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Diabetic Retinopathy Detection Using Deep Learning

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Abstract—

Diabetic retinopathy is a ailment resulting from out of control persistent diabetes which could result in overall blindness if no longer diagnosed early. To avoid the intense side consequences of diabetic retinopathy, the main cause of blindness amongst working-age adults, early clinical analysis and treatment are crucial. we hope to detect and prevent this sickness in rural regions in which scientific screening is difficult to conduct. presently, technicians travel to these rural regions to seize pix, which might be then reviewed and diagnosed through highly skilled medical doctors. by the usage of era, they desire to scale their efforts and ultimately be able to routinely locate disorder in photographs and suggest how excessive it might be. building a Convolutional neural community version that may routinely examine the degree of blindness in a patient by using looking at an photograph in their eye will assist us achieve this. Automation has the capability to drastically cut treatment instances for diabetic retinopathy on a massive scale.

Keywords— Diabetic Retinopathy, Artificial intelligence, Deep learning, Machine-learning, Dataset, CNN

I. Introduction

Iridology is the branch of technology that deals with the take a look at of the iris i.e. coloured part of the attention. The Iris is the greenish-yellow place surrounding the transparent scholar (displaying as black). The white outer vicinity is the sclera; the primary transparent component is the cornea. the primary purpose of the diagnosis is to accumulate a few facts about the underlying disorder. As era has evolved, there are numerous methods gift for diagnosis which are rather dependable and correct. essentially, is includes empirical technological know-how, to look into the specific location of the eye for systemic health situations of the unique organ of the body. Iridology is the analysis of clinical situations and “pre-sickness states” thru abnormalities of pigmentation in the iris. The location of abnormalities at the iris is associated with the area of the scientific situation inside the body. The iris of the attention is split into 60 sectors; every area is corresponding to an inner organ. The iris is associated with more than one nerve connections to the organs. depending at the functions of the iris category is carried out and diabetes is detected. Iridodiagnosis also can be used to detect disorder in the patient’s iris.

II. The motivation of project

Diabetes mellitus is on the increase and seems to be emerging as a major public health problem for our country. Interestingly, for every patient who is known to have diabetes, another has the disease but is unaware of it. It is a multisystem disorder, including cardiovascular disease, renal failure, peripheral neuropathy, and retinopathy which may lead to blindness. The relationship of diabetes mellitus and retinopathy is most interesting. It has been reported in the literature from the developed world that 20 years after the onset of diabetes, nearly all patients with type I diabetes (insulin-dependent) and more than 60% of those with type II diabetes (non-insulin-dependent) will have some degree of retinopathy. However, this also depends on the degree of metabolic control of diabetes.

III. Literature Survey

1] E. V. Carrera, A. Gonzalez and R. Carrera, ”Automated detection of diabetic ´ retinopathy using SVM,” 2017 IEEE XXIV International Conference on Electronics, Electrical Engineering and Computing (INTERCON), 2017, pp. 1-4, Doi: 10.1109/INTERCON.2017.8079692. This paper proposes a computer-assisted diagnosis based on the digital processing of retinal images in order to help people detect diabetic retinopathy in advance. The main goal is to automatically classify the grade of non-proliferative diabetic retinopathy at any retinal image. For that, an initial image processing stage isolates blood vessels, microaneurysms and hard exudates in order to extract features that can be used by a support vector machine to figure out the retinopathy grade of each retinal image. This proposal has been tested on a database of 400 retinal images labeled according to a 4-grade scale of non-proliferative diabetic retinopathy. As a result, we obtained a maximum sensitivity of 95% and a predictive capacity of 94%. Robustness with respect to changes in the parameters of the algorithm has also been evaluated.

2) L. Qiao, Y. Zhu and H. Zhou, ”Diabetic Retinopathy Detection Using Prognosis of Microaneurysm and Early Diagnosis System for Non-Proliferative Diabetic Retinopathy Based on Deep Learning Algorithms,” in IEEE Access, vol. 8, pp.104292-104302,2020,Doi: 0.1109/ACCESS.2020.2993937. This system analysis the presence of microaneurysm in fundus image using convolutional neural network algorithms that embeds deep learning as a core component accelerated with GPU(Graphics Processing Unit) which will perform medical image detection and segmentation with high-performance and low-latency inference. The semantic segmentation algorithm is utilized to classify the fundus picture as normal or infected. Semantic segmentation divides the image pixels based on their common semantic to identify the feature of microaneurysm. This provides an automated system that will assist ophthalmologists to grade the fundus images as early NPDR, moderate NPDR, and severe NPDR. The Prognosis of Microaneurysm and early diagnosis system for non - proliferative diabetic retinopathy system has been proposed that is capable to train effectively a deep convolutional neural network for semantic segmentation of fundus images which can increase the efficiency and accuracy of NPDR (non-proliferative diabetic retinopathy) prediction.

3) F. Alzami, Abdussalam, R. A. Megantara, A. Z. Fanani and Purwanto, ”Diabetic Retinopathy Grade Classification based on Fractal Analysis and Random Forest,” 2019 International Seminar on Application for Technology of Information and Communication (semantic), 2019, pp. 272-276, doi: 10.1109/ISEMANTIC.2019.8884217. In this paper, authors presented research based on fractal dimension which not only distinguishes the healthy subjects and diabetic retinopathy patients but also the severe level of diabetic retinopathy patients. By using the MESSIDOR dataset and Random Forest as Classifier, also obtained the results that fractal dimensions are able to distinguish the healthy subjects and diabetic retinopathy patients, but it did not obtain satisfactory results for classifying the severity of diabetic retinopathy patients (grade level). Thus, future directions which need to be explored are the other features such as univariate, multivariate, and other statistical features. It also needs to pay attention to red lesion detection to gain more information about diabetic retinopathy grade level.

4) ”Diagnosis of Diabetic Retinopathy by Using Image Processing and Convolutional Neural Network,” 2018 2nd International Symposium on Multidisciplinary Studies and Innovative Technologies (ISMSIT), 2018, pp. 1-5, Doi: 10.1109/ISMSIT.2018.8567055. This study describes the use of image processing and deep learning to diagnose diabetic retinopathy from retinal fundus images. For retinal fundus images enhancement approach, a practical method which contains HSV, V transform algorithm and histogram equalization techniques was used. Finally, a Gaussian low-pass filter was applied to the retinal fundus image. After the image processing, the classification was made using the Convolutional Neural Network. The performance of the proposed method was assessed using 400 retinal fundus images in the Kaggle Diabetic retinopathy Detection database. In experiments, classification work has been done for each stage of image processing. The classification study was performed after image processing. Twenty experiments were done for every stage and average values were found. A. Singh Gautam, S. Kumar Jana, and M. P. Dutta, ”Automated Diagnosis of Diabetic Retinopathy using image processing for non-invasive biomedical application,” 2019 International Conference on Intelligent Computing and Control Systems (ICCS), 2019, pp. 809-812. In this paper, MATLAB-based image processing is used which exploits the knowledge of Computer Science and Biomedical Engineering to identify whitish lesions, cotton wool spots, and hard exudates associated with DR. Based on the value of pixel counts, the image of the patient’s eye under examination is classified as a Diabetic Retinopathy eye or a Non-Diabetic Retinopathy eye.

IV. PROBLEM DEFINITION:

Currently, detecting DR is a time-consuming and manual process that requires a trained clinician to examine and evaluate digital color fundus photographs of the retina. By the time human readers submit their reviews, often a day or two later, the delayed results lead to lost follow-up, miscommunication, and delayed treatment. Clinicians can identify DR by the presence of lesions associated with the vascular abnormalities caused by the disease. While this approach is effective, its resource demands are high. The expertise and equipment required are often lacking in areas where the rate of diabetes in local populations is high and DR detection is most needed. As the number of individuals with diabetes continues to grow, the infrastructure needed to prevent blindness due to DR will become even more insufficient.

V. ARCHITECTURAL DESIGN

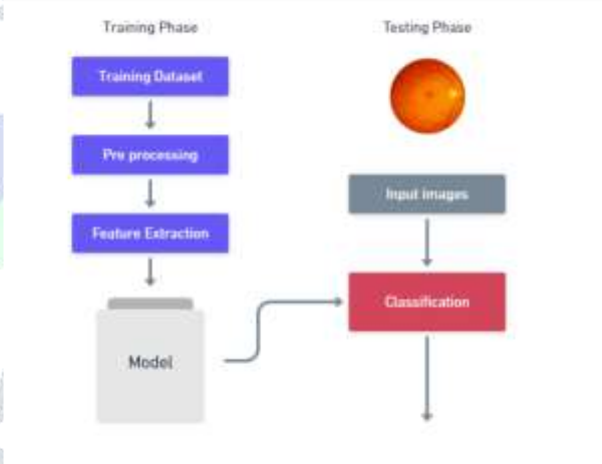

fig 1 : block diagram

The machine includes fundamental steps preprocessing, function extraction, and category. inside the trying out section verification is achieved with pertained pattern signatures

. • Dataset : This study used publicly available Kaggle Dataset for Diabetic Retinopathy Detection. The database was created with photos taken from publicly available retinopathy detection datasets. The Kaggle dataset incorporates one thousand pixels with diabetic retinopathy and 1000 photos without diabetic retinopathy. From the whole pics we've selected 122 pics with diabetic retinopathy and 122 regular pics. chosen extraordinary photographs contain exudates, hemorrhages, and microaneurysms.

•Preprocessing: In image pre-processing, to find exudates, initially the image from the dataset is transformed to HSV image. Color space conversion is converting a photograph that is represented in one color area to any other shade space, the aim being to make the translated image appearance as similar as feasible to the unique. red, Blue, inexperienced channels inside the given photo to Hue, Saturation, cost. It's far more useful to extract yellow-coloured exudates from RGB pictures while we convert RGB to HSV. Then aspect zero padding, median filtering and adaptive histogram equalization is carried out.

• characteristic Extraction: For binary classification, here we are using 2 functions, ie, quantity of exudates as first parameter and number of hemorrhages and microaneurysms as 2nd parameter. That is, we're counting a number of white pixels from the segmented pictures and dividing it by the overall variety of pixels inside the image.

• classification: within the proposed method we're imposing a hybrid classifier. this is we are using a aggregate of five classifiers, support vector machines, okay

nearest friends, and Random woodland. each classifier will classify the overall 244 pix into both ordinary or unusual snap shots. SVM classifier with kernel radial bias function and degree three is used. After obtaining the classifiers we have performed voting as a hybrid technique. training of the dataset is done on 5 special classifiers and testing is finished.

VI. ALGORITHM

CNN(Convolutional Neural community) - CNN is like everyday neural networks. They include at the least one convolutional layer observed with the aid of a minimum of one completely connected layer like a well known neural network. CNNs consist of neurons having variable weights and their values are set during the education phase. Inputs given to CNN require a minimal quantity of preprocessing as CNN's are made up of a selection of multilayer perceptrons. The CNN structure is made in any such manner as to make full advantage of a -dimensional input signal. they're broadly utilized in picture classification and language processing

A. Flowchart

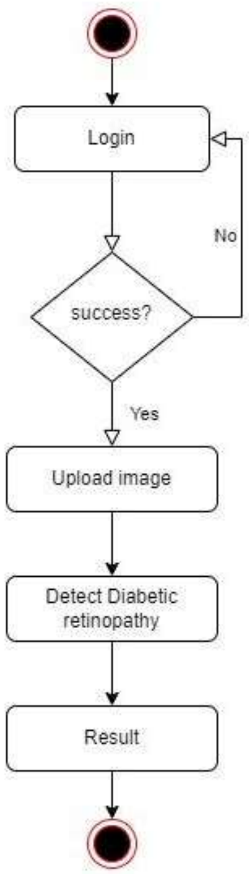

Fig 2.
(Flow Chart)

VII. CONCLUSION

1. The goal of this proposed study is to demonstrate how biomedical image processing can aid in the early and non-invasive detection of DR. Complex and time-consuming human labor is decreased with the aid of simple and straightforward image processing techniques. Images of diabetic retinopathy or non-diabetic retinopathy can be found in fundus eye images. The patient can save time and money by not having to go to a physician or clinician for a diagnosis of DR. A fundus camera and a computer system with OpenCV installed are essentially all that is needed for this proposed method, which makes it a deep learning algorithm for detecting Diabetic Retinopathy early and preventing patients with DR from losing their vision.

2.

VIII. FUTURE SCOPE

Later, extra diabetic retinopathy features, consisting of hemorrhages, reddish lesions, micro aneurysms, and so forth., may be centered on the use of different biomedical photo processing strategies for superior processing and detection of Diabetic Retinopathy snap shots with higher accuracy.

IX. EXPERIMENTAL RESULTS

For medical function evaluation, development is vital for the extraction of deep-layer capabilities. For characteristic extraction diverse forms of photo enhancement strategies like arithmetic operation, histogram equalization, and adaptive histogram equalization have been implemented. The detection of diabetes using Iridology includes photo acquisition, pre-processing, segmentation, Iris region, Normalization, feature extraction, and type. The consequences proven in Fig are up to the vicinity of interest extraction for precise diagnosis using a grid chart.

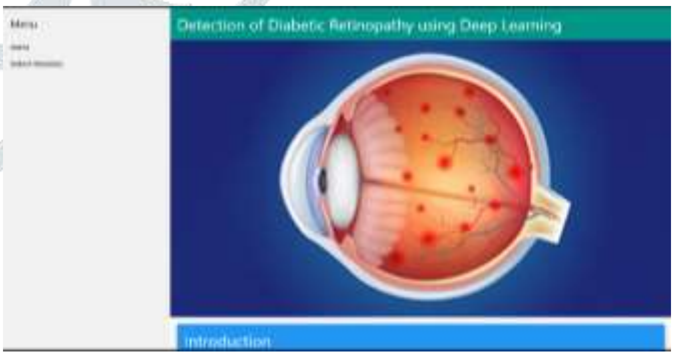

Fig.3
(GUI)

X. RESULT

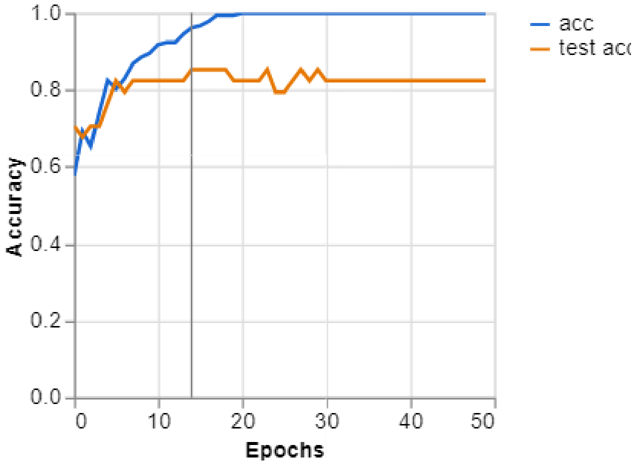

Fig. 3
(Accuracy Graph)

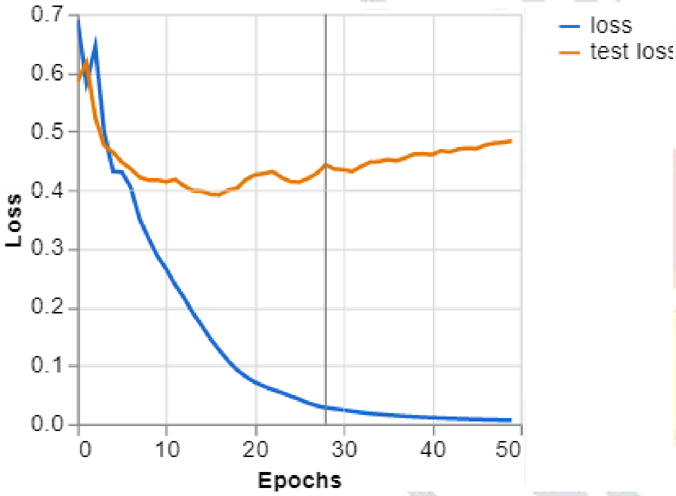

Fig. 4
(Loss Graph)

XI. REFERENCE

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[2] F. Alzami, Abdussalam, R. A. Megantara, A. Z. Fanani and Purwanto, "Diabetic Retinopathy Grade Classification based on Fractal Analysis and Random Forest," 2019 International Seminar on Application for Technology of Information and Communication (iSemantic), 2019, pp. 272-276, doi: 10.1109/ISEMANTIC.2019.8884217.

[3] L. Qiao, Y. Zhu and H. Zhou, "Diabetic Retinopathy Detection Using Prognosis of Microaneurysm and Early Diagnosis System for Non-Proliferative Diabetic Retinopathy Based on Deep Learning Algorithms," in IEEE Access, vol. 8, pp. 104292-104302, 2020, doi: 10.1109/ACCESS.2020.2993937.

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