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An Algorithm for Retinal Feature Extraction using Hybrid Approach

Parth Panchal[a], Ronak Bhojani[b], Tejendra Panchal[c*]

[a,b,c] *A. D. Patel Institute of Technology, New Vallabh Vidyanagar, 388121, Gujarat, India*

Abstract

Today, in the era of cutting-edge technology, demand for the reliable security system is increasing and so the biometric based authentication system. Several biometric based systems such as fingerprint and face recognition are used in various applications such as security devices and forensic identification. Human retina is one of the wellspring of biometric system which gives the most reliable and efficient method for authentication. Even in the medical science, ophthalmologist considers the changes in the retinal vessels as many retinal diseases are characterized by it. Retina feature extraction is a challenging task. In this paper, an easy and reliable method is proposed for retinal feature extraction. The concept of line tracking is used for the binarization of input retina image. A hybrid method of morphology and scanning window analysis (SWA) is applied for obtaining reliable result. Also, the validation of proposed method is checked against the database of 55 images of eyes with healthy, glaucomatous, and diabetic retinopathy.

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Keywords: Retinal image; fundus; morphological operation; feature extraction; SWA

1. Introduction

A biometric system is a recognition system that perceives a person on the premise of a component vector got from a particular physiological or behavioral characteristic that the individual has. This paper contemplates crucial challenge of retinal image analysis called segmentation. The individual traits used in biometric identification system

* Corresponding author. Tel.: +91-953-752-1255.
E-mail address: panchaltejendra@gmail.com

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can be physiological, for example, facial components, fingerprints, iris, and retina. The retina is a meager layer of cells at the back of the eyeball of vertebrates. The function of the retina is to convert light into nervous signals. The fundamental elements of a fundus retinal picture were characterized as the optic circle, fovea, and veins [1]. The macula or macula lutea is an oval-formed pigmented area close to the focal point of the retina of the human eye having diameter of nearly 5.5 mm and contains inside of it the 1.5 mm breadth fovea and, inside of that, the foveola, a 0.35 mm area that houses the highest grouping of cone photoreceptors in the retina and is concerned with empowering maximal, focal visual sharpness. As the blood vessels have unique structure of veins, it is widely accepted in biometric identification system. Examination of veins in the eye permits detection of eye diseases such as, diabetic retinopathy, hypertensive retinopathy, glaucoma, and arteriosclerosis [2].

A blemish in the technique of medical imaging for information representation for medicinal imaging is that the refinement between a clinical determination and the steps for feature extraction are not clear [3]. They regularly pass on the same data however it may not generally be the situation.

Xu and Lue [4] proposed a novel based strategy extricate substantial and thin vessels independently. Some authors have also considered Gabor wavelets to extract the vascular patterns such as a method proposed by Usman *et al.* [5]**.** Hoover *et al.* [6] Produced binary classifiers for vessel segmentation. Mendonça and Campilho [7] proposed a method for segmentation of blood vessels using morphological reconstruction. Chanwimaluang and Fan [8] has proposed a concept of matched filter detection. Numerous alternatives are found in order to implement segmentation over an algorithm to produce satisfactory results but to achieve reliable result, some modifications are essential to tune up the system to meet up the result having higher reliability. To remove noise from processed retinal image, Helen *et al.* [9] has proposed an algorithm that figure out if a processed pixel is a part of a vessel or not.

In this paper, focus is on examine whether it is conceivable to outline the procedure of feature extraction and clinical conclusion unmistakably and utilize an incremental learning system for keeping up the information required in image processing for feature extraction. The concept of linear tracking is used in the proposed algorithm to convert RGB image into the binary image. At last, after applying morphological operations, scanning window analysis is used extract the features such as ridges, bifurcation, and optical focal point of retina.

The remaining paper is organized as takes after: Section 2 contains the proposed methodology for feature extraction from retinal images. Experimental results are given in section 3 and the accuracy of the proposed algorithm is listed in Table 1. Conclusion is given in section 4 followed by future work in the last section.

2. Methodology

In this section the proposed system is outlined which appeared in Fig. 1. From Fig.1, it can be seen that initial phase in the calculation is to take the input retinal image and apply image enhancement on it for better edge extraction of blood vessels. In the wake of removing the spurs from the extracted edges, scanning window analysis combined with morphological operations is executed to extricate the features from it. The same methodology is utilized for the optical point of convergence. Every one of the progressions of the proposed steps is clarified in the following part.

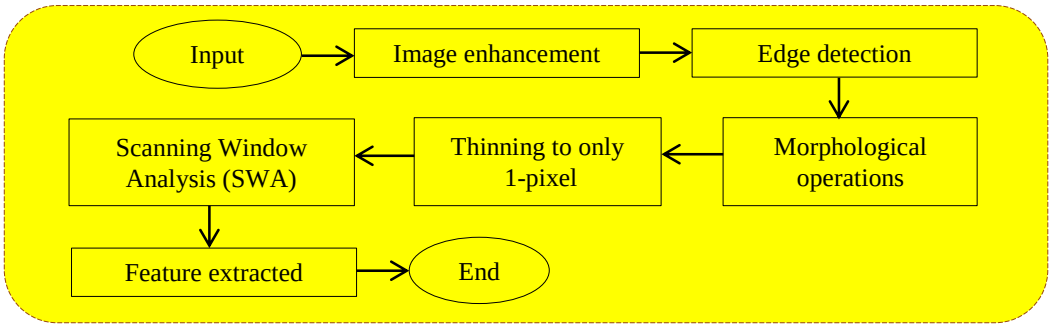

Fig. 1. Proposed algorithm.