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Contribution of Machine Learning and Deep Learning for Diagnosis of Retinal Detachment

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***Abstract*:** In medical specialty the human eye is a very important diagnostic issue. The problem of retinal detachment is commonly for the people over the age of 50 and it affects the people who had previous eye surgery like cataract removal and also severe eye injuries. The Segmentation in fundus imaging that is a non-trivial task because of the variable size of vessels, comparatively low distinction, and potential presence of pathologies like micro-aneurysm. Many machine learning, deep learning algorithms, have been proposed for this purpose. This paper provides recently invented ideas to improve the technique for blood vessel segmentation to enhance retinal fundus photographic images. Many variants of segmentation methods are considered, including Tyler L. Coye where is an improved version of segmentation methodology used to segment the blood vessels for fundus photography image. The proposed approach was tested and evaluated on Agarwal Eye Hospital's fundus dataset which consists of 100 photographic images.

Keywords— Pre-processing, Image Enhancement, Tyler Coye Segmentation Algorithm, Image extraction Retinal Detachment (RD)

I. INTRODUCTION

Retinal Detachment (RD) could be a disorderliness of the eye during which the retina breaks away from the layer beneath. It is clinically proved that the longer retinal detachment goes untreated then it makes permanent vision loss in the affected eye. Visual result needs to reengage the detached phase of the tissue layer with the Retinal Pigment Epithelial tissue (RPE). It is noted that color fundus imaging assists in tissue layer disease identification through representational process a photographic image of the retina.

Some methods of digital image processing and artificial intelligence techniques are blueprint for diagnosing and distinguishing the natural vision from the disease affected vision [1-2]. However, the problem of this analysis is to seek out an acceptable classifier to change slightly retinal color photographic image by altering artery-vein analysis to get correct binary images [3]. The fundus photographic image is an example of eye anatomy, color fundus retinal photographic image uses to review color images of the interior surface of the eye. It is mainly used in detection and analysis of visual retinal defective condition in scientific. Detached retina itself is uncomplicated however the indications occur like unexpected presence of a speck, perception of rapid and eyesight decrease that are cautionary signs for visual impairment. Machine learning techniques are used to segment tiny vessel segmentation [4]. It is found that most of the researchers focused on machine learning and deep learning techniques [5-7].

The tissue layer could be a physical tissue placed back of the eye. It is sensitive to light-weight. The quantity of sunshine going in the eye is checked by the iris then passed to the tissue layer.

The images are dropped on the retina and converted to electrical impulses. These electrical signals are the transmitted to the brain. Anatomy of the eye layer is visible on OCT (Optical Coherence Tomography) images.

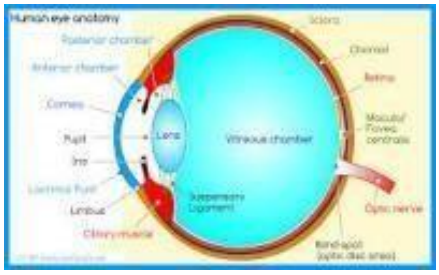

Figure 1. Normal Eye

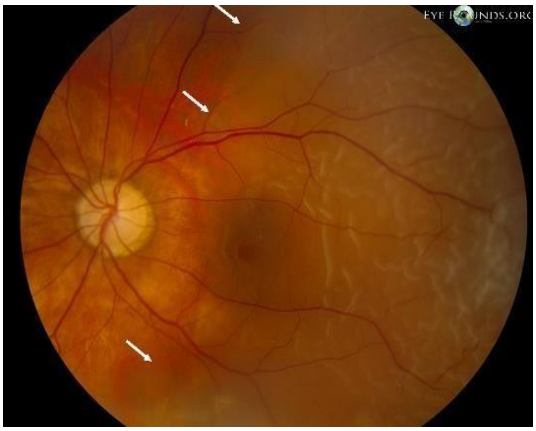

Figure 2. Retina Detached Eye

II. RELATED WORK

Rangayyan *et al.* [8], have proposed that gaussian filters based vessel segmentation and feature extraction. Miri et al. [9], have proposed a work which that are multiple structuring components are used to extract vessel ridges.
Diri *et al.* [10], have proposed that segmentation based on traditional active contour model. However, these methods are simply created and mathematically complicated. There are classical classifiers like Extreme Learning Machine model(ELM), Gaussian Mixture Model algorithm(GMM), K-Nearest Neighbors algorithm(KNN), Support Vector Machine algorithm(SVM), Neural Networks algorithm(NN) etc.

It used to discriminate vessel pixels from non-vessel pixels. M.J. Staal et al.[11], have proposed a comparative approach. This work consists of two algorithms that are an edge-based blood vessel segmentation methodology and SVM algorithm.

Ricci et al. [12], have proposed an Ada-Boost classifier to combine with several weak classifiers and to design strong classifier. In the above mentioned classifier is used to segment the vessels for fundus photography.

Fraz et al. [13], have proposed a combined approach an ensemble based bagged method and boosted decision tree algorithm. Additionally, applied a feature vector analysis reinforced the direction examination of morphological conversion, line-based edge detection, gradient vector based and finally Gaussian filters.

Roy Chowdhury et al.[14] , have proposed a novel three-phase blood vessel segmentation algorithm. First phase, it is needed to pre-processing. In the second phase, set of eight features are extracted using Gaussian mixture model (GMM) classifier. Finally, it is required to post process phase.

B. Lam et al. [15-16], have proposed vessel segmentation algorithms that reveal the principle of complexness of computation.

Mendonca et al .[17], have proposed detected center line using the combination of three techniques such as morphological operations, curvature data and North filtering. These false edges derived from edges are optic disc and exudates.

D. Marin et al. [18], have proposed neural network classifiers based on 7-feature set. These inputs are fed into neural network to find out the normal and abnormal images for the purpose of classification. This method based on moment in variants.

M.Niemeijer et al. [19], have proposed K- Nearest Neighbors (KNN) method based on Gaussian filters. Yuen Aoi Chee et al [20], have proposed an ultrasound images-based feature extraction method.

Hideharuohsugi et al. [21-23] ,have proposed that machine learning associated with a deep learning techniques are used to observe rhegmatogenous retinal detachment (RRD).The deep network achieved sensitivity is 97.6 and specificity is 96.5.The methodology conferred in is that the matched filtering based method .This methodology worked with the help of gaussian filters..

III. METHODOLOGY

In this research paper consists of four steps: (a) Data Pre-processing (b) Image Enhancement(c) Tyler Coye Segmentation (d) Feature Extraction.

A) Pre-processing

First, it is needed to do pre-processing, which provides the relevant clinical visual information and also offers better contrast. Then it is necessary to, convert into green channel and finally the strategy is checked from several datasets on different images.

B) Image Enhancement

Filtering method has been adopted at this step to maintain the characteristics or level of image.
In general, the image enhancement technique classified as spatial domain filtering is applied.

C) Tyler Coye Segmentation.

The above-mentioned algorithm is mainly used for blood vessel segmentation. Figure 3 shows the segmentation using Tyler L. Coye methodology. This method is used to exclude background from an object.

D Feature Extraction

In this research, feature extraction plays an important role. This method is used in machine learning and deep learning. The main

aim of the research is automatically to find and detach many required parts or shapes belonging to a digital photographic image. PCA based feature extraction is used to extracted the features.

Figure 4. Original image

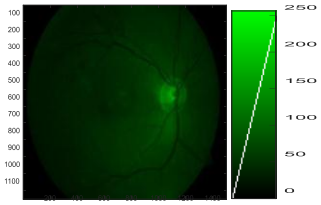

Figure 5. Green channel image

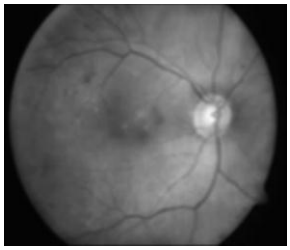

Figure 6. Grayscale image

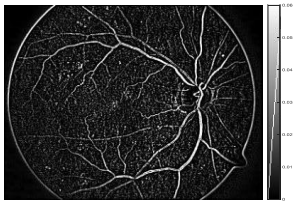

Figure 7. Tyler L. Coye Segmentation

Figure 8. PCA based Feature Extraction

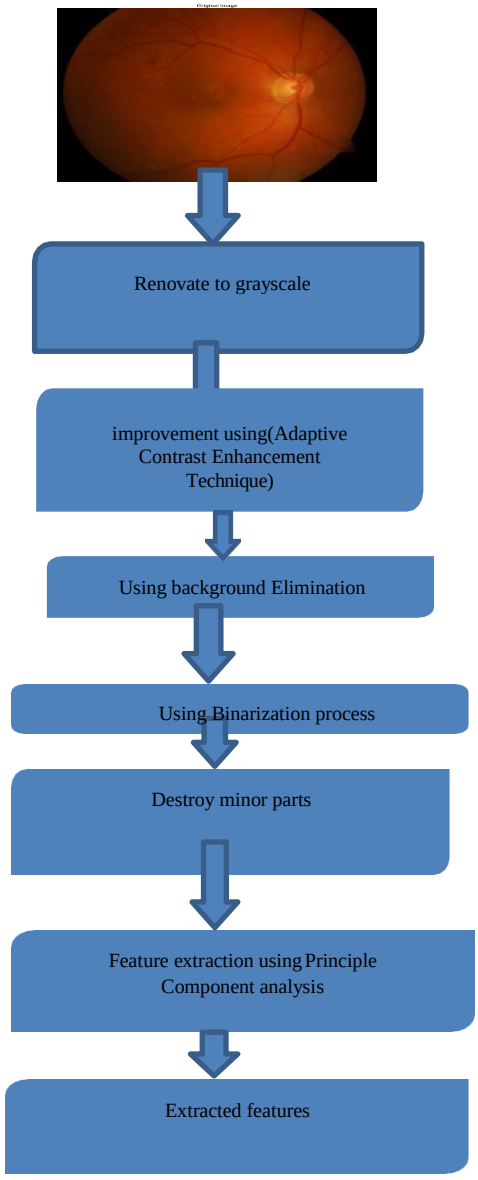

Figure 3. Flow chart of Tyler L. Coye segmentation

IV. EXPERIMENTAL EVALUATION AND RESUTS

By the human observers the proposed vessel segmentation algorithm is evaluated using the segmented vasculature. Manual vessel segmentation will take over two hours, whereas automated diagnosis of vessel segmentation algorithms aims to scale back the manual labor by keeping acceptable precision of vessel segmentation.

V. CONCLUSION AND FUTURE WORK

This work proposes a unique approach for Tyler L. Coye segmentation algorithm of retinal vessels. There are varied detection of retinal vessels algorithms that have previously been

developed and proposed that perform satisfactorily. This paper will act as a resource for the future researchers focused in automatic detection of abnormal signs of retinal detachment and assist them to develop more efficient algorithms.

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