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Prediction of Ocular Diseases Using Convolutional Neural Networks

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ABSTRACT: In India, there are 15 million blind people, with 75% of cases being treatable at one point. Lack of doctors is a significant challenge with 10,000 patients for every doctor. Early detection of eye ailments is essential to prevent blindness. Symptoms of eye disorders like cataracts, corneal ulcers, and trachoma are visible, making it possible to diagnose them early. A novel approach using deep learning techniques like convolution neural networks and image processing techniques like segmentation and morphology can be used to automate eye illness identification. The proposed model can detect eye conditions like cataract, glaucoma, and retinal diseases early. This automated system can help reduce the burden on doctors and improve access to eye care in India.

KEYWORDS: Cataract, Glaucoma, Retinal Disease, CNN

I.INTRODUCTION

A renewed interest in machine learning has emerged as a result of recent information technology advancements. This efficient technology helps with better decision-making and accurate predictions in a range of industries, including healthcare, banking, and other areas. High-resolution retinal pictures are now possible because to recent technological advancements. Illness in the human body could be predicted by diagnosing those photos We can minimize the risk of vision loss and keep an eye on potential eye disorders like cataracts and glaucoma by taking proper care of our eyes. Cataract is a condition that affects the eye's lens and impairs vision for those who have it. The lens's proteins can get denaturized, which can result in cataracts. Glaucoma is a disorder caused by increased eye pressure that harms the nerve that links the eye to the brain.

There are other more conditions that might harm the eyes. Since the symptoms of these conditions vary greatly, routine eye exams are your greatest line of defense.The development of computer tools and algorithms has shown a growth in the automated early diagnosis and identification of eye illnesses. In our study, retinal pictures that have undergone preprocessing are provided as input and fed into the CNN algorithm as a preprocessed image

II.OBJECTIVES OF THE STUDY

- The objective is to develop a deep learning model that can distinguish between a healthy eye and an eye with a disease.
- The goal is to create a system that can provide information about various eye-related problems and disorders to the user.
- The proposed model would be able to give the result with high accuracy.

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III. LITERATURE REVIEW

Eyes play a crucial role in our daily lives, enabling us to perceive and comprehend the world around us. In this study, machine learning techniques such as deep convolutional neural networks and support vector machines were used to develop an automated eye disease recognition system. The findings revealed that the DCNN model outperformed SVM models. Several models have been developed for eye disease detection in recent years, including a successful deep learning model that distinguishes between a normal eye and a diseased one. The paper provides an overview of deep learning, including its algorithms and how convolution neural networks operate. The study involved analyzing 10,000 patients, and the researchers suggest that in the future, they can create a customized deep learning model that diagnoses external eye issues/diseases using an uploaded eye picture, potentially in the form of a web-based or app-based application.[1]

An opaque area in the lens that impacts vision and causes decreased eyesight is referred to as a cataract. The authors of this study employed machine learning techniques, such as convolution neural networks (CNN) and image pre-processing,to predict various ocular disorders.Theprogramme foresees that both the left and right fundi have cataracts. Some of the biggest issues with vision are ocular eye disorders. The current research focuses on using machine learning approaches to detect cataracts.[2]

A fully connected Deep convolutional neural network is built utilizing fundus images, using supervised learning. The intention behind this is to avoid creating an intricate expert system for the treatment of glaucoma eye disease. The research shows that deep convolutional neural networks can aid in the reduction of the overall accuracy of deep learning models. In cases where there is an abundance of picture data and high cardinality categorical variables, deep convolutional neural networks are effective. The deep convolutional neural network is designed with 16 input neurons, one hidden layer, and 2 output neurons that can either be healthy or unhealthy[3]

The connection between Deep Learning (DL) architecture and the management of input data is discussed in this study. DL-based techniques typically focus on detecting a single ocular disease. The study evaluated the performance of DL-based methods for detecting ocular diseases in different hardware and software environments. The majority of DL-based methods use TensorFlow library, with or without Keras API, Caffe framework, or Matlab. However, detecting multiple potential diseases in the same screening, which is common in clinical settings, presents a significant challenge..[4]

This work introduces four deep learning models designed to identify ocular tumors. The authors used the ODIR dataset, which includes 5000 fundus images from various classes, to train Resnet-34, EfficientNet, MobileNetV2, and VGG-16, all cutting-edge image classification algorithms. Each of these models identifies a specific eye disorder. Results showed that the VGG-16 model achieved an accuracy of 97.23%, Resnet-34 model achieved 90.85%, MobileNetV2 model achieved 94.32%, and EfficientNet model achieved 93.82%. A real-time system for detecting ocular diseases would benefit from incorporating all of these models. Compared to other CNN-based models for ocular disease classification, the suggested technique in this study demonstrated superior performance.[5]

The training and testing phases utilized an open source dataset comprising OCT scans that included images of CNV (Choroidal neovascularization), DME (Diabetic Macular Edema), as well as Drusen combined with Glaucoma and Cataract images. The entire dataset consisted of approximately 86,000 images. A Pune ophthalmology institute provided 1000 photos of these disorders for the purpose of validation. The photographs from the dataset were simply used without any adjustments.[6]

Have used machine learning techniques to anticipate the timely detection of diabetic retinopathy, an eye ailment. This method uses the DRIVE database, which has different image conditions. Eye disease prediction is implemented by using decision tree and naïve bayes. Among the two classifiers, the decision tree technique is performing well with accuracy of 84.78789.[7]

No.	Paper Title	Author Name	Key Points	Remark
1	Eye Disease Identification Using Deep Learning	Sushma K Sattigeri,Harshith ,Dhanush Gowda, KA Ullas, Aditya,2022	The findings revealed that the DCNN model outperformed SVM models. Several models have been developed for eye disease detection, including a successful deep learning model that distinguishes between a normal eye and a diseased one [1]	The study involved analyzing 10,000 patients, they can create a customized deep learning model that diagnoses external eye issues/diseases using an uploaded eye picture, potentially in the form of a web-based application
2	Ocular Eye Disease Prediction Using Machine Learning'.	Rachana Devanaboina,Sreeja Badri, Madhuri Reddy Depa, Dr.Sunil Bhutada,2021	The authors of this study employed machine learning techniques, such as convolution neural networks (CNN) and image pre-processing, to predict various ocular disorders.[2]	The current research focuses on using machine learning approaches to detect cataracts.
3	An Expert System to Predict Eye Disorder Using Deep Convolutional Neural Network	Moahmmed Rashid Ahmed,Adil Deniz Duru, Osman Nuri Uçan, Oguz Bayat(2021)	The intention behind this is to avoid creating an intricate expert system for the treatment of glaucoma eye disease. [3]	The research shows that deep convolutional neural networks can aid in the reduction of the overall accuracy of deep learning models
4	Ocular Diseases Diagnosis in Fundus Images using a Deep Learning: Approaches, tools and Performance evaluation"	YaroubElloumi , Mohamed Akila, Henda Boudeggab(2019)	. The study evaluated the performance of DL-based methods for detecting ocular diseases in different hardware and software environments[4].	The majority of DL-based methods use TensorFlow library, with or without Keras API, Caffe framework, or Matlab.
5	Nadim Mahmud Dipu, SifatulAlamShohan, K.M.A Salam	Ocular Disease Detection Using Advanced Neural Network Based Classification Algorithms".	This work introduces four deep learning models designed to identify ocular tumors. The authors used the ODIR dataset, which includes 5000 fundus images from various classes, to train Resnet-34, EfficientNet, MobileNetV2, and VGG-16, all cutting-edge image classification algorithms[5].	Compared to other CNN-based models for ocular disease classification, the suggested technique in this study demonstrated superior performance
6	Detection of Retinal Eye Diseases by using Convolutional Neural Network	Suresh Limkar, Arbaaz Shaikh, Kirti Chiplunkar, Meghana Kharache,Tejaswini Chaudhari and Sneha Kulkarni(2020)	The training and testing phases utilized an open source dataset comprising OCT scans that included images of CNV (Choroidal neovascularization), DME (Diabetic Macular Edema), as well as Drusencombined with Glaucoma and Cataract images. [6].	A Pune ophthalmology institute provided 1000 photos of these disorders for the purpose of validation. The photographs from the dataset were simply used without any adjustments
7	Eye disease prediction using machine learning.	Aruna Ramanan P,Gowtham Rajan K,BalajiS,Nilesh P, Dr.K.Dhanalakshmi(2022)	Have used machine learning techniques to anticipate the timely detection of diabetic retinopathy, an eye ailment. This method uses the DRIVE database, which has different image conditions. [7].	Eye disease prediction is implemented by using decision tree and naïve bayes. Among the two classifiers, the decision tree technique is performing well with accuracy of 84.78789

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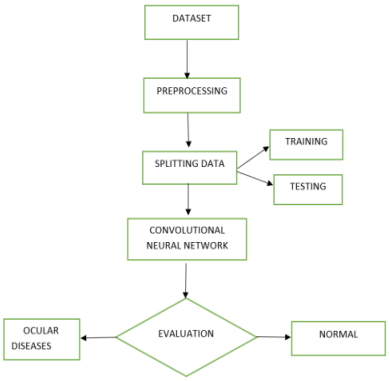
IV. METHODOLOGY OF PROPOSED SURVEY



1.**Data Pre-processing**:The first step is to load the image and ensure that all input images are resized to the same dimensions, which is necessary for the CNN model to process them.The next step is to convert the image to an array and also applies normalization to the pixel values of the image to ensure that they are in a suitable range for the CNN model.Finally, the processed image array is converted into a NumPy array and returned as input to the CNN model for prediction.

2.**Feature Extraction**: The process of extracting relevant visual features from eye images, which can then be used to train machine learning models for disease classification or detection. The process of feature extraction involves identifying distinctive patterns or shapes in the image that are characteristic of certain eye diseases.InceptionV3 is a pre-trained deep learning model that is being used as a feature extractor. This implies that the model is tasked with identifying and extracting crucial features from the input images, which will subsequently inform predictions regarding the eye's disease status.

3.**Building the model**: The model is trained on a dataset for ocular disease prediction and there will be a saved file that contains the trained model's configuration and parameters. The saved model is loaded and an input image is passed through the model for prediction. The pre-trained model is likely to be a deep neural network, which has learned to identify features in eye images that are indicative of various ocular diseases. The output of the model is the predicted class of the input image, which corresponds to the ocular disease that the model has learned to recognize.

4.**Train and test**: Training is to build a model that can generalize well to new data, meaning that it can accurately predict the labels of data it has never seen before. The purpose of the testing process is to assess how well the model performs on fresh, unobserved data. This is a crucial step in ensuring that the model can generalize effectively and is not merely memorizing the training data.

5.**Deployment**: Once the model is trained and tested, it can be deployed for use in clinical settings or other applications.Deploy the trained model in a user-friendly application that allows clinicians to upload new images and obtain predictions for the diseases of interest. The application should predict the disease and an explanation of the prediction results

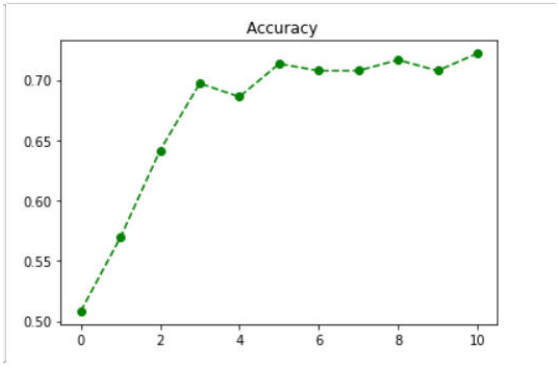


Figure 1 Model accuracy

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V.CONCLUSION AND FUTUREWORK

Early detection of eye illnesses is crucial, and the CNN approach is a highly effective method for predicting them. The goal is to achieve better accuracy, which can be achieved by considering all the relevant factors, including visible symptoms and data features. The CNN approach is suitable for working with various numbers of features and can provide reliable performance for detecting eye diseases. This means that all the available data can be utilized to improve the accuracy of the model. The research also suggests that one model can detect various ocular diseases efficiently, eliminating the need to create separate models for different eye conditions.

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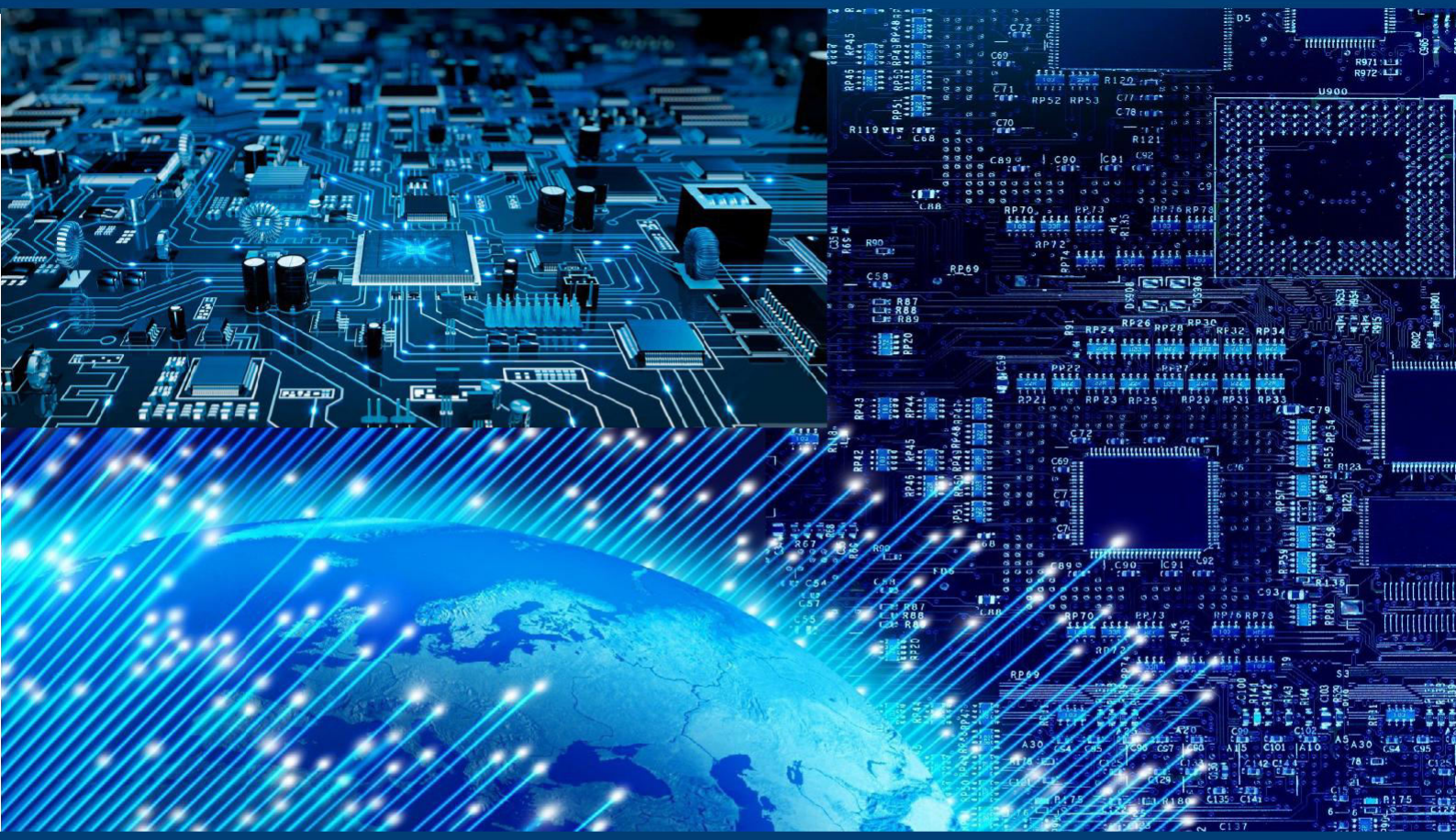

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