

Survey on Exudates Extraction for Fundus Images

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Abstract- Diabetic Retinopathy is a condition associated with diabetes, where blood vessels of the retinal area of eyes rupture. The lipids accumulated as the result of rupture are known as exudates. This project intends to develop an exudates extraction algorithm using the concept of image processing. Exudates are fluid composed of white blood cells that exudes out of the blood vessels into peripheral injury on the retinal surface. Detection of exudates well in time reduces the risk of eye damage. If exudates are detected in early stages it can be easily treated with laser therapies hence blindness caused by diabetes can be prevented. In this paper, a review on techniques, algorithms and methodologies used for detection of exudates from DR retinal fundus images are discussed.

Keywords- Exudates; Fundus Images; Hough Transform; SVM; Ophthalmologist.

1. INTRODUCTION

The most common disease found all around the globe is diabetes, where feeble amount of insulin results in high blood glucose level in people. India has more number of diabetic sufferers. The main reason for blindness in diabetic sufferers is due to the eye disease called diabetic retinopathy. [2]Diabetic retinopathy (DR) is a condition found in retina of the blood sugar patients and which leads to loss of eyesight being the most dangerous disease. [7]The arteries or capillaries present in the retina break, a liquid seep out into retinal area that gives rise to yellowish white exudates. It produces injury to retinal cone. The exudates can be identified when the sufferer progress to [4] some changes in the eyesight. The cause for the diabetic sufferer's eyesight is due to the exudates which also produce cataract, glaucoma and most importantly the diabetic retinopathy. This results in partial or overall lack of [3]eyesight that affects the human lifestyle. The sufferers who are having diabetes for more than ten years are at a peak level to chances of the diabetic retinopathy disease. The early symptoms of this disease contain the existence of small, red dots which are present inside the retina [1]. The systematic treatment to the diabetic sufferers for this disease will help to solve the problem of blindness in the patients. It is distinguished by many pathologies present in the retina, the primary symptom of this disease is presence of exudates which is a premature deformation in the retina. The recognition of these [8]pathologies in early stage reduces the harm to retinal core that prevents blindness.

Exudates are the major indication to diabetic retinopathy disease. In [3] eyeball, the secretion of exudates is due to the arteries or capillaries that are broken inside the retina. When these arteries or capillaries present inside the retina are broken, it releases pus like blood cells called exudates that seep out from the region of wound or injury. The exudates arise from the lipid or fat exuding from the abnormal growth of the blood vessels. [6]The retinal fundus pictures are used to capture the exudates present inside the eyeball. Normally, exudates are seen as yellow injuries in the retinal fundus pictures. The presence of exudates [1]can be observed through the retinal fundus pictures which indicate that the sufferer is having disease or the patient is suffering from the disease. Detecting the exudates in the early level reduces the harm to the human eyesight. [9]There are two types of exudates namely soft exudates and hard exudates. Soft exudates are seen like cotton wool marks which are huge in size and the nerve fibre layers present inside the retina are dead. Whereas hard exudates are yellow colour marks seen inside the retina, towards the rear pole which is close to the macula [4]. They are fat products that are broken down and left at the back till the restricted edema region. The hard exudates solve the issues when they are combining and expanding into the macular region that produces the macular edema. This results in [5]quick loss of eyesight in the diabetic sufferers. Hence, a systematic check-up is necessary for the diabetic sufferer's who are prone to diabetes.

This paper deals with solutions provided by researchers. Many different strategies for exudates

identification and evaluation are observed in the literature phase. The remaining paper will be arranged as shown below. Section II talks on a brief review of preceding methods used for detection and extraction of exudates. Section III discusses some conclusions which might be derived in the duration of experimentation manner.

2. LITERATURE SURVEY

Many research works were carried out and many powerful methodologies and algorithms have been proposed via researchers. In [5], automated prognosis of exudates using three-sigma control approach is used which computes colour depth form of exudates pixels. The retinal fundus snap shots are pre-processed that complements the shade depth and optic disc receives eliminated as, it divides the comparable abilities with exudates. The pre-processed snap shots are then produced based totally on statistics which are decided on from three-sigma manages approach. The blue colour pixels are [5]repressed while pink colour and green coloration pixels are getting used. Three-sigma approach is used to area up and occasional control restricts of exudates located in retinal fundus snap shots. Here, hough remodel technique satisfies that removed element is optic disc no longer the exudates and it profits great effects. This approach successfully represents the method utilized by [5]ophthalmologist for evaluation.

In [9], machine learning techniques are used to discover the presence and absence of the retinal exudates. The features consisting of mean, fashionable deviation and centroid are collected from LUV colour model after dividing the retinal fundus pictures to locate the lifestyles of exudates. The class is conveyed out with few classifiers like naive bayes, multilayer perceptron and extreme machine learning. To the retinal input photos, pre-processing strategies like Hue, Saturation and Intensity conversion and fuzzy c-means department are carried out. The exudates and non-exudates were classified by way of NB, MLP and ELM. The three techniques [9]used were super in overall performance whereas ELM is more effective in comparison to MLP and naive bayes. The ELM approach has first-rate accuracy than different exceptional classifiers. It effects in wealthy exudates detection method and allows determining disease in early stage that reduces the physical paintings. The approach of utilising ML approach to discover the

presence or absence of exudates [9]offers fairly dependable surroundings.

In [6], proposed a robust method to divide hard exudates from electronic shade, fundus pictures by using the use of anisotropic diffusion, adaptive thresholding together with support vector machine for type. The technique removes fake positives exactly whilst it's far applied amongst massive variety of pictures. The proposed approach gives immoderate stage of specificity and accuracy [6]which produces very low type of fake positives, that's a suitable super for the usage of in real-time diagnosis. The threshold right here is adaptive that makes the method of remedy absolutely automatic. This approach is used inside the improvement of few laptop aided technology for [6]ocular illness popularity from fundus snap shots.

In [3], proposed a successful photo processing approach for reputation of diabetic retinopathy diseases from the retinal fundus photos that satisfies the general overall performance metrics. Here, the image processing approach became carried out in two phase's namely diabetic retinopathy feature extraction and function type to apprehend diabetic retinopathy ailment. The effects manifested that photo processing technique used here has more sensitivity and accuracy. The proposed approach [3]might be effectively used or taken into consideration as excellent alternate manner because of peak stage of accuracy in detecting diabetic retinopathy. The results received are confirmed via evaluating with expert ophthalmologists[3].

In [8], proposed a collection of optimally altered morphological operatories for exudates reputation in diabetic retinopathy sufferers. This technique turned into advanced to discover exudates from the non-mydratic, much less assessment retinal fundus pictures and assist ophthalmologists for diabetic retinopathy screening remedy to become aware of signs and symptoms sooner and greater without difficulty. This technique works effectively on the bad computing device. The outcomes of this method may be advanced to deliver [8]an automatic machine to perceive exudates. Microaneurysm and haemorrhage recognition may be delivered to the machine so one can boom the ability to affirm the extent of diabetic retinopathy. These robotically diagnosed exudates are confirmed through evaluating with professional ophthalmologists.

In [1], proposed an authentic, intelligent and top stage of acting picture processing approach for continuous

popularity and segmentation of eyeball place of hobbies. Basic idea of this technique is photo putrefaction in small containers and constrained texture evaluation. Here, proper function identity primarily based at the statistical analysis via confusion matrices for various capabilities and restricted classifier fusion is proposed. [1]A deep convolution neural community, that is hooked up on supervised device learning for arteries or capillaries segmentation, is used to improve Region of Interest identity overall performance. The proposed method considers the details about picture pixel distribution, colour and textures. A CNN structure is usually recommended for arteries or capillaries division. The consequences show the correctness of [1]methodologies used and algorithms.

In [2], proposed a novel method to automatically perceive diabetic retinopathy from digital fundus photos. This work employs morphological operations for department and fuzzy common sense for identity system. [2]A fuzzy group is customary with colour version values and fuzzy guidelines are discovered set up on fuzzy common sense fixing for identification of diabetic retinopathy. The fuzzy policies discovered based totally at the proposed technique that has successfully identified the existence of diabetic retinopathy in retinal fundus pictures. The effects suggest that this [2]method helps the ophthalmologist in detecting diabetic retinopathy in early level of treatment procedure.

In [4], proposed a computerized scientific method for identity and grading of macular edema to help the ophthalmologists in early and automatic recognition of sickness. The proposed technique includes a unique method for correct identification of macula the use of an in-intensity feature set and [4]Gaussian mixture's method based classifier. It also represents a hybrid classifier as an ensemble of Gaussian aggregate model and guide vector device for stepped forward exudates identity in lifestyles of vibrant injuries which sooner or later ends in dependable type of enter retinal fundus pictures in diverse degrees of macular edema. This approach executed retinal fundus pictures exam for grading of edema the use of the hybrid classifier. It includes exudates identification followed by way of the macula detection. A novel technique for macula identification inside the injury and using hybrid classifier results in the high accuracy of this approach. The overall performance of [4]system is advanced whilst compared to existing published strategies because of importance on correct exudates

identification and reliable popularity of macula. The consequences verified that this technique may be utilized in automated medical machine for grading of diabetic macular edema.

In [7], proposed a method for automatic identification of exudates. The non-exudates like optic disc, arteries or capillaries and blood clots in ranges the use of gradient vector glide snake set of rules and region growing division set of rules. This improves effectiveness of identification by way of masking faux exudates. Then exudates are discovered via use of gabor filter out [7]texture side recognition based department set of rules. This algorithm should cover optic disc and the non-exudates like arteries or capillaries and blood clots. This set of rules is [7]less steeply-priced and the complexity is also low.

3. CONCLUSION

In this paper, a variety of techniques are discussed for detection and extraction of exudates. When the features of both background and foreground (exudates) in fundus images are independent, it was able to obtain good results. But when the features were similar it failed to distinguish between them. The human intervention was used to mention the parameters, which resulted in a lot of time consumption.

The future scope of the paper is to detect and extract the exudates correctly based on image processing algorithm along with machine learning technique. The extraction of exudates when features were similar can be done by regression ML technique which successfully distinguishes between background and exudates in fundus images. The image processing algorithm estimates the area of spread of exudates which can further be compared with database images using CBIR technique for serving doctors to prescribe medication as suggested in database images for the current patients.

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REFERENCES

- [1] Mohammed Shafeeq Ahmed and Baddam Indira, "Detection of Exudates from RGB Fundus Images using 3-Sigma Control Method", IEEE WiSPNET Conference 2017.
- [2] P.. R.. Asha and S.. Karpagavalli, "Diabetic Retinal Exudates Detection using Machine Learning Techniques", International Conference on Advanced Computing and Communication Systems ICACCS, Coimbatore, India, Jan 05-07, 2015.
- [3] Ravitej Singh Rekhi, Ashish Isaac, Malay Kishore Dutta and Carlos. M. Travieso, "Automated Classification of Exudates from Digital Fundus Images", IEEE 2017.
- [4] Nasr Gharaibeh, Obaida. M. Al-Hazaimeh, Bassam Al-Naami and Khalid. M. O. Nahar, "An Effective Image Processing Method for Detection of Diabetic Retinopathy diseases from Retinal Fundus Images", International Journal of Signal and Imaging systems Engineering, Vol. 11, No. 4, 2018.
- [5] Akara Sopharak, Bunyarit Uyyanonvara, Sarah Barman and Thomas. H. Williamson, "Automatic detection of Diabetic Retinopathy Exudates from Non-dilated Retinal Images using Mathematical Morphology Methods", Science Direct, Computerized medical Imaging and Graphics 32, 720-727, 2008.
- [6] Don popescu and Loretta Ichim, "Intelligent image processing system for Detection and Segmentation of Regions of Interest in Retinal Images", Symmetry 2018, 10, 73, doi: 10.3390.
- [7] S. Saheb Basha and Dr. K. Satya Prasad, "Automatic Detection of Hard Exudates in Diabetic Retinopathy using Morphological Segmentation and Fuzzy Logic", IJCSNS International Journal of Computer Science and Network Security, Vol. 8, No. 12, Dec 2008.
- [8] M. Usman Akram, Anam Tariq, Shoab. A. Khan and M. Younus Javed, "Automated Detection of Exudates and Macula for Grading of Diabetic Macular Edema", ELSEVIER, Ireland Ltd., 2014.
- [9] Priyadarshini Patil, Pooja Shettar, Prashant Narayankar and Mayur Patil, "An Efficient Method of Detecting Exudates in Diabetic Retinopathy: Using Texture Edge Features", International Conference on Advances in Computing, Communications and Informatics ICACCI, Jaipur.