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AN AI-ENABLED DIAGNOSTIC SYSTEM FOR DIABETIC EYE DISEASE DETECTION USING DEEP NEURAL NETWORKS

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ABSTRACT:

Timely detection of diabetic retinopathy and other diabetic ocular conditions is crucial, since they significantly contribute to worldwide visual impairment. This research introduces DeepDiabetic, a method using deep neural networks to independently identify diabetic eye problems in retinal pictures. DeepDiabetic employs sophisticated convolutional neural network (CNN) architectures to rapidly and accurately categorize and identify disease stages via the analysis of fundus pictures. The study findings demonstrate that the system proficiently differentiates diabetic eye diseases, possibly expediting patient help and enhancing overall outcomes. The suggested method provides a scalable, non-invasive, and economical tool to aid ophthalmologists in clinical decision-making and the implementation of comprehensive diabetic eye screening programs.

Keywords: Diabetic Eye Diseases, Diabetic Retinopathy, Convolutional Neural Networks (CNN), Fundus Image Analysis, Retinal Image Classification.

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I.INTRODUCTION

Diabetic retinopathy, diabetic macular edema, and other diabetic ocular disorders are major contributors to vision impairment and blindness worldwide. Timely identification and precise diagnosis are crucial for improving patient outcomes and averting substantial vision impairment. However, manual diagnosis by fundus examination may be a tedious process limited to specialists, marked by subjective variability.

Automated systems have shown significant potential in medical image processing, attributed to the rapid progress of artificial intelligence, especially deep learning. Deep neural networks, adept at identifying intricate patterns within large datasets, serve as a potent instrument for recognizing minor signs of diabetic eye problems that conventional approaches may overlook.

DeepDiabetic, an advanced identification method using deep neural networks, has enhanced the automated detection and categorization of diabetic eye diseases from retinal pictures. This system seeks to improve screening programs and reduce the effects of diabetic eye conditions, providing a scalable, dependable, and effective alternative to aid clinicians in early identification.

II.LITERATURE SURVEY

Diabetic retinopathy, a significant consequence of diabetes, is a leading cause of avoidable blindness globally. Addressing visual impairment requires prompt identification and immediate action. Vashist, Gupta, Singh, and Saxena (2019) highlighted the increasing prevalence of diabetic retinopathy in India and stressed the need for screening programs to detect these conditions at an early stage. The research emphasized the need of cost-effective screening, diagnosis, and referral systems across healthcare levels to raise awareness and reduce preventable blindness in diabetes patients.

Various medical disciplines have begun to acknowledge the promise of machine learning for illness identification and categorization. B. Aljaddouh and D. Malathi performed an extensive analysis of research trends from 2018 to 2021 concerning machine learning applications for the detection and classification of respiratory diseases. Their research indicated that machine learning might enhance medical diagnostics and provide significant insights for determining suitable tactics for future healthcare categorization issues.

The field of medical image analysis has seen considerable success with deep learning models. D. M. Ibrahim, N. M. Elshennawy, and A. M. Sarhan developed a multi-class classification model using deep learning for the diagnosis of COVID-19, pneumonia, and lung cancer, employing chest X-ray and CT imaging. Their work shown that CNN-based architectures outperform in medical picture classification, comparing VGG19-CNN, ResNet152V2, and hybrid models. VGG19-CNN attained peak performance with an accuracy of 98.05%.

A. E. Minarno, M. H. C. Mandiri, Y. Azhar, F. Bimantoro, H. A. Nugroho, and Z. Ibrahim suggested an automated method for detecting diabetic retinopathy. The system will use retinal fundus pictures with the EfficientNet-B7 model. Their study emphasized the significance of picture preprocessing in the classification of retinal illnesses using augmentation and preprocessing strategies to enhance model performance and reduce overfitting. The results showed an impressive test accuracy of 84%.

A multi-class diabetic eye disease classification framework using retinal fundus pictures was established by R. Sarki, K. Ahmed, H. Wang, Y. Zhang, and K. Wang via the use of convolutional neural networks. They proved that deep learning methodologies may autonomously detect diabetic eye problems and facilitate clinical screening by creating a model with 81.33% accuracy and 100% sensitivity and specificity.

III.EXISTING SYSTEM

Diabetic retinopathy, diabetic macular edema, and other diabetic ocular disorders are major contributors to vision impairment and blindness worldwide. Timely diagnosis and immediate treatment of these conditions are essential to avert permanent blindness. The conventional diagnosis method depends on ophthalmologists manually evaluating retinal pictures. This method may be challenging, subjective, and prone to inaccuracies owing to human weariness or differences in skill level. A lack of competent medical professionals in several areas intensifies delays in diagnosis and treatment. Modern CAD systems have sought to tackle these difficulties; nevertheless, their dependence on manually created features and traditional machine learning techniques leads to variable accuracy and relevance.

DISADVANTAGES

- Ophthalmologists once invested significant time and effort in the manual analysis of retinal pictures for diagnosing diabetic retinopathy and other diabetic ocular disorders. This method is laborious, prone to inaccuracies, and time-intensive.
- Modern automated systems may use traditional machine learning techniques, which often need manually crafted features. As a result, they may inadequately capture the intricate patterns present in retinal pictures, resulting in reduced accuracy.

IV.PROPOSED SYSTEM

The suggested method, "Deep Diabetic," utilizes deep neural networks to accurately and efficiently detect diabetic eye problems from retinal pictures, beyond the constraints of previous methodologies. Unlike conventional approaches, deep learning models—particularly CNNs—demonstrate remarkable proficiency in independently identifying intricate patterns and features within picture data. The system may reduce reliance on expert availability and human error by incorporating these sophisticated approaches, enabling consistent, fast, and objective diagnostics. This method signifies a notable progression in diabetes healthcare technology, seeking to enhance early detection efficacy, refine

patient therapy, and eventually avert blindness linked to diabetic ocular conditions.

ADVANTAGES

- This technology facilitates speedy identification and urgent treatment via the expeditious analysis of pictures and the provision of instant findings.
- The automated system might be used in clinics and rural locations to improve screening accessibility in places lacking professionals.

V.SYSTEM MODEL

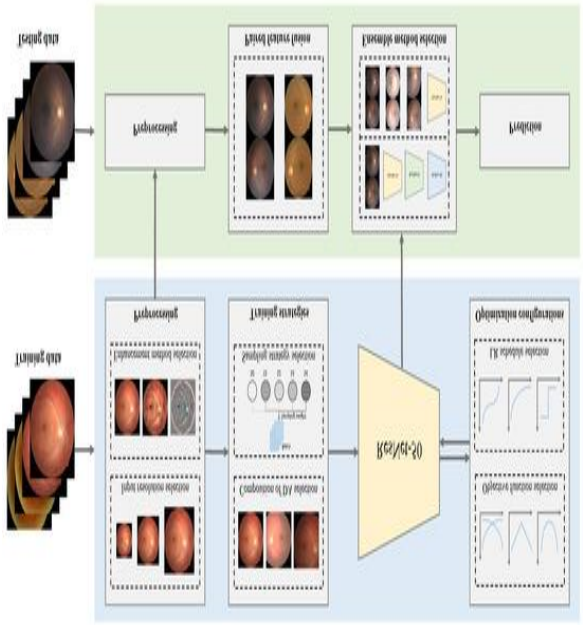


Fig 1.System Model

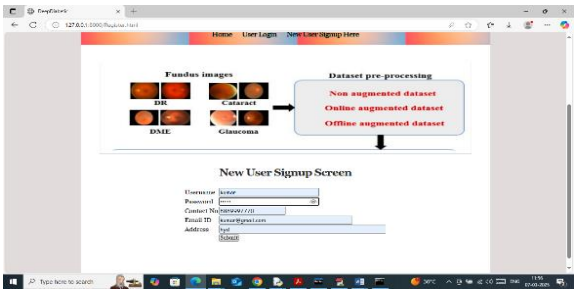
VI.MODULES

We have developed the following modules to implement this project.

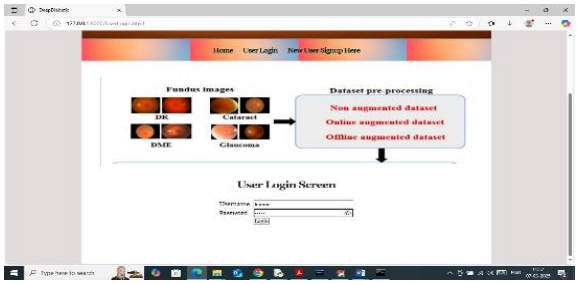
- New User Sign up: This module enables user registration for the application.
- User Login: Users are permitted to access the system.
- Upload DR Dataset: This module enables the upload of DR datasets to the program.
- Processed Dataset: Following feature extraction, augmentation, and pixel value normalization, this module will process all photos. The dataset will be divided into two groups, with 80% designated for training and 20% for testing, consisting of the processed photos.
- Run DL Algorithms: Each deep learning method employs 80% of the dataset for training and 20% for testing to evaluate the accuracy of the predictions produced by the trained model.
- Predict Diabetic Eye Disease: This module allows users to submit test images for analysis by the EfficientNetB0 model to determine the kind of eye illness.

VII.SCREENSHOTS

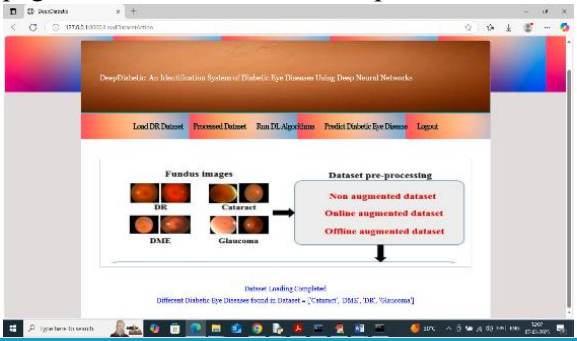
To access the next page, choose the "New User Sign Up" option on the previous screen.



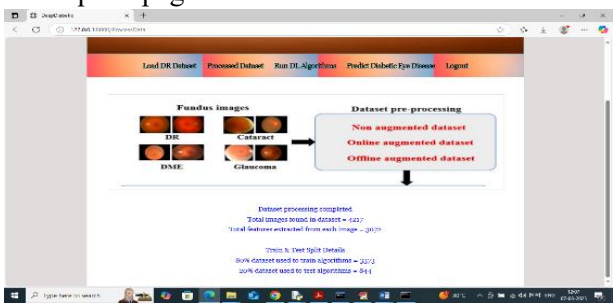
The user enters their registration information on the previous screen and then clicks the button to go to the next page.



Upon logging in, the user will see the following page, as shown in the previous screen.

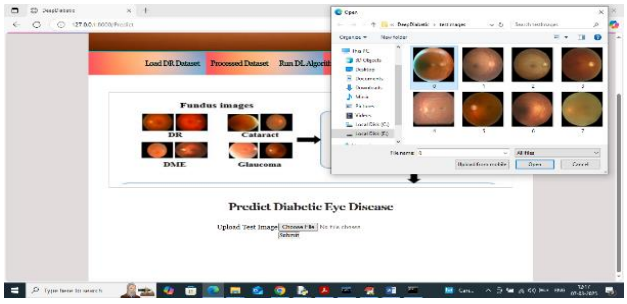


Upon importing the dataset and examining the various categories of eye diseases, choose the "Processed Dataset" option to begin the dataset processing. Consequently, you will encounter the subsequent page.

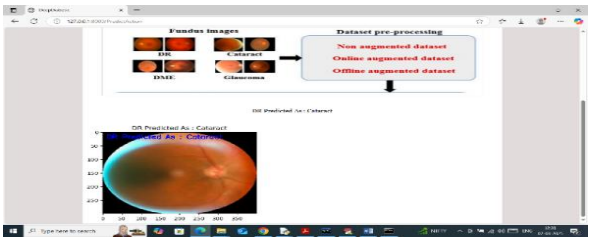


The screen above shows the number of processed images, the total features retrieved from each image, and the sizes of the training and testing datasets. To begin algorithm training, click the "Run DL Algorithms" button; this will redirect you to the following page.

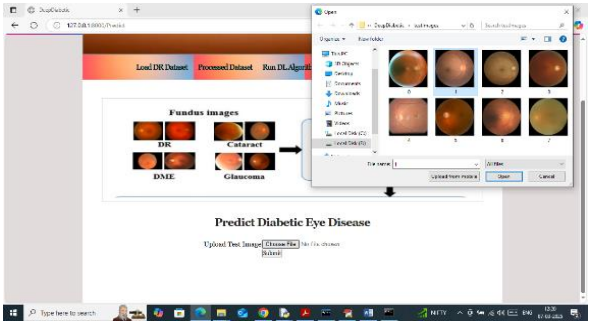
The table above presents the outcomes of each method: ResNet152V2 achieved 95% accuracy, EfficientNetB0 attained 97%, and VGG secured 93%. The subsequent graphs depict the classification confusion matrices of multiple algorithms: the x-axis signifies the predicted labels, the y-axis indicates the actual labels, the blue boxes represent the number of incorrect predictions, and the differently colored boxes along the diagonal denote the number of correct predictions.



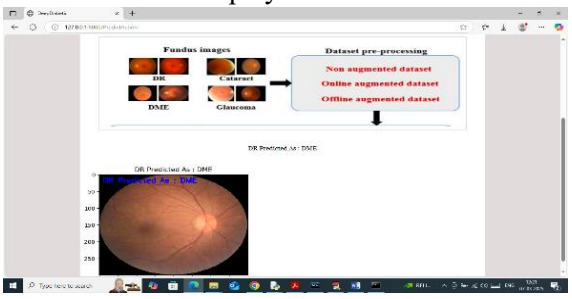
To get the following prediction result, upload a test picture from the 'test Images' directory inside the code folder, as shown on the previous page. Thereafter, activate the buttons.



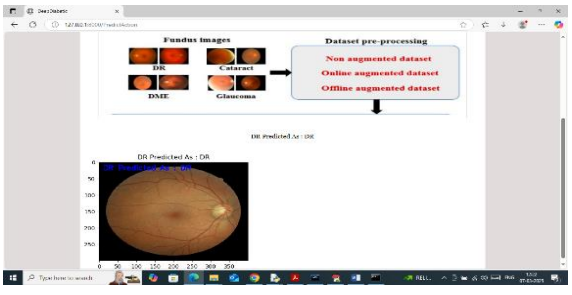
Additional photographs may be submitted and assessed in a similar manner. The previously described issue is expected to be a diabetic eye illness referred to as a cataract.



Integrating an extra picture into the aforementioned display.



We recognized the previously given picture as a DME.



The previously stated picture was recognized as DR.

Similarly you can upload and test other images.

VIII.CONCLUSION

This research introduces Deep Diabetic, a diagnostic methodology using deep neural networks to accurately and reliably detect diabetic eye problems from retinal pictures. The system use sophisticated convolutional neural networks to autonomously extract and categorize pertinent features, exceeding conventional machine learning techniques. The experimental findings suggest that the method is reliable and might function as a clinical screening tool. Deep Diabetic's rapid and accurate diagnostic assistance may fulfill the need for screening diabetic ocular diseases, particularly in areas with limited access to specialists. This will provide timely intervention and improved results for patients.

IX.FUTURE ENHANCEMENTS

Subsequent updates will concentrate on improving the model's relevance across a wider range of circumstances by expanding the dataset with images taken at various stages of diabetic eye illness. Furthermore, diagnostic precision may be improved by using multi-modal data, such as patient history and other diagnostic techniques. To improve accessibility and usability in underserved or rural regions, we will investigate real-time distribution on web and mobile platforms. Integrating explainable AI approaches into healthcare procedures will improve doctors' comprehension of the model's judgments, hence promoting trust and enabling integration. To establish the system as a standard diagnostic tool, it must undergo ongoing improvement and validation via comprehensive clinical studies.

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