International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 2 Issue 5, May - 2013

Extraction Of Retinal Blood Vessel Using Branching Points And Vessel Connectivity

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Abstract

Accurate extraction of retinal blood vessels is a challenging task in medical aided diagnosis for identifying the disease like diabetic retinopathy, hypertension, glaucoma, obesity, arteriosclerosis and retinal artery occlusion, etc. This paper is about the extraction of retinal blood vessels by the shadowing and shading for detecting diabetic retinopathy. This project improves the rate of detection, and the accuracy of estimating the location at branching points. The problem of extracting the blood vessels is formulated as detecting branching points using corner detection and shadowing. The corner detection points with two dominant and different edge directions in its neighborhoods. Also the corner detection improves the rate of detection of branching points, and the accuracy of location estimates, enabling a more complete extraction of retinal blood vessels and more accurate counting of branch poin*ts in retinal systems.*

1. Introduction

In recent times, Sweden and other parts of the world have been faced with an increase in age and society related diseases like diabetes. According to recent survey [9] 4% of the country population has been diagnosed of diabetes disease alone and it have been recognize and accepted as one of the main cause of blindness in the country if not properly treated and managed.

Early detection and diagnosis have been identified as one of the way to achieve a reduction in the percentage of visual impairment caused by diabetes with more emphasis on routine medical check which the use of special facilities for detection and monitoring of the said disease. The effect of this on the medical personnel need not be over emphasized, it has lead to increase work load on the personnel and the facilities, increase in diabetes screening activities just to mention a few[9]. A lot of approaches have been suggested and identified as means of reducing the stress caused by this constant check up and screening related activities among which is the use medical digital image signal processing for diagnosis of diabetes related disease like diabetic retinopathy using images of the retina. Diabetes is a disorder of metabolism.

Diabetic retinopathy (DR) can be defined as damage to microvascular system in the retina due to prolonged hyperglycaemia. The prevalence of DR in the Chennai Urban Rural Epidemiology (CURES) Eye Study in south India was 17.6 per cent, significantly lower than age-matched western counterparts. However, due to the large number of diabetic subjects, DR is likely to pose a public health burden in India. CURES Eye study showed that the major systemic risk factors for onset and progression of DR are duration of diabetes, degree of glycaemic control and hyperlipidaemia. Hypertension did not play a major role in this cross-sectional analysis. The role of oxidative stress, atherosclerotic end points and genetic factors in susceptibility to DR has been studied. It was found that DR was associated with increased intima-media thickness and arterial stiffness in type 2 Indian diabetic subjects suggesting that common pathogenic mechanisms might predispose todiabetic microangiopathy. Curcumin, an active ingredient of turmeric, has been shown to inhibit proliferation of retinal endothelial cells *in vivo*.

Visual disability from DR is largely preventable if managed with timely intervention by laser. It has been clearly demonstrated that in type 2 south Indian diabetic patients with proliferative DR who underwent Pan retinal photocoagulation, 73 per cent eyes with good visual acuity (6/9) at baseline

maintained the same vision at 1 yr follow up. There is evidence that DR begins to develop years before the clinical diagnosis of type 2 diabetes. Our earlier study demonstrated that DR is present in 7 per cent of newly diagnosed subjects, hence routine retinal screening for DR even at the time of diagnosis of type 2 diabetes may help in optimized laser therapy. Annual retinal examination and early detection of DR can considerably reduce the risk of visual loss in diabetic individuals.

This work is one of the methods of applying digital image processing to the field of medical diagnosis in order to diagnosis and treatment of diabetic retinopathy. This work determines the presence of branching points and vessel connectivity by means of corner detection and shadowing in order to improve the performance of MF-FDOG on the pathological images taken by the medical images on hospitals.

2. Related Works

The paper [1] The Matched filter (MF) was first proposed to detect vessels in retinal images. It makes use of the prior knowledge that the cross-section of the vessels can be approximated by a Gaussian function. First Order Derivative Of Gaussian The idea comes from the fact that the Gaussian function (i.e. the cross-section of a vessel) will have a strong positive response to the MF but its response to the FDOG is anti-symmetric. In contrast, although the non-vessel step edge will have partially strong positive responses to MF, its response to the FDOG is positive and symmetric.

The paper[2] propose a new class of derivatives which we refer to as photometric quasi-invariants. These quasi-invariants share with full invariants the nice property that they are robust against photometric edges, such as shadows or specular edges. Further, these quasi-invariants do not have the inherent instabilities of full photometric invariants. These quasi-invariant derivatives in the context of photometric invariant edge detection and classification. Experiments show that the quasi-invariant derivatives are stable and they significantly outperform the full invariant derivatives in discriminative power.

This paper [3] propose a simple method to express shading and shadowing of virtual objects in Mixed Reality especially appropriate for static architecture models in outdoor scenes. We create the shadows of the virtual objects in a fast and efficient way using a set of pre-rendered basis images and shadowing planes. The proposed method is limited in interactivity but can operate in near real-time.

This paper [4] focus on the structure tensor, or color tensor, which adequately handles the vector nature of color images. Further, it combines the features based on the color tensor with photometric invariant derivatives to arrive at photometric invariant features. The combination of the photometric invariance theory and tensor based features allows for detection of a variety of features such as photometric invariant edges, corners, optical flow and curvature. The proposed features are tested for noise characteristics and robustness to photometric changes.

This paper [5] proposed an object-based approach for predicting, identifying shadow areas and their corresponding surrounding areas based on airborne laser scanner (ALS) data. Quantitative analysis of shadow effects is followed based on high-resolution multi-spectral (MS) images. The differences of spectral values between shadow areas and their surrounding areas are quantitatively measured and compared. Per-object comparison between shadow areas and their corresponding surroundings is considered much more robust as compared with per-pixel approach. A shadow correction model is proposed that is based on quantitative comparison of different sites with different configurations.

This paper [6] is about corner detection plays an important role in computer vision as well as in 3D reconstruction of a scene. With the help of the corners we can determine the most characteristic points of an object and so reconstruct them. Corners are useful in case of pattern recognition, as well. In this paper a new corner detection scheme is introduced which is based on fuzzy reasoning and applies a special local structure matrix.

3. Proposed Work

3.1 Architecture

The input image taken from the database is a pathological image. The spherical derivative is applied with Gaussian filter. Once the derivative is applied quasi invariance and variance is applied to suppress to form shadowing and shading. Which produces the fine suppressed image of retinal blood vessels? From which the branching points are detected by means of corner detection.

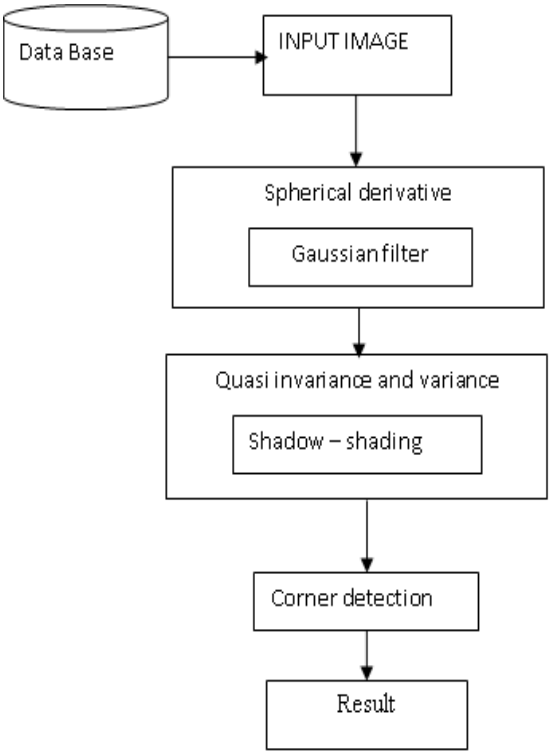

Figure : 3.1 Overall Architecture

4. Conclusion

This paper is about the extraction of retinal blood vessels by the shadowing and shading for detecting diabetic retinopathy. This project improves the rate of detection, and the accuracy of estimating the location at branching points. The problem of extracting the blood vessels is formulated as detecting branching points using corner detection and shadowing. The corner detection points with two dominant and different edge directions in its neighborhoods. Also the corner detection improves the rate of detection of branching points, and the accuracy of location estimates, enabling a more complete extraction of retinal blood vessels and more accurate counting of branch points in retinal systems.

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