

# Identification of Abnormalities in Retina using Machine Learning Technology

Hemalakshmi.G.R <sup>1</sup>, Karpagam.J <sup>2</sup>, Kiruba.M <sup>2</sup>

<sup>1</sup> Assistant Professor(SG),Dept. of CSE,National Engineering College,Kovilpatti.

<sup>2</sup> Final year Computer Science and Engineering, National Engineering College,Kovilpatti.

**Abstract-** In the retinal fundus images, the most significant task is the diagnosis of the retinal diseases. Ophthalmologists need an automation system for diagnosis with reduced time. Early diagnosis and treatment of different retinal diseases is extremely essential to prevent it from getting worse or even leading to blindness. Soft Computing techniques with image processing algorithms take part in analyzing and assisting Ophthalmologists towards disease diagnosis.

## I. INTRODUCTION

People are facing new emerging and automated technologies in their day to day life. Due to automation, urbanization, industrialization and changes in the food habits there occurs so many health issues. One of them is diabetic retinopathy, which happens to the diabetes who is suffering due to the insufficient production of insulin in their body. These diabetes are caused due to many reasons, some of them are lifestyle factors, gene and overweight. The rising prevalence of diabetes notably emerging in Asian countries such as India and China. According to WHO in India by 2030 around 79.4 million people will be affected by diabetes, which is the largest number in any country in the world. About 33% of the patients suffering from diabetes have the symptoms of diabetic retinopathy. Since the diabetic patients are hugely affected by this diabetic retinopathy. Hence we need a system which accurately differentiate the normal retina and the affected retina. So to identify diabetic retinopathy, we are going to segment the retinal fundus image and the abnormal retina is identified and now it is easy for the ophthalmologist to give the proper treatment at the correct time. Thus the objective of the project is to find the abnormalities in the retina using machine learning technology and further extending it as an IoT project.

## II. LITERATURE SURVEY

**Akram Youssry et al (2016)** applied feature extraction methods such as 4- D Feature vector generation, optimized soft-max feature vector normalization and combine using optimized non-linear transformation. The proposed classification quantum mechanics-based algorithm is applied on the combined image to get the segmented blood vessel image. This algorithm is tested on the database DRIVE and sensitivity, specificity, and accuracy are 80.29, 97.34, and 95.83 %, respectively

**R.GeethaRamani et al (2015)** formed a feature vector by applying the pre-processed technique on the fundus images. K-means clustering and principal component analysis is performed on the feature vector to group pixels as either vessel or non-vessel cluster. The post-processing morphological techniques implemented on the vessel segmented output from previous phase. The method is applied on the DRIVE database and the accuracy 95.36 is achieved.

**Gehad Hassan et al (2015)** uses mathematical morphology methods such as Top-Hat Transform and Gaussian filtering methods for a preprocessing and K-Means and vessel extraction methods for classifying the blood vessels. The results obtained by the proposed approach shows the effective average accuracy of 95.10% and best accuracy of 96.25%.

**Malak T. Bantan et al (2016)** implemented the basic preprocessing steps such as image acquisition, grayscale conversion and contrast enhancement, intensity adjustment, complement and adaptive histogram equalization. Mathematical morphological opening, binarization and noise extraction methods are implemented on the pre processed image and the specificity of 97%, a sensitivity of 69% and an Accuracy of 94% was occurred as a result.

**SangitaBharkad et al (2017)** locates OD using appropriate threshold and grayscale morphological dilation and median filtering for segmentation of the

region. The proposed algorithm is tested on DRIVE, DIRATEDB0, DIRATEDB1 and DRIONS databases and the accuracy 100%, 96.92%, 98.98%, 100% is achieved. The sensitivity and specificity is in the range 74.60–87.07%, 99.39–99.61% is obtained.

### III. PROBLEM FORMULATION

Diabetic retinopathy (DR) is a genuine eye sickness that begins from diabetes mellitus and is the most widely recognized reason for visual impairment in the developed nations. In this manner, much exertion has been made to set up dependable computer aided screening frameworks dependent on shading fundus pictures. In previous work, “On combining computer-aided detection systems,” showed that the fusion of the results of the several MA detectors leads to an increased average sensitivity measured at seven predefined false positive rates.

### IV. PROPOSED SYSTEM

The proposed system is meant for the diabetic patients who are more vulnerable to the disease. And also in India there are shortage of 1,27,000 eye doctors and 45% of the patients suffer vision loss before diagnosis (Tensor Flow). So we need a system which can provide exact differentiation in the variation of normal eye and the affected eye. The System is implemented by extracting the feature of the retinal image and processed for finding the variation between the affected and the unaffected eye. The system consist of monitor for display, Raspberry pi as a processor, HDMI to VGA converter for connecting the monitor and the Raspberry pi.

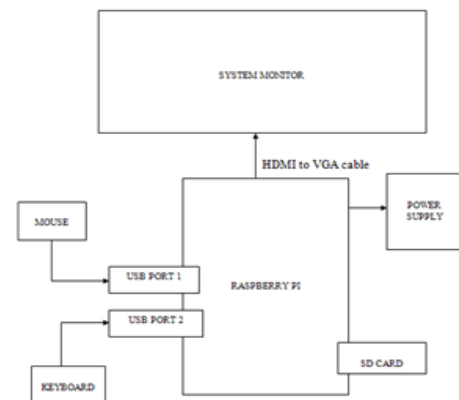
### V. METHODOLOGY

The processor used in detecting the abnormalities in the retina is Raspberry Pi. The Raspberry Pi is a series of credit card-sized single-board computers. In Raspberry pi, the retinal fundus image is segmented and it is processed using K-means clustering algorithm. In the initial step, a button is attached to the Raspberry Pi. When the button is pressed, the image is fetched using the commands and processed in the Mat Lab platform. When the image processing is completed, the status of the retinal fundus image is displayed. (whether the retinal is affected or not).

#### A. Preprocessing

The first preliminary step of image analysis is the preprocessing for automated retinal disease diagnosis. The preprocessing techniques involve

Denoising of an image, contrast enhancement and differentiation of foreground and



background etc. Conversion of the RGB image into the Red, Green and Blue channel images in which features from each channel image extracted and carried out classification for abnormality retinal disease.

#### B. Optic Disk Segmentation

The Optic disk are located using the appropriate threshold and grayscale morphological dilation and median filtering for segmentation of the region. The proposed algorithm is tested on DRIVE, DIRATEDB0, DIRATEDB1 and DRIONS databases and the accuracy 100%, 96.92%, 98.98%, 100% is achieved. The sensitivity and specificity is in the range 74.60–87.07%, 99.39–99.61% is obtained.

#### C. Blood Vessel Segmentation:

K-means and Fuzzy C-means (FCM) which also includes a hard and soft clustering stage to get binary vessel map. The post processing step was applied to removes falsely regions. Applying this clustering method achieves 95.94% and 95.71% of accuracy.

#### D. Exudate Segmentation:

Morphological Component Analysis (MCA) is applied as a first stage and dynamic thresholding and mathematical morphology technique is used for detection of exudates and give result as AUC of 0.961 and 0.948 and 0.937.

### VI. CONCLUSION

The project further can be extended by showing the status of the retina to the ophthalmologist via phone using GSM module. GSM is a standard used across worldwide for mobile communication and is used to send the message to the authorized mobile number regarding the status of the retinal fundus image. The next part of the project will be specifically identifying the anatomical feature of Diabetic Retinopathy such as Optic disc, Blood vessel, Microaneurysm, Haemorrhage, Exudate by processing

the appropriate algorithm such as Morphological Dilation and Median Filtering, K-means clustering, Ensemble classifier, Morphological, SVM classifier respectively.

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