A REVIEW ON OCULAR DISEASE DETECTION

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Abstract— Eye disorders are the leading cause of eyesight loss in both developing and developed countries. Identifying and identifying a specific eye condition at an early stage can ensure that patients receive adequate care and that the eye surgeon is supported effectively. Eye problems in the elderly are a serious health issue. The natural function of eye tissues declines as people become older, and ocular disease becomes more common. Cataracts, Macular Degeneration, Hypertension, Diabetic Retinopathy, Myopia, and other age-related eye disorders and visual impairments in the elderly are the most prevalent causes.The loss of vision in the centre of the eye is caused by macular degeneration. Hypertension, which is caused by a lack of aqueous fluid drainage in the eyes, pathological myopia, and cataracts, which cause clouding or blurring of vision.The loss of vision in the centre of the eye is caused by macular degeneration. Hypertension is caused by a lack of aqueous fluid outflow in the eyes. Pathological myopia is caused by cataracts, which obscure or blur the lens of the eye. In diagnosis and illness management, a computer-based intelligent approach for categorization of various eye disorders is quite important. This system compares three categorization algorithms for four distinct types of eye data sets (three different kinds of eye diseases and a normal class). The suggested system employs Resnet, a deep learning model architecture. These raw photos are used to extract features, which are then given into the classifiers. We want a system that can identify eye disorders with greater precision and speed.

I. INTRODUCTION

Disease and malnutrition are the leading causes of vision impairment. According to the World Health Organization (WHO), more than 42 million people worldwide are blind .The most prevalent causes of blindness worldwide, according to WHO estimates from 2002, are: 1) cataracts (47.8%), 2) diabetic retinopathy (4.8%), and 3) myopia (3.7 percent) 4)Degeneration of the Macula (2.8 percent) 5) Hypertension (1.9%) and other factors, to name a few. Cataracts, often known as myopia, are responsible for about half of all blindness. Fundus illnesses, which are the leading cause of blindness, can cause vision loss.Diabetic retinopathy (DR), age-related macular degeneration (AMD), cataract, and other fundus illnesses now influence visual function. Fundus illness that progresses to a late stage has a significant influence on the patient's visual function, and there is no particular therapy for it. Diabetes sufferers are one of the world's most populous illness categories today.

As the population becomes older, more people will be impacted by vision-impairing illnesses including cataracts and glaucoma. These eye illnesses progress slowly, and the patient may not notice the progressive loss of vision until the condition has progressed to the point where vision is severely impaired. The earlier disorders are recognised and treated, the better the chances of preventing vision loss and curing. The normal, cataract, redness levels, diabetic retinopathy, and corneal haze eye are all briefly described here.The eye functions similarly to a camera. The cornea, which is like a window in the white of the eye and provides much of the focusing ability, allows light rays reflected by the objects we look at to enter the eye. The cornea is the eye's primary lens, and it is on the cornea that refractive surgery will be performed.

A compromised blood supply to the optic nerve head contributes to optic nerve head injury, according to the vascular aetiology of glaucoma theory. When the ocular perfusion pressure goes outside the typical range of autoregulation, localised injury might ensue. This might be due to a systemic problem (low systemic blood pressure, big nocturnal blood pressure drops, or peripheral vasospastic diseases) or a local blood supply problems .

Cataract is a clouding of the natural lens of the eye, which is located behind the iris and pupil. Diabetic retinopathy is a condition characterised by abnormalities in the retina's blood vessels. Diabetic retinopathy is divided into two stages : i)Nonproliferative retinopathy is a kind of retinopathy in which blood vessels enlarge and leak in the early stages of the illness. This produces macular edoema (retinal swelling), which can lead to visual loss. ii) Proliferative retinopathy is a more advanced form of retinopathy in which abnormal new blood vessels sprout on the retina's surface. These blood vessels can burst and leak into the vitreous, the transparent watery gel that fills the eye, resulting in significant vision loss.

While diabetic retinopathy cannot be totally avoided, you can lower your chances of it developing or progressing. Controlling your blood sugar can help you delay the onset of retinopathy and prevent it from worsening. It also reduces the need for laser surgery or other retinopathy-related operations. The majority of hazes dissipate over time or following drug therapy. Reduced visual acuity can be caused by severe corneal haze. It's a refractive surgical problem that causes the typically clear cornea to become cloudy.

Ocular hypertension is caused by a lack of aqueous humour drainage (a fluid inside the eye). This basically implies that too much fluid enters the eye and isn't evacuated, causing excessive pressure to build up. Eye pressure can be raised by an injury to the eye, some disorders, and some drugs. If you have a family history of hypertension, you are at a higher risk. AMD(age-related macular degeneration) is an eye condition that causes central vision blurring. It occurs when the macula — the region of the eye that regulates crisp, straight-ahead vision — is damaged as a result of ageing. The retina includes the macula.

The increased likelihood of occupational virus exposure makes healthcare practitioners particularly vulnerable. Imaging specialists and technicians are given first attention so that any potential viral interaction may be avoided. In addition to personal protective equipment (PPE), dedicated imaging facilities and procedures may be considered, which are critical in reducing hazards and saving lives.

Several critical contactless imaging procedures have been built, ranging from the use of monitoring cameras in the scan room or on the device to transportable CT systems with improved patient access and flexible installation. The TOF sensor is activated, audio information is given to start the person evaluation, and a 15 second time frame is given. Aim for more precision. can aid in the earlier diagnosis of ocular diseases The Resnet-50 detection technique is a hybrid solution that incorporates both neural networks (NN) and feature vector descriptions based on the histogram of oriented gradients (HOG) method. The resultant working copy of the network model was saved in Caffe framework format and processed in OpenCV Deep Neural Network module for this example.

II. LITERATURE REVIEW

On OCT Image Classification via Deep Learning Volume 11, Number 5, October 2019 Depeng Wang ,Liejun Wang.

In this paper, the application of the neural network models with effective feature reuse features based on the retinal OCT datasets in the diagnosis of AMD, DME was tested and evaluated. The optimization strategies of different neural network models, the effects of different neural network models on final diagnostic recognition and the adaptability of different neural network models to different datasets were studied. Two publicly available OCT datasets were used to evaluate the performance of the neural networks we selected and the impact of differences among datasets. After analysis and comparison, two neural network models CliqueNet and DPN were obtained, which have better effects on different datasets. CliqueNet and DPN can be applied to actual clinical diagnosis.The macular area is an important area of the retina, which is related to fine vision, color vision, and other visual functions. The vision will be negatively affected once lesions occur in the macular area. Senile macular degeneration, also known as age-related macular degeneration (AMD), is the aging change in the macular area, which occurs mainly in people over 45 years old and the prevalence rate of AMD increases with age, making it one of the primary causes of blindness in the elderly. Diabetic macular edema (DME) is a major complication of diabetes in the eyes, which is the leading cause of blindness in young adults in developed countries. Therefore, early detection is important for the treatment of AMD and DME . OCT is an imaging technique that detects the back reflection of the incoming weak coherent light or several scattered signal in different levels of the biological tissue based on the fundamental of weak coherence light interference, thus the two or three dimentional structural image of the biological tissue can be obtained through scanning .OCT is widely used in the diagnosis of AMD and DME.

Multi-label classification of fundus images with efficientnet jing wang, liu yang 1, zhanqiang huo 1 , weifeng he 2 , and junwei luo Published in: 24 November 2020.

Developed an automated end-to-end framework for detecting multi-label fundus diseases, and achieved well results on the public data set ODIR-2019. Convolutional neural network (CNN) has achieved remarkable success in the field of fundus images due to its powerful feature learning ability. Computer-aided diagnosis can obtain information with reference value for doctors in clinical diagnosis or screening through proper processing and analysis of fundus images.According to the obtained results, as more and more public data sets are available, the training of deep neural networks in the medical field is a feasible choice, but the practical application of deep learning in clinical practice is still an open problem. First, for the ODIR-2019 data set, one of the labels 'O'(other diseases) contains a variety of uncommon fundus diseases. The amount of data for some diseases is very limited, which makes it very difficult to improve the performance of a network. Another basic limitation comes from the black box of the nature of deep networks. The network automatically learns features from images, but the specific features learned are unknown.

Generalized Deep Learning Model for Glaucoma Detection by Sertan Serte, Ali Serener;16 December 2019.

Published in: 2019 3rd International Symposium on Multidisciplinary Studies and Innovative Technologies (ISMSIT).

Glaucoma is an eye disease that, in its late stages, can result in blindness. It is caused by a damaged optic nerve and has few early signs. To identify a glaucomatous eye, ophthalmologists may utilise perimetry, tonometry, and ophthalmoscopy. Deep learning has also been used to help in the identification of glaucoma. A generic deep learning algorithm for glaucoma diagnosis utilising fundus pictures is presented in this research. The model is trained and evaluated on numerous datasets and architectures, unlike earlier work. The results reveal that the model is 80 percent of the time equivalent to or better than previous work in the literature. Convolutional neural networks have previously been used to successfully classify and identify malignancies of the brain, lung, abdomen, heart, breast, bone, and retina using medical pictures. Deep learning systems such as AlexNet, GoogLeNet, VGGNet, ResNet, and DenseNet have produced classification results that are equivalent to or better than those of medical physicians on occasion.

Glaucoma Diagnosis over Eye Fundus Image through Deep Features Alan Carlos de Moura Lima, Lucas Bezerra Maia, Roberto Matheus Pinheiro Pereira; 20 August 2018.

The major goal of this study was to assess the performance of the main CNN pre-trained models from the ImageNet challenge in classifying the eye fundus picture using feature extraction from the RIM-ONE dataset, under normal and glaucoma conditions. In comparison to the other proposed combinations, the ResNet50 model paired with the Logistic Regression classifier earned the greatest accuracy value for the r2 version, demonstrating the model's ability to properly detect photos with glaucoma.Glaucoma is an ocular condition in which the optic nerve of the eye is damaged, resulting in a narrowing of the visual field and an increase in intraocular pressure, which can lead to blindness in late stages. The purpose of this paper is to offer a study on the usage of Convolutional Neural Networks (CNNs) for automated diagnosis of eye fundus pictures using CNNs. As a result, a comparison of the primary CNN designs for feature extraction was produced. Different classifiers were used to compare the collected features, which were then evaluated on RIM-ONE datasets. On the RIM-ONE-r2, the findings show promise for the combination of ResNet and Logistic Regression, with an AUC of 0.957, and for InceptionResNet with the same classifier, with an AUC of 0.860 on the RIM-ONE-r3.

III. PROBLEM STATEMENT

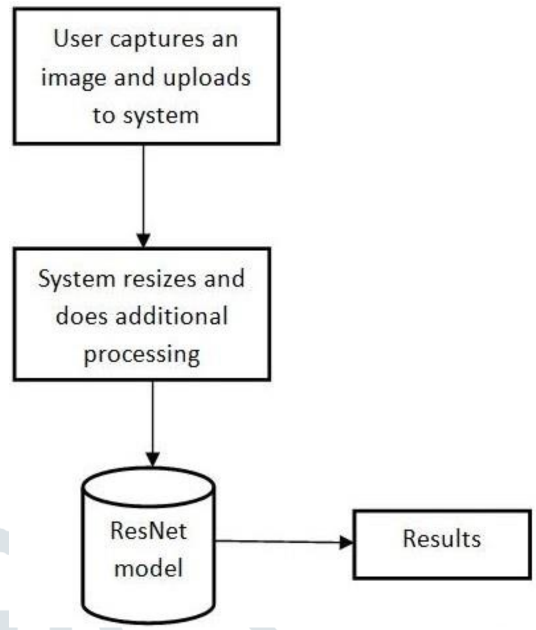
Using multiple machine learning approaches, an automated eye illness identification system is created in current systems. The human eye portion is automatically extracted from the facial image in our eye disease identification technology. The picture capture stage is the initial step. A digital camera was used to record this process. The approach loads the original Image as an input image first, and then our algorithm finds the face from the input image. The face photographs are scaled at 500500 pixels in our technique. The approach then divides the numerous face features into parts. We apply the eye sections of the image for learning once the eye component has been split from the face part.in the ImageNet database, established pretrained deep neural networks have been trained on at least a million photos to recognise thousands of items. The image collection includes both common and unusual things, such as pencils, animals, buildings, textiles, and geological formations. All layers save the last three—fully linked, softmax, and classification layers—can be frozen in one form of transfer learning. After then, the last three layers are taught to identify new categories.

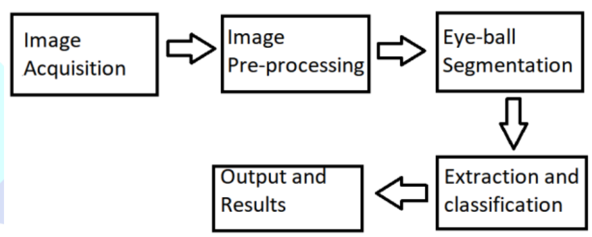
IV. PROPOSED SYSTEM

The proposed system adapts several architectures of ResNet-trained convolutional neural networks (CNNs) to operate as feature extractors for Fundus pictures. The CNNs are then integrated using Resnet, a consolidated machine learning approach. The proposed system adapts several architectures of ResnetNet-trained convolutional neural networks (CNNs) to operate as feature extractors for Fundus pictures. The CNNs are then coupled with the Resnet Classifier, a consolidated machine learning approach. The results demonstrate that the MobileNet architecture with the SVM classifier utilising a linear kernel, which achieves an accuracy and an F1-score of 90.5 percent, is the extractor-classifier pair with the greatest performance for one of the datasets.The best combination for the other dataset is Resnet-50 with MLP, which achieves a 90% accuracy and F1-score. As a result, the suggested method is effective in identifying Ocular Disease in Fundus-images.

V. ARCHITECTURE DESIGN

The proposed methodology for classifying an Fundus as being of a healthy patient or a patient affected by any particular ocular disease. First, we describe the datasets of images used in this study. Then, we explain the process of feature extraction, which is based on the transfer learning theory. After that, we present the classification techniques applied and the steps of their training process. Lastly, we define the metrics we use to evaluate the results and to compare it to other approaches.





The original data is first separated into a training set and a validation set in a 9:1 ratio, after which the data is cropped, the aspect ratio is cropped to 1:1, and the picture is ultimately shrunk to 299 x 299 pixels.we employed data augmentation techniques including random rotation of 45, 90 degrees, translation, and so on to increase the size of the data set while keeping the essential aspects of the original image rather than making a complete replica. The histogram equalisation process is then applied to both the original picture and the grey image, resulting in a more uniform grey value distribution, increased contrast, and more vivid detail features..The fundus photos are what we utilise. We employ the pre-trained Resnet-50 model, which uses robust features learned from the OCRD14 dataset implicitly. We perform our own data split because the OCIRD-5K dataset does not offer sufficient data split for training purposes. After a long search for a solution, the best I could come up with was to write a function that would comb through the entire dataset looking for keywords like cataract, glaucoma, diabetic retinopathy, and so on, returning these instances and concatenating them to get an estimate of the total number of cases for the various diseases. Because they were the most common conditions in the dataset, I narrowed it down to fundus pictures of normal, glaucoma, cataract, and diabetic retinopathy.

CONCLUSION

In Ocular Disease detection We used different CNN models in this study to try to categorise individuals with Eye Disease based on their fundus images. Several deep transfer learning models for automatically diagnosing Eye Disorders from photos (Fundus Images) are presented in this paper. The model was trained using a pre-trained Resnet-50 network, and then transfer learning was applied to the pre-trained network for quicker and more efficient training, which enhanced the model's performance. We also came to the conclusion that the Resnet has the finest performance and is best suited for use. We've effectively identified eye problems using fundus scans, demonstrating the potential for using such approaches to automate diagnosis duties in the near future.The great accuracy observed might be reason for worry because it could be due to overfitting. This may be confirmed by comparing it to new data. Large datasets may be employed in the future to improve patient categorization accuracy and classification accuracy. We don't want to build a flawless detection technique; instead, we want to look into the most cost-effective approaches to battle this disease. Such approaches may be explored for additional study in order to demonstrate their real-world use.The experimental results showed that the developing deep neural network outperformed existing state-of-the-art approaches in detecting occular illnesses from fundus pictures. The system's capabilities will be expanded by including the performance of various algorithms on a huge number of datasets. To capture the temporal and spatial information, recurrent neural networks were used.

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