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Diabetic Retinopathy Detection

Nischit Patel, Kevin Patel, Kunj Patel and Suvarna Pansambal

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Nischit Patel, Kevin Patel, Kunj Patel, Dr. Survarna Pansambal
Department of Computer Engineering
Atharva College of Engineering

ABSTRACT

According to the International Diabetes Federation (IDF), the overall population of diabetics in India was around 50.8 million in 2010, and it is expected to climb to 87.0 million by 2030. Diabetic Retinopathy is one of the most common problems associated with Type 2 diabetes. Diabetic Retinopathy is a condition that causes blindness in people aged 20 to 64. Long-term diabetic retinopathy disrupts the normal flow of fluid out of the eye, putting pressure on the eyeball and potentially damaging nerves, which can lead to glaucoma. Diabetic retinopathy can be detected and treated early, which reduces the chance of visual loss.

Manual Diabetic Retinopathy Diagnosis by ophthalmologists involves time, effort, and money, and can lead to misdiagnosis if computer-aided diagnosis systems are not used. Deep Learning has recently emerged as one of the most popular methods for achieving high performance results in a variety of fields, including medical image analysis and classification. This study tackles the topic of predicting diabetic retinopathy in advance in order to avert future consequences. The suggested classifier is based on the Mobile Net architecture, which is a lightweight, mobile-friendly design that was trained on retinal fundus images from the Aptos 2019 challenge data set.

The proposed enhanced model gives an accuracy of 96% and precision, recall, f-1 scores are 0.95, 0.98 and 0.97 respectively. Presented results demonstrate that this model achieves promising results and can be deployed as an application for clinical testing. This work attempts to suggest the diabetic retinopathy complications in advance. The intention of the work is to help the practitioners not to replace the ophthalmologist.

KEYWORDS

Diabetic Retinopathy, MobileNetV2, CNN, Retinal fundus images, Deep Learning, Binary Classifier, Vision Loss

INTRODUCTION

Diabetes is the most suitable disease for applying deep learning concepts . There are many researchers working on prediction of diabetes disease and complications arising from diabetes. There are many applications available which help the practitioners to study the disease and complications but many applications have their own advantages and flaws. According, Indian peoples are more prone to diabetes because of lots of reasons including lifestyle, consumption of type of food and inadequate physical activities. Diabetic Retinopathy is one of the major complications that affects the human eye of diabetic people. Damage to the blood vessels of light-sensitive tissue of the retina causes this disease. Diabetic Retinopathy (DR) is a compilation of diabetes that causes the blood vessel of the retina to swell and leak fluids and blood. It is the leading cause of blindness for people aged 20 to 64 years. Diabetic Retinopathy (DR) is a leading cause of vision loss globally. According to the article presented in the claims that approximately one-third of the 285 million population having diabetes mellitus worldwide intimates signs of diabetic retinopathy.

LITERATURE REVIEW

Sanskruti Patel[1] has applied pre-trained Convolutional Neural Network (CNN) models VGG16 and MobileNetV1. The test by VGG16 is 89.51% and MobileNetV1 is 89.77%.

Sarah Sheikh, Uvais Qidwai[2] have proposed lightweight mobile network and tested the performance of our classifier built using MobileNetV2 – a lightweight, mobile friendly architecture, which is trained using retinal fundus dataset. they have achieved an accuracy of 91.68% The macro precision, recall, and f1-scores are

Jiaxi Gao∗ et.al[3] they proposed a computationally efficient classification system based on efficient CNNs. It can be seen that the proposed Model Ensemble achieves a QWK score of 0.852

Shorav Suriyal et.al[4] they have focused on detection aspects of a mobile application developed to perform DR screening in real time. The application is powered by a tensorflow deep neural network architecture that is trained and tested on 16,798 fundus images. The final accuracy of the model is 73.3%

Kanika Verma et.al[5] their analysis revealed that TP=14, FP=0, TN=9, FN=2, value (PPV)=1, and value (NPV)=0.8181. The unknown test cases were by 88.46%. This shows that the of classification based on area and perimeter of blood vessels and hemorrhages produce motivating results. Sinthanayothin et al., (2003) reported sensitivity of 80.21% and specificity of 70.66% while differentiating diabetic retinopathy from normal images. Here, the we preprocessed using adaptive, local, and They adopted a neural network based classification.

Azar and Valentina E. Balas[6] their paper presents new auto matic approach for detecting retinal abnormalities. The developed algorithm helps in deciding whether the patients with potential sight and needs or patients not

Qummar, S., Khan, F. G., Shah, S., Khan, A., Shamshirband, S., Rehman, Z. U., ... & Jadoon, W. et.al[7] has a deep learning ensemble approach for diabetic retinopathy detection.

Abràmoff, Michael D., et al[8] have implemented a "Automated early detection of diabetic retinopathy." Ophthalmology

No	Author	Title	Description
1	Sanskruti Patel	Diabetic Retinopathy Detection and Classification using Pre-trained Convolutional Neural Networks	In this paper, they have applied pre-trained Convolutional Neural Network (CNN) models VGG16 and MobileNetV1. The test accuracy achieved by VGG16 is 89.51% and MobileNetV1 is 89.77%.
2	Sarah Sheikh, Uvais Qidwai	Using MobileNetV2 to Classify the Severity of Diabetic Retinopathy	In this paper, they have proposed lightweight mobile network and tested the performance of our classifier built using MobileNetV2 – a lightweight, mobile friendly architecture, which is trained using retinal fundus dataset. they have achieved an accuracy of 91.68% The macro precision,

			recall, and f1-scores are 77.6%, 83.1%,and 80.1% respectively.
3	Jiaxi Gao , Cyril Leung , Chunyan Miao	Diabetic Retinopathy Classification Using an Efficient Convolutional Neural Network	In this paper, they proposed a computationally efficient classification system based on efficient CNNs. It can be seen that the proposed Model Ensemble achieves a QWK score of 0.852
4	Shorav Suriyal, Christopher Druzgalski, Kumar Gautam	Mobile Assisted Diabetic Retinopathy Detection using Deep Neural Network	This paper focuses on detection aspects of a mobile application developed to perform DR screening in real time. The application is powered by a tensorflow deep neural network architecture that is trained and tested on 16,798 fundus images. The final accuracy of the model is 73.3%.
5	Kanika Verma. Prakash Deep and A. G. Ramakrishnan.	Detection and classification of Diabetic Retinopathy using retinal Images	Sinthanayothin et al., (2003) reported sensitivity of 80.21% and specificity of 70.66% while differentiating diabetic retinopathy from normal images. Here, the retinal images we preprocessed using adaptive, local, and contrast enhancement. They adopted a neural network based classification.
6	Ahmad Taher Azar and Valentina E. Balas	Classification and detection of Diabetic Retinopathy	The eye diseases mainly contribute to blindness and often can't be remedied because the patients are diagnosed too late with the diseases. The paper presents new auto matic approach for detecting retinal abnormalities. The developed algorithm

			helps in deciding whether the patients with potential sight threatening retinopathy and needs further examination or patients not in need of further referral
7	SEHRISH QUMMAR1 , FIAZ GUL KHAN 1 , SAJID SHAH 1 , AHMAD KHAN1 , SHAHABODDIN SHAMSHIRBAND 2,3, ZIA UR REHMAN1 , IFTIKHAR AHMED KHAN 1 , AND WAQAS JADOON	A Deep Learning Ensemble Approach for Diabetic Retinopathy Detection	Diabetic Retinopathy (DR) is an ophthalmic disease that damages retinal blood vessels. DR causes impaired vision and may even lead to blindness if it is not diagnosed in early stages. DR has five stages or classes, namely normal, mild, moderate, severe and PDR (Proliferative Diabetic Retinopathy).

CONCLUSION

Diabetic Retinopathy is one of the major complications that take place because of Type II diabetes mellitus where blood vessels swell as well as can even break. Early detection of disease helps to prevent further complications and helps the expert to treat the patient in early stages. The proposed system is based on MobileNet architecture with dense blocks for image classification. Though compression and acceleration of the network model reduces the classification accuracy including dense blocks allows to improve the performance of the Mobile Net. In future, the same architecture can be applied to detect the further other complications taking place because of diabetes mellitus. In **Future** We are planning to make multi class classifiers that will further classify the image into categories from 0 to 4. The frontend can be made using latest cutting-edge technological advancements like material design and trending design patterns which will help the doctor, eye clinics or appointed authority to easily maneuver the website. They can check details of patients who are suffering from the diabetic retinopathy and get the results quickly

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