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Automatic Diabetic Detection for Eye Disease using Images Processing

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***Abstract*: Diabetic eye disease is one of the major problems worldwide. That can cause major eye impairment, including a permanent loss of vision. Early detection of eye diseases increases the survival rate by successful treatment. The blood vessels are the primary anatomical structure visible in retinal images. The segmentation of retinal blood vessels has been accepted worldwide for diagnosing both diabetic and retinal diseases. Thus, it requires an appropriate vessel segmentation method to detect retinal diseases such as diabetic retinopathy and cataracts automatically. Detecting retinal diseases using computer-aided diagnosis (CAD) can help people avoid the risks of visual impairment and save medical resources. Existing methods practically gave good testimony to understanding the genetics of retinoblastoma. Innovative development of low-cost application-based intelligent systems integrated with a microscopic lens allows patients in remote and remote areas to be regularly screened and diagnosed. The diagnostic system uses artificial neural network algorithms to analyze retinal images captured to detect retinal disease status. The algorithm is first trained using a personal computer with infected and normal retinal photos and then developed in an atmospheric diagnostics application. The proposed methodology is to explore machine learning techniques to detect diabetic diseases using thermography images of an eye and to introduce the effect of variation of abnormality in the eye structure as a diagnosis imaging modality, which is useful for ophthalmologists to make the clinical diagnosis. Images are pre-processed, and then Gray Level Co-occurrence Matrix (GLCM) based texture features from grey ideas, statistical features from RGB and HSI images are extracted and classified using a classifier with various combinations of features. They detect diabetic diseased eyes, a CNN classifier is used for classification, and their performance is compared. A different-fold cross-validation scheme is used to enhance the generalization capability of the proposed method.**

Keywords*: Retinal disease Neural Networks, Retinal image analysis, Blood Vessel Detection, Image Segmentation, Fundus Image Classification, Feature Selection*

INTRODUCTION

Particularly in the field of medicine, new values are being created because to technological advancements. The retina is the unique non-invasive window into the deep-seated blood vessels of the eye. The retinal fundus picture primarily reveals the retinal blood vessels. Cataracts, diabetic retinopathy (DR), high blood pressure, etc., all have an effect on the body's structure and features, and these variances reflect this. More than half of all cases of vision impairment in the developed world are attributable to cataracts. Almost typically, this illness only affects very young children. If this diabetic's condition progresses, they may become blind or have to have an eye removed. It also discusses chromosomal mutations and their effects. Retinoblastoma may develop in people of any age. The illness may be broken down into heritable and asymptomatic subtypes. It is well known that bilateral retinoblastomas are heritable but

unilateral retinoblastomas are not.

LITERATURE SURVEY

Infrared Imaging for Human Thermography and Breast Tumor Classification using Thermal Images [1]. The significance of Infrared Thermography (IRT) and the role of machine learning in thermal medical image analysis for human health monitoring and various disease diagnosis in preliminary stages. The first part of the proposed study provides comprehensive information about the application of IRT in the diagnosis of various diseases such as skin and breast cancer detection in preliminary stages, dry eye syndromes, and ocular issues, liver disease, diabetes diagnosis and last but not least the novel COVID-19 virus. Whereas in the second phase we have proposed an autonomous breast tumor classification system using thermal breast images by employing state of the art Convolution Neural Network (CNN).

Detection of Diabetic Eye Disease from Retinal Images Using a Deep Learning Based CenterNet Model [2]. The manual localization of DR and DME lesions requires experienced human experts to locate finer points of interest from colored fundus images, and classify them into appropriate groups through a grading system. To cope with the challenges of a manual detection system, a robust automated technique based on a custom CenterNet model and a DenseNet-100 feature extractor is introduced in the proposed work. We evaluated our approach on two benchmark datasets, namely, APTOS-2019 and IDRiD, and achieved accuracies of good respectively.

Machine Learning-based Diabetic Retinopathy Early Detection and Classification Systems- A Survey [3]. The performance of various machine learning algorithms-based DR detection and classification systems. These systems are trained and tested using massive amounts of retina fundus and thermal images from various publicly available datasets. These systems proved their success in tracking down the warning signs and identifying the DR severity level. The reviewed systems' results indicate that ResNet50 deep convolutional neural network was the most effective algorithm for performance metrics. The Resnet50 contains a set of feature extraction kernels that can analyze retina images to extract wealth information.

Svm Based Method For Diabetic Eye Disease Detection [4]. a non-invasive procedure has been presented to guage the presence of diabetic diseases within the eye. The classification of diabetic diseased and normal eye IR images is completed through Support Vector Machine classifier using various combination of texture and statistical features The simulation results indicate that the classifier in the detection of diabetic diseased eye performed in the accepted level and provide accuracy, sensitivity, specificity classifier.

Facial Paralysis Detection in Infrared Thermal Images Using Asymmetry Analysis of Temperature and Texture Features [5]. a quantitative thermal asymmetry analysis method for early diagnosis of facial paralysis in infrared thermal images. First, to improve the reliability of thermal image analysis, the facial regions of interest (ROIs) were segmented using corner and edge detection. A new temperature feature was then defined using the maximum and minimum temperature, and it was combined with the texture feature to represent temperature distribution of facial ROIs. Finally, Minkowski distance was used to measure feature symmetry of bilateral ROIs. The feature symmetry vectors were input into support vector machine to evaluate the degree of facial thermal symmetry. The results showed that there were significant differences in thermal symmetry between patients with facial paralysis and healthy people.

Automatic Detection of Diabetic Eye Disease Through Deep Learning Using Fundus Images: A Survey [6]. a systematic survey of automated approaches to diabetic eye disease detection from several aspects, namely: i) available datasets, ii) image pre-processing techniques, iii) deep learning models and iv) performance evaluation metrics. The survey provides a comprehensive synopsis of diabetic eye disease detection approaches, including state of the art field approaches, which aim to provide valuable insight into research communities, healthcare professionals and patients with diabetes.

Pre-diagnosis of Diabetic Retinopathy using Blob Detection [7].an effective feature extraction technique based on blob detection followed by classification of different stages of diabetic retinopathy using machine learning technique. This feature extraction technique could help automatic characterization of retina images for diabetic retinopathy with an accuracy of 83 per cent with the most efficient machine learning classification algorithm, which would help specialists to handily recognize the patient's condition in a progressively precise manner.

Automatic Detection of Diabetic Retinopathy: A Review on Datasets, Methods and Evaluation Metrics [8]. The system, analysis and explanation of retinal fundus images need ophthalmologists, which is a time-consuming and very expensive task, but in the automated system, artificial intelligence is used to perform an imperative role in the area of ophthalmology and specifically in the early detection of diabetic retinopathy over the traditional detection approaches. Recently, numerous advanced studies related to the identification of DR have been reported. This paper presents a detailed review of the detection of DR with three major aspects; retinal datasets, DR detection methods, and performance evaluation metrics.

Diabetic Retinopathy Detection using Ensemble Machine Learning [9]. points out promising technological advancements for the healthcare and medical sectors, especially in the early detection of many types of illnesses. Each and every disease is best treated when in its earliest stages, such as, and most importantly, Cancer, Diabetic Retinopathy, Cholesterol abnormalities, and many others. Moreover, automatic detection models are time and cost-efficient, which will serve various communities and regions, and can be run by any practitioner once they are familiar with the models processing and how decisions are displayed. In the present work, we introduce a new framework for Diabetic Retinopathy detection using Ensemble Machine Learning.

Detecting Diabetic Retinopathy Using Embedded Computer Vision [10]. The development efforts on an embedded vision algorithm that can classify healthy versus diabetic retinopathic images. Convolution neural network and a k-fold cross-validation process was used. We used 88,000 labelled high-resolution retina images obtained from the publicly available Kaggle/EyePacs database. The trained algorithm was able to detect diabetic retinopathy with up to 76% accuracy. Although the accuracy needs to be further improved, the presented results represent a significant step forward in the direction of detecting diabetic retinopathy using embedded computer vision

RESEARCH EMTHODOLOGY

In the proposed research work to design and implement a system that can provide eye diabetic disease detection using deep learning, the procedure carried out various features extraction using image segmentation and the use of CNN deep learning classification algorithm to detect the actual disease.

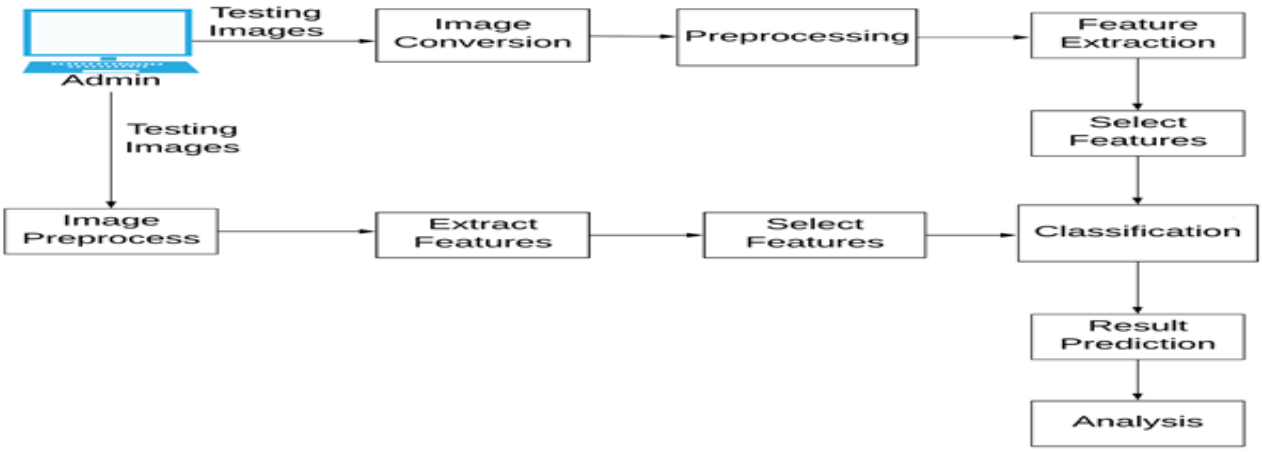

Figure 1: Research methodology of proposed system

Implement Process

The graphic depicts how the method would be implemented for the diabetic eye images dataset. The dataset is first pre-processed before being trained using the CNN method. The CNN's layer-by-layer operation is as follows:

1. The convolution layer is the first layer of a CNN to which we may feed a pre-processed image to extract the various characteristics of the input image using numerous image filters.

2. Because pictures are nonlinear in form, images are also nonlinear. To keep the nonlinearity, we must apply RELU to it.

3. The eye picture will be pooled and down-sampled to get the feature matrix.

4. The image vector from the pooled picture matrix will be flattened and fed into a fully linked layer.

5. A dropout layer is used as a fully connected layer to regularise neural networks.

6. The multidimensional picture will be flattened and transformed to vector format, after which the eye condition will be classified into a specific group.

7. For multiclass classification, the softmax function is utilised. (Accurately classifying an input picture into the five categories of diabetic retinopathy would be beneficial.)

APPLICATIONS

- EyePACS Application: It's like a license-free Web-based DRS system designed to simplify the process of image capture, transmission, and review. The system provides a flexible platform for collaboration among clinicians about diabetic retinopathy.
- Diabetic detection application
- Disease prediction using IoT and ML for diabetic retinopathy systems.

CONCLSUION

Automated techniques for diabetic retinopathy diagnoses are essential to solving these problems. While deep learning for binary classification generally has achieved high validation accuracies, multi-stage classification results are less impressive, particularly for early-stage disease. The system also works on the image as normal RGB and greyscale images. From a computer perspective, retina processing is reviewed with several methods and process steps. They are important. Divide the blood vessels as an image that can be used to identify the right disease. The resulting image is summarized in the accompanying problem with problems such as brightness and contrast of the result. Therefore, improving overall performance by focusing on pre-processing and extracting results is essential. The automated Diabetic Retinopathy diagnosis system is thus used to detect various lesions of the retina, i.e. exudates, micro aneurysms and haemorrhages, and their count size and location to assess the severity of the disease so that the patient can be diagnosed early and referred to the specialist well in advance for further intervention. Certain features present in the normal physiology of the retina have to be differentiated from the abnormal pathology, e.g., the optic disc has the same pixel brightness as the exudates and thus has to be localized before establishing the presence of the exudates. Similarly, the blood vessel and fovea region must be subtracted from the retinal image before diagnosing micro aneurysms and haemorrhages. Finally, the CNN Algorithm predicts the good classification accuracy of the system.

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