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Automated Detection of High Exudates and Cotton Wool Spots in Diabetic Retinopathy

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Abstract— Diabetic Retinopathy is the damage caused to the retina of the eye due to the diabetes. There are a large number of people, who are suffering from Diabetic Retinopathy that leads to blurring of vision or even blindness, if not treated at an early stage. Hence it is important to detect Diabetic Retinopathy at an earlier stage and provide treatment otherwise it may lead to vision demages. This paper presents to identify or earlier detection of the High Exudates and Cotton Wool Spots in Diabetic Retinopathy through Color transformation and Image Enhancement using FFT.

Keywords— *High Exudates ,Cotton Wool Spots,FFT etc.*

I. INTRODUCTION

In India, the persons who are having Type I and Type II Diabetics are Suffers from Diabetic Retinopathy. Diabetic Retinopathy is a very common eye disease among the people who are having Diabetics. It is seen from the age of 24 to 70 yrs. Diabetic Retinopathy , which causes vision loss but not all of as sudden but the step by step process. Diabetic retinopathy is graded into the different types based on the severity. In Early stages of deduction is completely curable. Diabetic retinopathy does not show any early warning signs, but include new blood vessels formed at the back of the eye ,vitreous hemorrhage, specks of blood or spots, floating in a person's visual field, and blur vision On funduscopic exam, a doctor will see cotton wool spots, hard exudates because of which the perimeter and spread area of the retinal blood vessels appear to be deviating from normal observations.

II. STRUCTURE OF HUMAN EYE

The front part of the eye is made up of the cornea, iris, pupil and lens, and focuses the image onto the retina. The retina is the light sensitive membrane that covers the back of the eye. This retina membrane consists of millions of nerve cells which gather together behind the eye to form a large nerve called the optic nerve.

When the light enters the eye, it is focused to a pinpoint on the macula, a small area in the centre of the retina at the back of the eye. The macula is responsible for central detailed vision, and allowing us to view fine details of the objects, colours, read and recognize the faces.

When light stimulates the nerve cells in the retina, messages or signals are sent through the optic nerve to the brain. The optic nerves from the two eyes joins inside the brain. The brain uses information from each optic nerve to combine the vision from the two eyes allowing us to see one image.

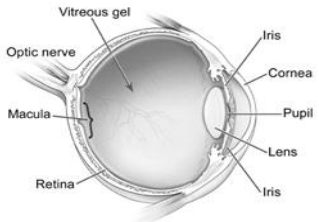


Fig. 1

What is diabetic eye disease?

Diabetic eye disease is a group of eye conditions that can affect people with diabetes. It can affect many parts of the eye, including the retina, macula, lens and the optic nerve.

Diabetic retinopathy .It affects the blood vessels of the retina. It is the most common cause of vision loss among people with diabetes and also cause of vision impairment and blindness among the people.

Diabetic macular edema (DME). A consequence of diabetic retinopathy, DME is swelling in an area of the retina called the macula.

Glaucoma is a eye diseases which damages the eye's optic nerve—the group of nerve fibers that connects the eye to the brain. Some types of glaucoma are associated with increased

pressure inside the eye. The diabetes doubles the risk of glaucoma.

III. DIABETIC RETINOPATHY

What causes diabetic retinopathy?
Chronically high blood sugar from diabetes leads to Diabetic Retinopathy by damaging the tiny blood vessels in the retina. The retina detects light and converts it in to the signals and sent through the optic nerve to the brain. Diabetic retinopathy can cause blood vessels in the retina to bleed fluid or hemorrhage (bleed), distorting vision. In the advanced stage , it also leads to cell loss in the retina.

A.Diabetic Retinopathy's four stages are:
Mild Nonproliferative Retinopathy: It is also called (NPR) . Balloon-like swellings are found in the retina's tiny blood vessels is called Microaneurysms.It occurs at the earliest stage of the disease. These Microaneurysms may leak fluid into the retina.

Moderate Nonproliferative Retinopathy:It is also called as (MNPR). As the disease progresses, blood vessels in the retina may swell and distort. It may also lose their ability to transport blood. Both conditions cause characteristic changes to the appearance of the retina and may contribute to DME.In this stage only Cotton Wool Spot found.

Severe Nonproliferative Retinopathy. Many blood vessels are blocked, blood supply is deprived to that areas of the retina. These areas secrete growth factors that signal the retina to grow new blood vessels.

Proliferative Diabetic Retinopathy (PDR). At this advanced stage, growth factors secreted by the retina trigger the proliferation of new blood vessels, which grow along the inside surface of the retina and into the vitreous gel, the fluid that fills the eye. The new blood vessels are fragile, which makes them more likely to leak and bleed. Accompanying scar tissue can contract and cause retinal detachment—the pulling away of the retina from underlying tissue, like wallpaper peeling away from a wall. Retinal detachment can lead to permanent vision loss.

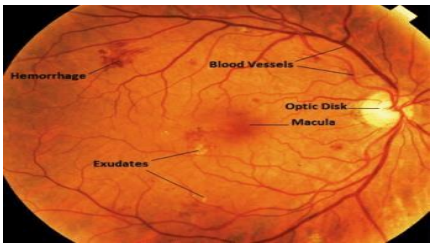


Fig. 2

B.Symptoms of Diabetic Retinopathy:

- Micro Aneurysms

Micro aneurysms are a tiny aneurysm or swelling, in the wall of blood vessel. A person who has diabetes may have the defect Micro aneurysms.It is found in the retina of the eye. These aneurysms can rupture and leak blood and damages the blood vessels . Micro aneurysms are the first evident sign of non-proliferative diabetic retinopathy. If these macro aneurysms forms in the macular area, so the patient has decreased central vision. If these macro aneurysms ruptures, so the patient has cloudy or little vision where the blood spreads.

- Dot and blot hemorrhage

These hemorrhages arises slightly deeper, pre-venular, capillaries. In the middle layer of retina dot and blot like structures arises. It can cause hypertension, blockage of arterial vein. Blot hemorrhage are often large and darker. It occur very deeper layer of retina where the cells flow in vertical direction. It can also cause impairment of vision.

- Cotton wool spot

In the funduscopic examination, there are finding some abnormality on the retina in the eye. It can be appear as yellow-white patch on the retina because the damage done to the nerve fibers and when there is swelling in the surface layer of retina.

- Hard exudates

Exudates are the lipid residues from serious leakage from damaged capillaries. There is a yellow blot on the retina which is commonly known as exudates .It looks shiny and waxy. It locates on the outer layer of retina.

IV. METHODOLOGY

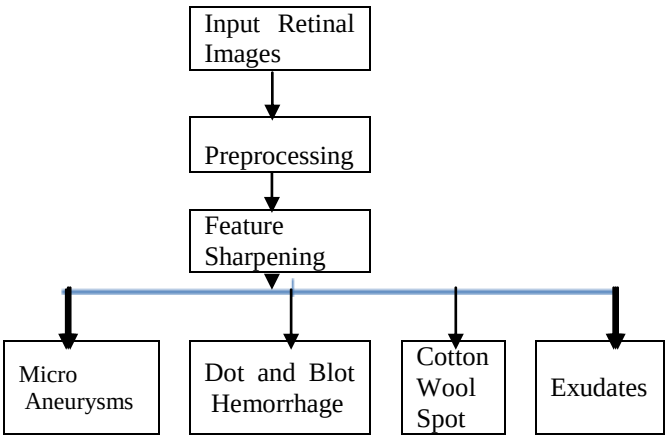
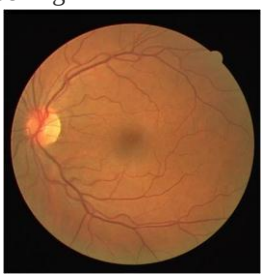


Fig. 3

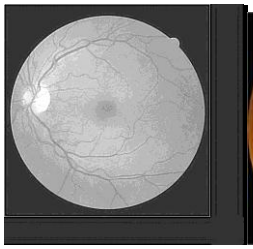
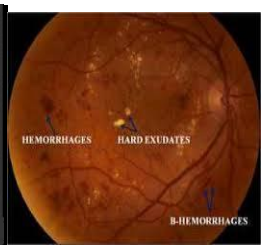
The first step is to get the retinal image input and we want to pre process the image by converting the colour image into

gray images. In that we can spot the Cotton Wool Spots and Exudates. To get the clear prospect we want to again go for the enhancement of the image by using the method FFT sharpening

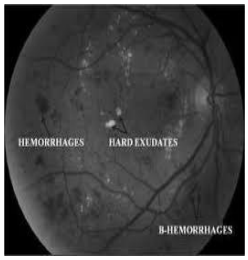



a.Original Image Fundus. b.ColorConversion Fundus

Fig. 4

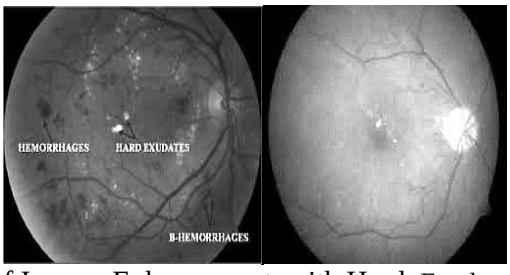



c.Image Enhancement d.Images with Hard Exudates,Hamerrhage



e.Color conversion of Images with Hard Exudates, Haemorrhage

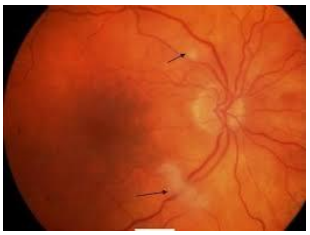
Fig. 5



f.Images Enhancement with Hard Exudates,Hamerrhage

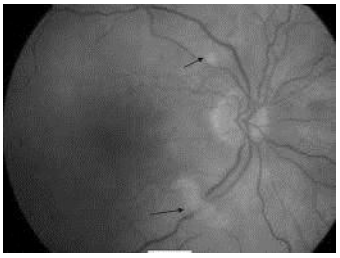
g. Images Enhancement with Hard Exudates

Fig. 6



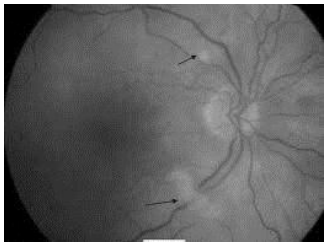
h.With Cotton Wool Spot

Fig. 7



i.With color conversion in Cotton Wool Spot

Fig. 8



j.With Image Enhancement Using FFT.

Fig. 9

V. CONCLUSION

In this paper, I have tried to explore methods towards the development of an automated system for the purpose of detecting CWS and High Exudates. This work determines the presence of diabetic retinopathy by applying techniques of digital image processing on fundus images . It is useful and also more clear comparing to all the methods.

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AUTHOR PROFILE

I'm MRS.S.PONNAMMAL working as an Assistant Professor in JP College of Arts and Science. I completed my UG in BCA and PG in M.Sc(IT).And also completed SET eligibility test. My area of interest is Image Processing .So, I mainly concentrate on Biomedical Image processing.

