

# A Novel Fuzzy Knowledge Based Glaucoma System for Diabetic Retinopathy using Vessel Extraction from Fundus Images

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## ABSTRACT

*The fuzzy knowledge based on the glaucoma will be designed for the working location of the private ophthalmologist. The status of various circumstances of the patient's will be implemented by a modular decision method with help of monitor detection. The modular decision technique will consist of fuzzy standards and neural classifiers. This technique can able to process the perimetry and fundus images. The diabetic retinopathy (DR) is a one mode of diabetes complication and it will have strong impact on the eyes of a human body. This disease will be caused by destruct to the blood vessels at the retina. Initially the diabetic retinopathy may not have any symptoms and it just causes a little vision issue. The diabetic retinopathy will have different treatments like intravitreal clinical treatment and sutureless standards plana vitrectomy. These treatments will provide a great relief to the disease related to eyes. The vessel extraction approach dependent on image improvement procedures and individualgrouping strategies incorporate fuzzy technique. The photographic of the rear eye will be called as fundus images. The vessel extraction from retinal fundus images will able to determine the various ophthalmologic sicknesses like diabetic retinopathy, glaucoma and hypertension. It is a difficult challenge because of presence of various noises embedded with thin vessels. In this paper, the visibility issue of the eye will be detected based on fuzzy knowledge using glaucoma and will capture the fundus images with help of the process of vessel extraction.*

*Index terms:* Fuzzy knowledge, Intravitreal, Vessel extraction, Fundus images, Diabetic retinopathy and Retina.

## I. INTRODUCTION

The two diseases like glaucoma and diabetic retinopathy will become the most dangerous eye disease since they give visual deficiency. It is very important and essential function for the ophthalmologist to identify the status of the patient and proper therapy at the right time. In some developed countries like Germany the patients who are suffering with vision problems are essentially handled by the private ophthalmologists [1]. The fuzzy knowledge in fuzzy logic system represents the facts regarding the fundamental rules of fuzzy set theory. So the fuzzy knowledge will provide reasonable analysis on disease related to eye. In fuzzy logic system the fuzzy logic and fuzzy sets will be used as prominent tool for indicating the various versions of knowledge about the relevant problem and it will also be used for modeling the relations and interactions among its variables. The glaucoma is nothing but a set of rules that affect the optic nerve and the eye [2]. The eye plays a major role in the part of the human body by providing vision. This affect of the eye will be generally created due to abnormal over pressure in the eye. The glaucoma plays a major impact in way creating the blindness to the people at the age of 65. The blindness will be formed at any age but most probably quite a natural disease for older people. The glaucoma has various forms and it may not give any symptoms or some time it will give mild symptoms. The impact is continuous to the point that you may not see an adjustment in vision until the condition is at a serious stage.

Since loss of sight because of glaucoma can't be detected easily, it's critical to have ordinary eye tests that incorporate estimations of your eye pressure so a finding can be made in its beginning phases and treated with a great accuracy [3]. If the symptoms of the glaucoma will be perceived early, vision loss can be eased back or prevented. If the problem is serious then it should require treatment for life long. Diabetic retinopathy is the most well-known diabetic eye illness and a main source of visual deficiency in American old people. It is brought about by changes in the blood vessels of the retina. In certain individuals with diabetic retinopathy, blood vessels may expand and release liquid. In others, ordinary fresh blood vessels develop on the outside of the retina. In the illness's beginning phases, an individual may not see changes to their vision. However, after some time, diabetic retinopathy can deteriorate and cause vision loss. Diabetic retinopathy generally influences the two eyes. Diabetic retinopathy (DR) is vein harm in the retina that occurs because of diabetes [4]. The diabetic retinopathy will be used to retrieve the accurate images from fundus images using vessel extraction method. The major disease qualities occurred to create the problems with vision of a human body. These symptoms related to diabetic can cause a lot of problems especially in terms of deficiency in vision.

Individuals with diabetes ought to have their vision checked in any event once every year to preclude DR. There are retinal medical procedures that can calm symptoms, but controlling diabetes and overseeing early indications are the best approaches to overcome the problems related to DR. The diabetic retinopathy (DR) is having a lot of impact on the diabetes related to human body. The very significant origin of loss of visual capability of human's eye will be the surely diabetic retinopathy for entire world population. The complete protection of an eye will be prominently provided by the retina. The retina is the major body of the human that surely influence the quality of the vision. The retina will be completely dedicated to provide the light. The retina can be capable to modify the any mode of light that strike the eye of a human body into the form of signals. These signals can easily be decrypted and understood by the human's mind with

a great accuracy. The method of diabetic retinopathy will be capable to generate or create a images those are purely related to the vision of the human body. The natural eye of humans can have great capability of sight which makes the eye to capture any mode of complicated image. The diabetic retinopathy has a major drawback by means of providing dangerous defects with related to the retina. So it provide deliver the liquid in the eye of human and consequently it forms the disturbance in the quality of a vision.

## II.LITERATURE SURVEY

In nowadays, there is an expanding interest for design automatic systems that screen lot of people for vision compromising illnesses like glaucoma and diabetic retinopathy and to provide a automatic detection of the sickness [3]. The image processing is currently turning out to be practical and a helpful module for screening. The ophthalmologist will be able to use fundus images and these images are created by the digital imaging technique. The digital image technique provides excellent databases of history of the fundus images. The supervising of the improvement and treatment capability will be monitored by the ophthalmologists. These advanced images can possibly be handled via automated investigation systems [5]. The fundus image analysis is a critical function, due to the fluctuation of the fundus images regarding shading or the loss in quality of images. The complicated structures that related to retina of the human will be purely controlled by the process called morphology. Based on the various exclusive features of a retina with respect to the several patients and it may lead to take faulty decisions. In present paper, various instances with utilization of the advanced picture related methods are utilized to get better quality image from fundus images. The different possible examinations to recognize the components those are related to the retinal like optic disc, optic cup and sores like hard and delicate exudates. The significant commitments to identify glaucoma and seriousness of diabetic retinopathy utilizing fundus images are depicted in this section.

Glaucoma discovery algorithms are extensively characterized into two classifications, which depend on the location of optic plate and identification of optic cup. Optic plate and optic cup discoveries are looked at dependent on the 33 localization, detection and limit extraction technique. Strategies to distinguish diabetic retinopathy are disclosed as for different extractions of features and abnormally discovery in fundus images. The inadequacies in the current algorithms are distinguished and a strategy is proposed to identify glaucoma and diabetic retinopathy at a beginning phase for screening applications. Vulnerability is a difficult part in human's regular daily existence. Since the future can't be anticipate, it is difficult to be sure about what precisely will happen every day. The fundamental driver of vulnerability is the lack of data [6]. The data might be inadequate, fragmentary, not completely solid, unclear, opposing or insufficient in some other way. These different data inadequacies may bring about various kinds of vulnerability. The three significant kinds of vulnerabilities are fuzzyness (or ambiguity), which results from the imprecise limits of fuzzy sets, non-particularity (or imprecision), which is associated with sizes (cardinalities) of relevant sets of options and hardship (or friction), which communicates clashes among the different arrangements of options (SaikatMaity, Jaya Sil 2009).

Anyhow, most uncertainties are negligible, reasonable or unimportant. There is a significant level of vulnerability the board in smart systems. Since human thinking and decision making is fuzzy, including a serious extent of ambiguity in proof, idea usage and mental model detailing (Wang and Elhag 2006). The collection of ocular impairments which produced in optic

nerve injury will be described with help of Glaucoma. Due to glaucoma there is a gradual loss of retinal vision. The retinopathy is simply referred to the loss of vision. According the sources related to the world health organization more than 80 million of people are suffered by the glaucoma worldwide and approximately 13 percent of the people are having a chance to get complete blindness. In developed country like United States the glaucoma was treated as the one of the major reason to cause blindness to the people. This disease will became more serious and dangerous for the elderly people when compared to the young population. The glaucoma will be attacked with mild or neglected symptoms and most of the people are even unable to identify this disease until it became sever disease [7]. If the people are failed to identify it at initial stage it may have maximum chances to cause loss of irreversible vision at huge rate of possibility. The detection of glaucoma at early stage can be possible by the two significant parameters such as recognizing the harm factors and screening. In this it is possible to detect the population who suffered with glaucoma at an early stage before affecting of irreversible damage. In this paper, it is focused on the how the glaucoma will be identified at an early so that the loss will be reduced to a great extent. The fundus images are extracted with great quality by using the Glaucoma System for Diabetic Retinopathy using Vessel Extraction (GSDRVE) and fuzzy logic.

### III. GSDRVE SYSTEM

The fundus photography will be used to take the fundus images. The fundus photography will be completed by capturing a photo at a better location generally fundus. The advanced technology called intricate microscope will be incorporated with a model cameras and these type of cameras have flash with them. The peripheral retina, optic disc and macula are the major available designs of the fundus photos. The designs are very useful designs of the retina. The original image will be applied as an input and generally it consists of three regions such as Red, Green and Blue in the fundus images.

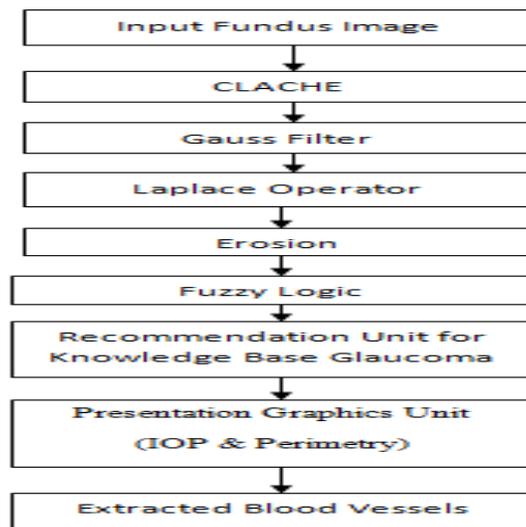


Fig. 1: Flowchart for Vessel Extraction in GSDRVE System.

The CLACHE and image enhancement will be done based on the histogram of an image. The OpenCV1(Open Computer Vision) method uses a adaptive histogram equalization. The technique called OpenCV1 will be performed to the derived images. The boundaries of the

image will be determined based on the boundaries of the fundus images and they can also used to get the width of the vessels. The retina's vessels will be derived by improve the quality of the image that can be extracted from fundus image. The entire process how the fundus images are extracted from clinical images by using vessel extraction and fuzzy logic will be described in as shown in fig.1. The Laplace operator is used to get the required portion of the image from the fundus image as shown in fig. 2(a). The wanted vessels can be possible to get by using thresholding of the image. This can also isolate the undesired part of the vessel. The technique of Erosion is much useful in the process of isolating the faulty vessels and generally these faulty vessels are developed due to thresholding process. It is very important to isolate the vessels those are broken into smaller pieces so that it can have only required width of the vessels. In this way the operation of the vessel extraction will be achieved. Based on the various derived features of the diabetic retinopathy such as domain, shape and color the automatic detection will be possible. Due to this process some abnormalities will be formed by capturing the fundus images at different positions and this will be shown in fig.2 (b). The abnormal fundus image will be improved its contrast after performing photo coagulation and it will show in fig.2(c). The major form availability of vessels in this method is in the mode of RGB. The effective method which is called as ISODATA iteration method will be used to extract or derive the Gauss filter from the fundus images. In a Gauss filter there is a possibility of presenting huge number of vessels so the extraction is very important. The output of the gauss filter will be shown in fig.3. There are two approaches to determine the abnormalities of the fundus images such as direct approach. The direct approach involves only screening whereas indirect approach contains both screening and monitoring. All vital information and data will be used in the process of discovery of crucial circumstances has provided by information of patient. The derived information can be transformed to a desired form so that the data preparing is takes place easily. The advanced techniques called intraocular pressure (IOP) and perimetry will be helpful in the analysis of Glaucoma. The type of genuine numbers will be determined based on IOP and the perimetry is used to provide the output of software. This software is used to determine sensitivity loss of information.

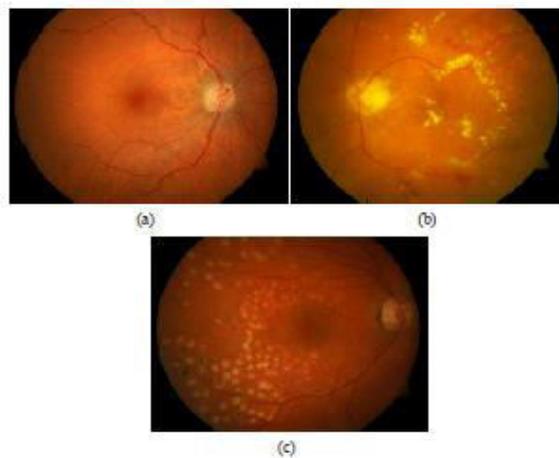


Fig. 2: (a) The normal fundus image, (b) The abnormal fundus image and (c) The abnormal fundus image

The fuzzy based knowledge is useful to know the status of the IOP method. The direct prediction results of the medical information are determined by using fuzzy sets. The analysis of the perimetry information classification has two methods. The first method is used to find visual field of the fundus image and second method is used to find the changes in the body of the patient. The most serious disease that will be attacked to patients those who are suffering from diabetic is diabetic retinopathy and it will have immense impact on the blood vessels of the retina of the humans. The ophthalmologist can able to perform treatment and prevent the complete blindness if the patients can approach them at an early stage. The two techniques such as morphological image processing and fuzzy logic will collectively utilized to identify the complicated issues related images of retina. At very starting phase the method called morphological technique will be utilized to detect hard effusions with help of morphology. The process of morphology contains removal of the optic disc. Later in proceeding stages the complicated effusions will be extracted or derived with help of algorithms based on fuzzy logic. The fuzzy logic can utilizes the parameters in the RGB that related to the image of retina in the process of making fuzzy sets

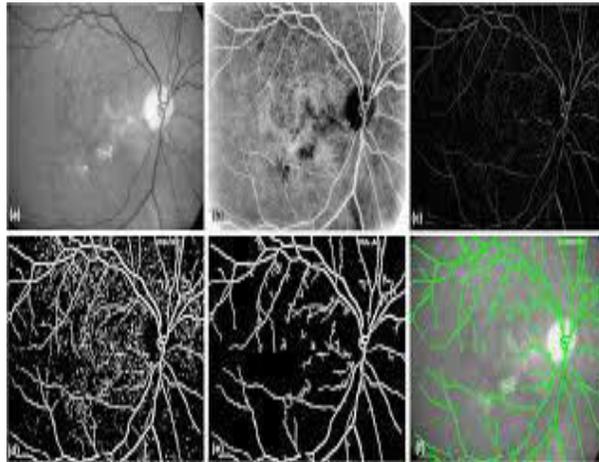


Fig.3: The Extraction of Gauss Filter.

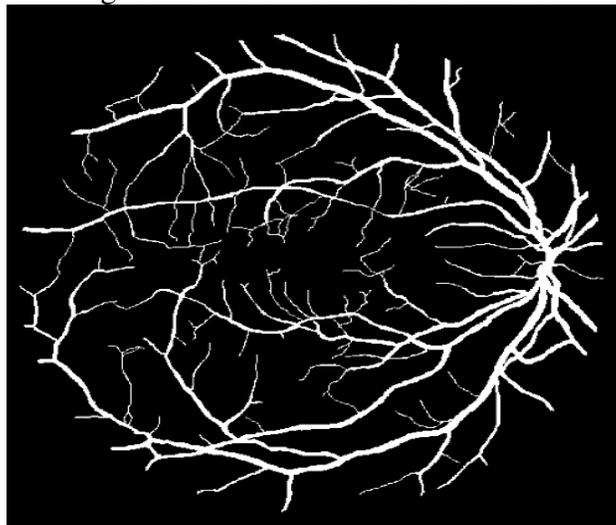


Fig. 4: The extracted blood Vessels

Depending on the input parameters applied to a processor such as red, green and blue mediums of a pixel in effusions process. The derived output of fuzzy logic which was calculated for complicated effusions based on its related area. The improvement of the diabetic retinopathy can achieved by the ophthalmologist based on the area utilized by the blood vessels of the healthy persons. In this technique the process of extraction of blood vessels will be achieved by using method of matched filtering. This method uses the preprocessing procedure in the way enhance the performance of the extracted blood vessels as shown in fig.4. The significant achievement of this technique is generating a better improved automatic Blood Vessel Extraction (BVE). The automatic blood vessels extraction will be much needful for the eye care efficient experts or professionals in the view of patient's therapy, medical study, and health research and screening. The accuracy of the GSDRVE System will be purely depends on the number of datasets used in the process. As the number of datasets increases in proportional to it the accuracy of the system will be increased. In this technique the background of the image in all its corners can be initially changed and later the efficient technique called homomorphic filter can be used to smooth the clinical images. This process can improve the brightness and contrast of the image when compared the actual images. The improvement of the signal of the blood vessels those are stay in the range below the threshold range can be possible by using fuzzy logic and blood vessel extraction methods. So by using the fuzzy knowledge based approach for glaucoma system in diabetic retinopathy the fundus images are extracted based on the blood vessel extraction.

#### IV. RESULTS

Table I: The Accuracy of the Extraction of the Blood Vessels.

Datasets	Existed System	GSDRVE System
10	81.6	83.4
20	83.2	85.9
40	88.7	90.2
60	91.9	93.4
80	96.1	97.8
100	97.3	98.6

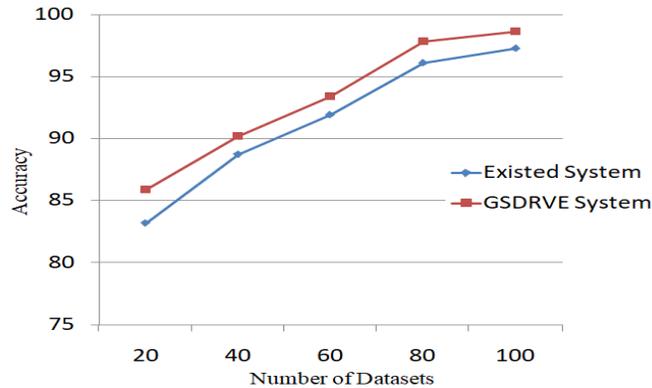


Fig. 5: The accuracy of the Existed System and GSDRVE System

The fuzzy knowledge based glaucoma system related to the diabetic retinopathy will be implemented to extract the high quality images from the available fundus images using blood vessel extraction process. This process is purely based on the number of datasets used for the deriving the image as shown in Table I. From that table it is very clear that as the number of datasets increases its obviously increases the accuracy. The accuracy was increased in a present GSDRVE System when compared to the existed system. The accuracy of the existed system and GSDRVE System will be shown in fig. 5. It shows that the accuracy of the proposed GSDRVE System will be increased as soon as the number of datasets increased. So the accuracy of the images derived from fundus images will be enhanced by using fuzzy logic and blood vessel extraction.

## V. CONCLUSION

The present diabetic retinopathy (DR) technique is a one mode of diabetes complication and it has strong impact on the eyes of a human body. Initially the diabetic retinopathy may not have any symptoms and it just causes a little vision issue. The diabetic retinopathy has different treatments like intravitreal clinical treatment and sutureless standards plana vitrectomy. These treatments have provided a great relief to the disease related to eyes. The fuzzy knowledge based on the glaucoma was designed for the working location of the private ophthalmologist. The vessel extraction from retinal fundus images has determined the various ophthalmologic sicknesses like diabetic retinopathy, glaucoma and hypertension. The vessel extraction approach depended on image improvement procedures and individual grouping strategies incorporate fuzzy technique. The photographic of the rear eye is called as fundus images. In this paper, the visibility issue of the eye has detected using fuzzy knowledge based on glaucoma and it was capture the fundus images with help of the process of vessel extraction.

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