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DIABETIC RETINOPATHY INFECTION DETECTION & CLASSIFICATION USING ADVANCE GENETIC ALGORITHM

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Abstract- Diabetic retinopathy is a disorder which affects the retina of the eye by effecting or damaging the blood vessels which results in leakage of blood and fluids from eye which causes swelling of retinal tissue and blurred vision. This concept proposes an advance genetic algorithm to segment retinal image so as to get infected region accurately. The main goal is automatic retinal image analysis, which can reduce the workload associated to manual grading as well as save diagnosis costs and time. The aim of this project is to detect the diabetic retinopathy (DR) and to perfectly classify an image into different stages of a retinal diseases using fuzzy logic also to put necessary prescription against future diseases spreading.
Keywords- Diabetic Retinopathy, Advance Genetic Algorithm, fuzzy logic.

1. INTRODUCTION:

Diabetic Retinopathy is a disease of the retina resulting from the effects of diabetes on the retinal blood vessels. It is the leading cause of blindness in those of ages between 20 & 60.
There are 3 main types of diabetic retinopathy:

1.1 Background Diabetic Retinopathy

Diabetic retinopathy is commonly seen in people who have been diabetic for a long time. The patient's vision is normal and his retinal blood vessels are mildly affected.

1.2 Diabetic Maculopathy

Fluid and protein may be leaked from the retina's blood vessels as a result of diabetes. This causes swelling of the retina. Vision will become blurred if the swelling involves the macula (centre of the retina).

1.3 Proliferative Diabetic Retinopathy

The retinal blood vessels are blocked, leading to the formation of new vessels which are abnormal and fragile. This may lead to haemorrhage (rupture of the vessels) in the eyes and cause a sudden vision loss.
In more advanced cases, scar tissue develops. The scarring will pull and distort the retina. This may cause the retinal to detach, resulting in a more severe loss of vision.

Types Of Available Treatments:
A. Laser Treatment
In the case of diabetic maculopathy, laser treatment to the points of leakage can decrease swelling and stabilize the vision. In the early stages of proliferative diabetic retinopathy, more extensive laser treatment can be done to slow down the formation of abnormal blood vessels, thereby preventing the development of more severe complications. Laser treatment has its risks. Some patients may experience a decrease in vision to the sides (peripheral vision). In others, night and colour vision may be affected.

B. Surgery
Surgery such as vitrectomy may be required in more severe cases where the disease continues worsening (persistent bleeding the eye/retinal detachment) despite the laser treatment.
Injection of Medication Inside The Eyes Medications such as Triamcinolone and anti VEGF can be injected inside the eye to help maintain/ improve vision in some patients with diabetic retinopathy.

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Ways To Prevent/ Delay Diabetic Retinopathy
Diabetic patients have to keep a tight control of their blood sugar, as well as to keep their blood pressure and blood cholesterol within the normal limits.

2. LITERATURE SURVEY:

2.1 Early Eye Examination Saves Sight:
It is important for diabetic patients to go for eye screening early in order to detect diabetic retinopathy. If diabetic retinopathy is not detected or treatment is not required after the initial examination, diabetic patients should still go for regular follow up with their eye doctors as diabetic retinopathy may develop with time. Early treatment gives patients a good chance of maintaining their vision throughout their life.
Diabetic retinopathy is a severe and widely spread eye disease. It is the commonest cause of legal blindness in the working-age population of developed countries [1]. Diabetic retinopathy occurs when diabetes damages the blood vessels inside the retina, leaking blood and fluids into the surrounding tissue. This fluid leakage produces microaneurysms, hemorrhages, hard exudates, and cotton wool spots (a.k.a., soft exudates) [2], [3]. Diabetic retinopathy is a silent disease and may only be recognized by patients when changes in the retina have progressed to a level where treatment becomes difficult or even impossible.
The increasing number of diabetic retinopathy cases worldwide requires intensifying efforts in developing tools to assist in the diagnosis of diabetic retinopathy. Automatic detection of diabetic retinopathy will lead to a large amount of savings of time and effort. Thus, Wu et al. [1] proposed a method for automatic detection of micro aneurysms in retinal fundus images. In [4], Maher et al. already evaluated a decision support system for automatic screening of non-proliferative diabetic retinopathy. In fact, support vector machines were used by Maher et al. [5] in the automated diagnosis of non-proliferative diabetic retinopathy. Several image pre-processing techniques have also been proposed in order to detect diabetic retinopathy [6]–[9]. However, despite all these previous works, automated detection of diabetic retinopathy still remains a field for improvement [2].
The clinical features of diabetic retinopathy are microneurysms, haemorrhages, exudates and new vessels. A description of these features18 is given below: (a) Micro aneurysm and Haemorrhages: They appear as tiny dots or blots of blood in the retina image. Vitreous haemorrhages, which resemble large pools of blood in the retina, is excluded. The image is graded by their quantity rather than size. MA is a tiny aneurysm, or swelling, in the side of a blood vessel. In people with diabetes, microaneurysms are sometimes found in the retina of the eye. The detection of MA and it's variation with the normal image clearly shows its presence in the diabetic image. In the early stages of DR, patients are mostly asymptomatic; however, in the later stages of the disease, patients may find symptoms that includedistortion, floaters and blurred vision. Microaneurysms are the earliest clinical sign of diabetic retinopathy. haemorrhages appears same as that of microaneurysms if they are small in size; they occur as MA distortion in theinner layers of the retina, such as the deeper nuclear and outer plexiform layers. Hemorrhages are also termed as red lesions. (b) Exudates: They appear as circinate patterned yellowish flecks in the posterior pole of the retina. It is actually lipids leaking from the capillaries in the eye. Image is graded by its area in retina. An exudate is any fluid that filters from the circulatory system into lesions or areas of inflammation. The fluid is composed of serum, fibrin, and white blood cells. Exudates may ooze from cuts or areas of infection or inflammation [3]. However, there hasn't been a significant amount of difference in the number of exudates for a normal or DR affected image (c) New vessels: These vessels are fine and fragile. New vessels grow because the current vessels of the eye no longer function as well. Image is graded by its area in field where these new vessels exist. (d) Cotton wool spots. They look fluffy grey white and are found near the optic disk. There are accumulations of axoplasmic material within the nerve fibre layer. Image graded by its area with Respect to optic disc area. The explanations of steps involved in this work are described below: 1. The preliminary step in automated retinal pathology diagnosis is image preprocessing. This includes various techniques such as contrast enhancement, foreground/background differentiation, image de-noising, etc. A Haarwavelet technique which is available in Matlab Toolbox is used in this work. 2. The second step is the feature extraction technique in which suitable feature set is extracted from the enhanced retinal images and from the detected anatomical structures. The objective of the feature extraction is twofold: (a) Generating a feature set which maximizes the within-class similarity and minimizes the between-class similarity measures and (b) Aid in dimensionality reduction which ultimately minimizes the convergence time period of the classifiers. The feature extraction techniques for retinal images are broadly divided into two classes. The first category is the direct method in which the textural features are extracted from the preprocessed images. The second category is the indirect method in which various 15 anatomical structures are initially segmented from the pre-processed images and then features are extracted from these anatomical structures. These anatomical structures include macula, vascular network (retinal blood vessels) and the optical disk. Initially a survey on features based on direct method is performed followed by a survey on features based on anatomical structures. 3. Hough transform is used for OD detection .The detected optical disk features are supplied as inputs to the classifiers to detect glaucoma in retinal images. This work has highlighted the applicability of OD detection techniques to differentiate the normal and the abnormal images. Diabetic retinopathy has four stages, namely, mild, moderate, severe and proliferative eventually leading to blindness. The stages are irreversible and the disease can only get worse. Thus, it is important for early detection to stop the disease from processing. A brief description of stages of DR is given below: (i) Mild Non-proliferative diabetes retinopathy mild NPDR: Sparse appearance of micro aneurysms and tiny

haemorrhages appear within the retina. (ii) Moderate Non-proliferative diabetes retinopathy moderate NPDR: More micro aneurysms and larger haemorrhages appear. Also, exudates and cotton wool spots are present.

3. PROBLEM DEFINITION

To detect diabetic retinopathy by analytically analyzing the retinal image so, that we are able to reduce the workload associated to manual grading as well as time and able to compare the DR image from normal image.

4. PROPOSED METHODOLOGY

Algorithm

1. Input an Image
2. Preprocess an Image
3. Apply Advance Genetic Algorithm
4. Identify Infected region (Region of Interest)
5. Image Fusion with Original Image
6. Apply Fuzzy Rules on ROI
7. Get precautionary measures from Fuzzy Rules.

Stop.

4.1 Data Flow Diagram

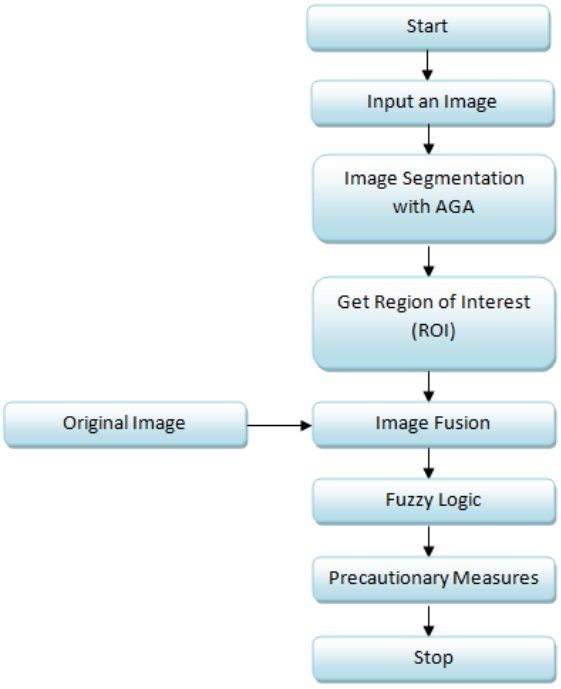

Fig. 4.1: Data Flow Diagram

4.2 System Architecture Diagram:

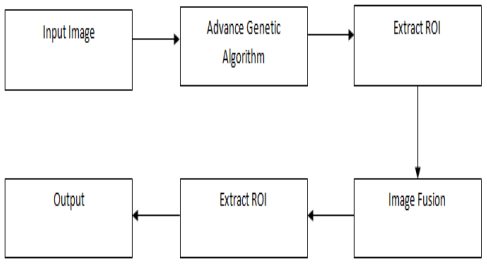

Fig. 4.2: System Architecture Diagram

5. EXPECTED OUTCOMES:

By using Advance genetic algorithm we are going to detect the Diabetic retinopathy and by using fuzzy rules we are able to do classification.

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