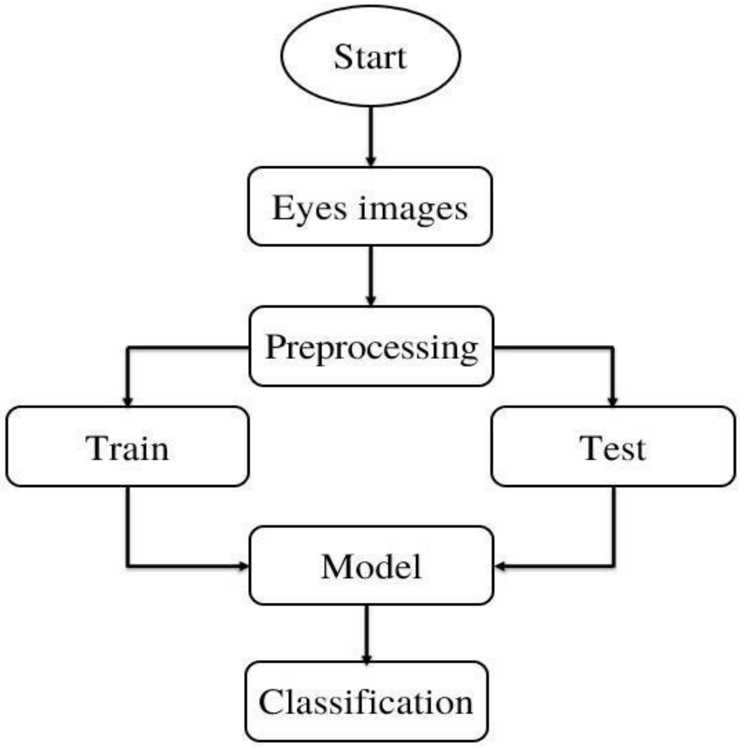
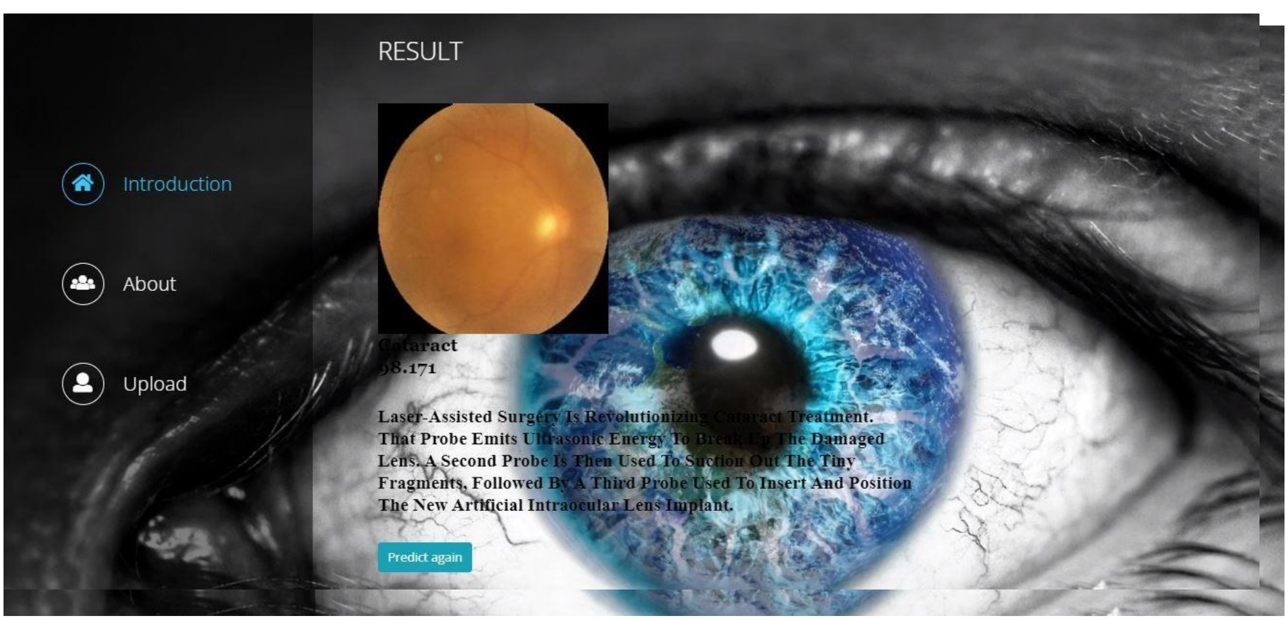


Fig 1 : Block Diagram

4.RESULTS:

With the aid of deep learning method, the categorization of eye disease images is carried out in this case.



TEST CASES:

Input	Output	Result
Input text	Tested for the classificatio n of Eye Disease	Success

5.CONCLUSION:

In this experiment, we successfully recognized images of eye problems and sorted them into those affected by eye diseases or not using deep learning and transfer learning techniques. Here, we've used a dataset of eye diseases classification images, which is trained using CNN and transfer learning methods and will be classified as various types of eye diseases. We put the system to the test by providing an image and classifying it after training.

6.FUTURE SCOPE:

This may be used to classify and identify the numerous eye disorders that affect people in the future, creating more accurate models that have a higher degree of dependability.

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