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Retina vessel detection by using DCT Filtering

Nimerbir Kaur, Amanjot Kaur

Global institute of Management and Emerging Technology

Abstract- This is the research paper, which is based on the Retinopathy. Retinopathy is an eye disorder that is very closely related to diabetes. The full name is Diabetic Retinopathy, and can lead to blindness because it causes the retina to become damaged. When your blood sugar is too high damage can be done to the blood vessels, including those in your eyes. When this happens new blood vessels may develop over the retina causing scar. In this paper we used a DCT Filtering to remove the lighting and the noise from the image. It's a very unique method through which we can easily remove the noise from the retina .The method is evaluated on the publicly available DRIVE and STARE_DBI. In this paper firstly we extract the RGB image then remove the background noise and last we will apply the DCT Filtering.

Index Terms- Vessel detection, Segmentation, DCT, Fundus Image, Retinopathy, Diabetes, Blood Vessel, Retina, Segmentation.

I. INTRODUCTION

Retinopathy is an eye disorder that is very closely related to diabetes Diabetic retinopathy is caused by changes in the blood vessels of the retina. When these blood vessels are damaged, they may leak blood and grow fragile new vessels. When the nerve cells are damaged, vision is impaired. Diabetic retinopathy is the most common diabetic eye disease and a leading cause of blindness. DABETIC retinopathy is a leading cause of blindness affecting 95% of type 1 diabetics within 15 years of onset of whom 2% may become blind and 10% suffer severe visual impairment. Annual screening is recommended to identify progression allowing early treatment, which may prevent up to 90% of cases of blindness .Grading standards for screening include background and sight threatening retinopathy, the latter being particularly important to detect reliably. The full name is Diabetic Retinopathy, and can lead to blindness because it causes the retina to become damaged. Retinopathy is an eye disorder that is very closely related to diabetes.[1] The full name is Diabetic Retinopathy, and can lead to blindness because it causes the retina to become damaged. When your blood sugar is too high damage can be done to the blood vessels, including those in your eyes. Now days, diabetic retinopathy is a key reason for the blindness in elder age people. Patients who are suffering from diabetes are more likely to have eye disease but the main threat to eye sight is effect on retina. To detect the diabetic retinopathy in diabetic patients, retinal images should be analyzed. The typical Fundus Image looks like in the Figure 1the bright optic disc and vascular network can clearly seen in this image

Figure 1: Retinal Fundus Image

In the scope of image processing, segmentation of the optic disc, blood vessels and macula in digital fundus images is important for the research area of medical image analysis. [7].It is used to efficiently implement the diagnostic evaluation and taken as a basis of the cure to illness of patient. Early diagnostic is play an important vital role and prevent various cardiovascular and ophthalmologic diseases/problems. Generally, these problems are diabetes, cardiovascular disease, hypertension, arteriosclerosis, chorodial neovascularization, injuries and etc. Now days, diabetic retinopathy is a key reason for the blindness in elder age people. Patients who are suffering from diabetes are more likely to have eye disease but the main threat to eye sight is effect on retina. [1] To detect the diabetic retinopathy in diabetic patients, retinal images should be analyzed. The quality of the blood vessels structures in a retinal image is an important characteristic, as the ridges carry the information of characteristic features required for minutiae extraction. Retinal images are usually known as Fundus images are at the back of eye. Analysis of retinal images leads us to detect different diseases like retinopathy, glaucoma and macular degeneration. Diabetic retinopathy that can damage the retina is usually occurring due to diabetes mellitus complications which can lead to blindness if not treated in early stages [2]. Retina is usually red in color due to rich blood supply in it and it is responsible for the bright vision. Ophthalmologists analyze the retina by considering Now days, diabetic retinopathy is a key reason for the blindness in elder age people. Patients who are suffering from diabetes are more likely to have eye disease but the main threat to eye sight is effect on retina. [1] To detect the diabetic retinopathy in diabetic patients, retinal images should be analyzed. Retinal

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II. PRE FILTERING TECHNIQUE

Pre filtering is a technique which is used for removing the background noise from the original image

Fig: 2 Original image

Fig:2 Show that the original image where the point allotted on it where the RGB show some value its means that it has a background noise and after apply the pre filtering technique the back noise will be remove from the original image Fig:3 show the RGB value zero its means now in the background of the Retinal image is noise less.

Fig 3: After remove background noise

Firstly we will remove the background noise by from the retinal fundus image by using pre filtering technique .After using pre filtering technique we will extract the RGB image from the second image, and we will work on the only green image because we can easily detect the vessel from the green image .then after this one we will apply the DCT filtering technique to remove the noise and the light effect from the green image.

III. EXTRACTION OF RGB IMAGE

We all well know that every images make up their primary colour i.e Red, Blue and Green. Extraction is way to extract these all colour from the image. Extraction is the main part of Retinal images. The main work of the Retinopathy which is totally based upon blood vessel detection, the detection of blood vessel mainly done on the green part from the RGB colour. If we extract the green part from the original image the vessel shown very clearly than the other part of the RGB colour. It's clearly we can see in the Fig 4 there is extraction of RGB images but vessel easily seen in the green part ,So we always do work of Retinopathy on the green part of the retinal image[10]

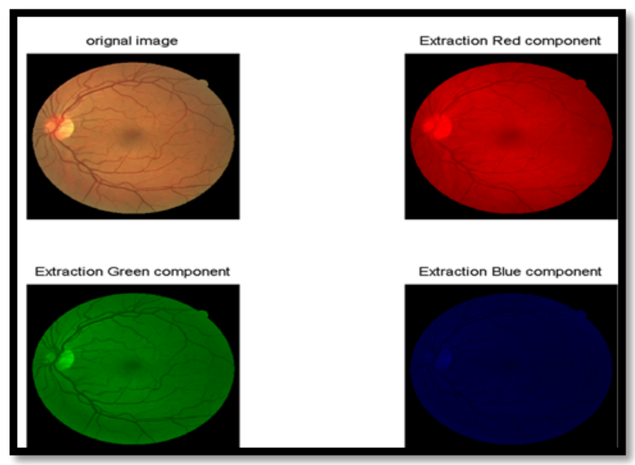

Fig 4: Extraction of RGB image

IV. APPLY DCT FILTERING ON THE IMAGE

Firstly we have know about DCT Filtering, it's a process through which we can remove the Noise and the lighting effect from the image Digital images are often degraded by noise, due to the imperfection of the acquisition system or the conditions during the acquisition. Noise decreases the perceptual quality by masking significant information, and also degrades performance of any processing applied over the acquired image. Hence, image profiteering is a common operation used in order to improve analysis and interpretation of remote sensing, broadcast transmission, optical scanning, and other vision data . Till now a great number of different image filtering techniques have been designed including nonlinear nonadaptive and adaptive filters , transform-based methods techniques based on independent component analysis (ICA), and principal component analysis (PCA) ,and so forth. These techniques have different advantages and drawbacks thoroughly discussed in ,and other references.

The application areas and conditions for which the use of these filters can be the most beneficial and expedient depend on the filter properties, noise statistical characteristics, and the priority of requirements. For effective filtering, it is desirable to considerably suppress noise in homogeneous (smooth) regions and to preserve edges, details, and texture at the same time. Acceptable computational cost is the most important requirement that can restrict a practical applicability of some denoising techniques, for example, those based on ICA and PCA .[5] From the viewpoint of noise suppression, preservation of edges, details and texture, and time efficiency requirements, quite good effectiveness has been demonstrated by locally adaptive methods .The latest modifications of locally adaptive filters include both typical nonlinear scanning window filters (employing order statistics) and transform-based filters, in particular, filters based on discrete cosine transform (DCT). For many image denoising applications, it is commonly assumed that the dominant noise is additive and its probability density function (pdf) is Gaussian . For microwave radar imagery, however, multiplicative noise is typical. The pdf of the noise can be either considered Gaussian or non-Gaussian (e.g., Rayleigh, negative exponential, gamma) depending on the radar type and its characteristics .Images scanned from photographic or some medical images are other examples [6] where additive Gaussian noise model fails. Homomorphic transformation can sometimes be a reasonable way of converting signal-dependent or pure multiplicative noise to an additive noise, which then can be filtered appropriately.However, quite often achievable benefits are not so obvious and without losing efficiency, it is possible to perform filtering without applying a homomorphic transformation to data (e.g., film-grain noise). Lee or Kuan filters are among those conventional and widely used techniques that aim to suppress multiplicative noise without the use of the homomorphic transform. The performance of such filters is improved by their integration into an iterative approach. However, iterative techniques are usually computationally costly, and they often may introduce oversmoothing. In this work, we aim to develop a class of transformbased adaptive filters capable of suppressing signaldependent and multiplicative noise, while preserving texture, edges, and details, which contain significant information for further processing and interpreting of images. In Section 2, we briefly overview a nonlinear transform domain filtering (how it is derived from a least mean square sense optimal filtering), for additive Gaussian noise. Note that any decorrelating orthogonal transform will be a possible choice for a transform domain filtering approach. Yet, we concentrate on the DCT in the following sections, discussing why we expect it to be a good choice for the transform domain filtering.

This algorithm of DCT-based denoising can be, in general, summarized below.

(1) Divide an image to be processed into overlapping blocks (scanning windows) of size M × M; let s be a shift (in one dimension, row, or column wise in pixels between two neighbouring overlapping blocks.

(2) For each block, with the left upper corner in the *ij*th pixel, assign
x=(m, l) = g (i + m , j + l) , m ,l = 0,……., M-1

(i) Calculate the DCT coefficients as follows:

$$X[p,q] = c[p]c[q]\sum_{m=0}^{M-1}\sum_{l=0}^{M-1} x(m,l)$$

$$\text{X Cos}\,\frac{[(2m+1)q\pi]}{2M}\ \text{Cos}\,\frac{[(2L+1)q\pi]}{2M}$$

Where

$$C[p]=\begin{cases}\sqrt{\frac{2}{M}},\ 1 \leq p \leq M-1\\ \frac{1}{M}\ ,p=0\end{cases}$$

$$C[q]=\begin{cases}\sqrt{\frac{2}{M}},\ 1 \leq q \leq M-1\\ \frac{1}{M}\ ,q=0\end{cases}$$

(ii) Apply thresholding to the DCT coefficients *X*[*p*, *q*] according to the selected type of thresholding and obtain *X*th[*p*, *q*].

(iii) Obtain the estimates within each block by applying the inverse DCT to the thresholded transform coefficients as

$$X[m,l] = c[p]c[q]\sum_{m=0}^{M-1}\sum_{l=0}^{M-1} x(m,l)$$

$$\text{X Cos}\,\frac{[(2m+1)p\pi]}{2M}\ \text{Cos}\,\frac{[(2L+1)q\pi]}{2M}$$

(iv) Get the filtered values for the block as

$\bar{f}(i + m, j + l) = xf(m, l),\ m, l = 0, \ldots, M - 1.$ (12)
(3) Obtain the final estimate $\ddot{f}$ for a pixel at *i j*th location by averaging the multiple estimates of it, these come from neighbouring overlapping blocks including that pixel.[7]

In Fig 5and 6 the original image from the drive and starve database, and the two results come out first is when we did not apply DCT Filtering and the second is when we apply DCT Filtering. When we did not apply the DCT filtering the retina vessel did not detect properly and for the diabetic operation vessels are necessary It's very clear that after applying DCT Filtering the image of retina show more vessels and has a less noise .In this we can remove much noise from the image by using DCT Filtering its very helpful method to remove the noise.

So, when we detect vessel without DCT Filtering we can't improve result for vessel detection specially in the case diabetic retinopathy DCT Filtering is must otherwise the result will not come properly

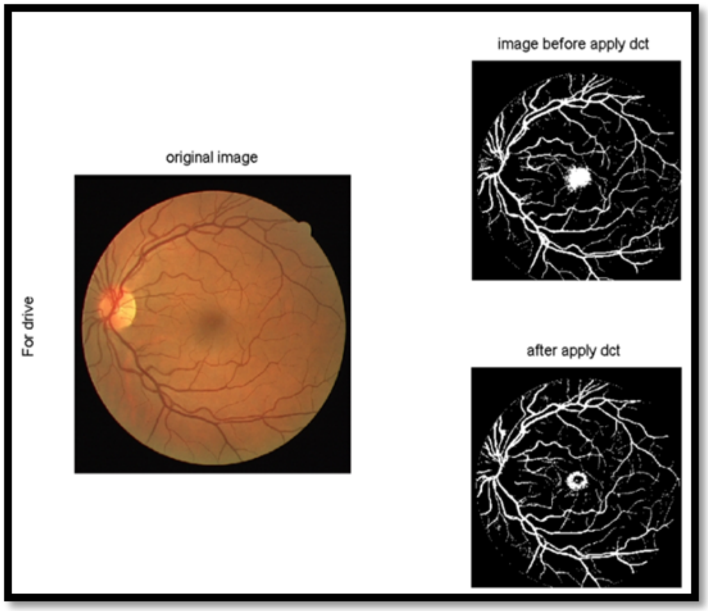

Fig:5 Image after applying DCT Filtration(For Drive Database)

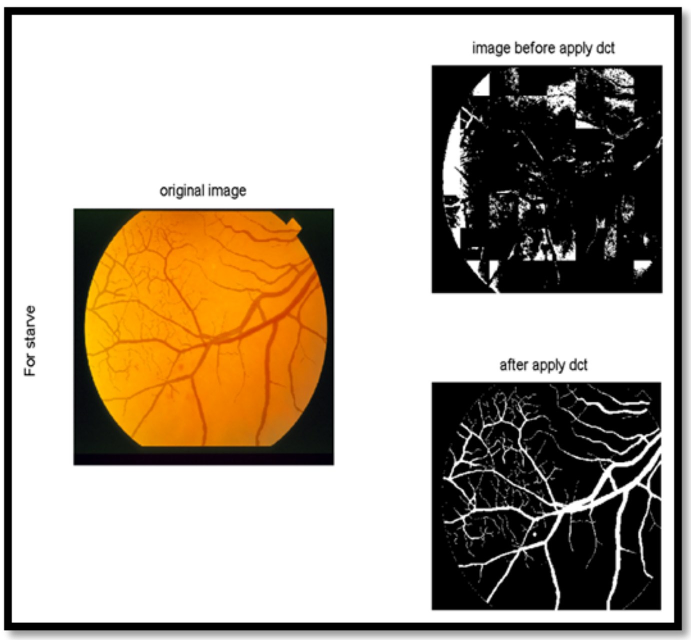

Fig:6 Image after applying DCT Filtration(For Starve Database)

V. CONCLUSION

In this research paper we consider a Retinal image which has been taken from the Drive and starve database firstly we remove the background noise by applying the Pre Filtering technique and then extract the RGB component and we work on the green component then apply DCT Filtering on the green component . DCT filtering help to remove the noise from image and the lighting effect from the Digital images . So, when we detect more vessel and improve result for vessel detection specially in the case diabetic retinopathy .For future work we will improve vessel detection through which we detect more vessel

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AUTHORS

First Author – Nimerbir Kaur, Mtech, Student of Global institute of Management and Emerging TechnologyNbhangu1@gmail.com

Second Author – Amanjot Kaur, Mtech, Professor of Global institute of Management and Emerging Technology