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A NOVEL ALGORITHM FOR DETECTION OF PAPILLEDEMA IN LUMINOSITY AND CONTRAST ENHANCED RETINAL IMAGES

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Abstract - *Papilledema is a disease caused by the intracranial pressure due to any reason and it will results in swelling of optic disc. Enhanced color retinal images are taken to detect the presence of this disease. Normal images with poor quality cannot be used for diagnosis .Quality degradation may be due to uneven illumination, image blurring, low contrast etc. luminosity and contrast enhancement is applied on the poor quality retinal images .R, G and B channels in the color retinal image is enhanced by the luminous gain matrix which is the obtained by gamma correction of the value channel in HSV color space. Contrast is enhanced by CLAHE (contrast limited adaptive histogram equalization) in the luminosity channel of L*a*b* color space. In this enhanced image, optic disc is located. Papilledema is indicated by the swelling of optic disc.So optic disc (OD) is needed to be located at first .OD is the brightest region in retina. It is the exit point of retinal nerve fibers from eye and the entrance and exit point for retinal blood vessels. OD is located using swarm intelligence. When the number of pixels in the located OD is greater than a threshold value, the disease is said to be detected otherwise not. It is very effective as well as time saving work*.

Key Words: **Gamma correction, L*a*b*colour space, optic disc, swarm intelligence, Luminosity**

1. INTRODUCTION

There are many diseases associated with the retina. Papilledema is one of such diseases. It is due to the intracranial pressure. It will result in swelling of the optic disc .The efficient means of detecting papilledema is valid in nowadays where people are common to many eye diseases. In order to detect papilledema the retinal images from the patients must be analyzed. These images are having poor quality due to uneven illumination, image blurring, low contrast etc. So these images must be enhanced. There are many enhancement methods from that enhancement based on luminosity and contrast adjustment is used here.Enhancement is carried out in color retinal images. By performing gamma correction in the value channel of the HSV (hue, saturation, and value) color space will results in a luminance gain matrix and it is used to enhance the R,G and B (red green and blue) channels. Contrast is then enhanced in the luminosity channel of L*a*b* color space by CLAHE (contrast limited adaptive histogram equalization). In recent years many enhancement methods are proposed including image luminosity and contrast normalization techniques, A multi scale method based on the contour let transform, CLAHE (contrast limited adaptive histogram equalization), Retinex-based enhancement algorithm etc. These methods are used to provide enhancement for retinal blood vessels by exhibiting greater contrast between blood vessels and the retinal background in both gray scale and color retinal images. Here the green channels of the color retinal image displays a high contrast between the vessels and the background these enhanced retinal images lose color information or other important image features. So the analysis of the ophthalmologists gets degraded. The retinal diseases are analyzed using the measurement of optic disc size and the optic cup size. By separating the optic disc, it will be helpful for analyzing the nerve vessels. By analyzing these nerve vessels various retinal diseases such as glaucoma, cataract, and cardiac disease can be detected [1][2]. By performing enhancement of retinal images based on luminosity and contrast enhancement we can distinguish various anatomical structures like the macula, optic disc (OD), optic cup and blood vessels and also it can provide increased quality without color distortion and over enhancement. To avoid the common problem of color distortion, all the processes are performed on the luminosity channel. Now, coming to the detection of papilledema which is optic disc swelling. The optic disc is needed to be located at first. The idea of swarm intelligence is used for the segmentation of the optic disc. When the number of pixels in the located optic disc is greater than the threshold value, papilledema is said to be detected otherwise not.

2. LITERATURE SURVEY

There are various methods and algorithms which are implemented in fundus images. By calculating the optic disc the disease of the fundus images can be identified. Huiqi Li et al. [3] have implemented Principal Component Analysis(PCA) to find out the lesions in the retinal images. Optic disc layer can be found by the modified active shape

model algorithm and this technique has disadvantaged one due to the slow processing. Hoover [4] implemented the geometric analysis of optic disc and the retinal blood vessels to separate the disc location in the retina. The method used in the above paper is the fuzzy logic to find the optic disc and optic cup from the fundus image

3. PROPOSED WORK

The proposed technique consists of following block diagram. The block diagram represented in the figure 1

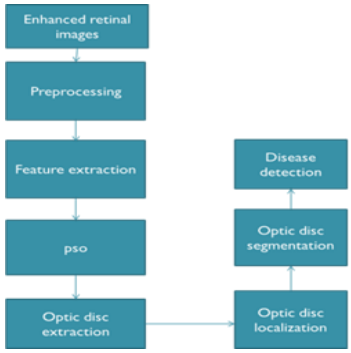

Fig- 1: Block diagram of proposed work

3.1 IMAGE ACQUISITION

The images are obtained from nearby hospital. From that a number of images which are normal as well as diseased are selected. The input image of the retina is shown in the figure.2

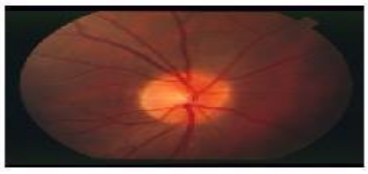

Fig-2: Input image

3.2 PRE-PROCESSING

A number of Pre-processing steps should be followed on the retinal images before Optic Disc localization. These are given by

- Resizing
- Grey scale conversion
- Median filtering
- Adaptive histogram equalization
- Background subtraction
- Median filtering
- Mean filtering

3.3 IMAGE ENHANCEMENT

ENHANCEMENT OF COLOUR RETINAL IMAGE

It consists of two steps: Luminosity enhancement and contrast enhancement

LUMINOSITY ENHANCEMENT

Luminance can degrade visual quality. So it is essential to enhance luminous effect. Color retinal images are split in to R, G, B channels then it is converted in to HSV (hue, saturation and value) color space. The luminosity channel is used for all processing, performing gamma correction on luminosity channel will results in luminance gain matrix. This luminance gain matrix is used to enhance RGB channels. Gamma correction is an image processing method, here the luminance is transformed nonlinearly, and the transformation curve is

$$w = u^{r}$$

Where u has the values in the range (0, 1) and it is the normalized fixed value of the luminosity channel. W is the normalized output and 'r' is a constant

CONTRAST ENHANCEMENT

CLAHE method is used to enhance contrast of the Color retinal images. In this method retinal image is divided into small regions known as tiles. The local contrast is enhanced in such a way that the histogram on each tile is equalized here. The luminosity enhanced R, G, B channel is converted in to L*a*b* color space. Then CLAHE is applied on the luminosity channel and again color space conversion is carried out. That is converted in to RGB. Then channel is merged and the enhanced color retinal image is obtained. The enhanced image is shown in the figure 3

Fig- 3: Enhanced image

3.4 IMAGE SEGMENTATION

OPTIC DISC LOCALISATION

Optic Disc is the brightest region in the retina, and it is the exit point of retinal fibers. Papilledema is affected to the Optic Disc. The location of OD is very important

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3.5 FEATURE EXTRACTION

PARTICLE SWARM OPTIMIZATION

PSO is a computational method that optimize a problem by iteratively trying to improve a candidate solution with regard to a given measures of quality. In the location of optic disc there is a group of particles. Optic disc is the brightest region so the intensity of the pixels will be very high. PSO algorithm is used to locate optic disc. In particle swarm optimization the swarm is modeled by particles that can move along the multidimensional space each particle has its own velocity and position. The particles move towards the best position each particles aim is the global best position which is the desired position. This global best is updated when a new best position is known. Every particle tends to follow another particle which is nearest to the global best. Local best is the best position of each particle. Every particle communicates with each other .Neighborhood best is the best position obtained by communicating with another particle in the swarm.
The constriction coefficients are
Phi 1=20.5

Phi 2=20.5

Phi 1=20.5=Phi 1=20.5+Phi 1=20.5

Chi=2/ (phi-2+sqv + (phi^2-4*phi)

W=chi inertia weight

Wdamp = 1 Inertia weight dumping ratio

C1=chi*phi1 personal learning coefficient

C2= chi*phi2 global learning coefficient, the population size is row *Colum.

After locating the optic disc, a circle is drawn on the location of the optic disc to identity it clearly

3.6 CLASSIFICATION

PAPILLEDEMA DETECTION

After locating the optic disc it is converted into binary form. In that optic disc having a round shape with white colour and background is black. A predefined threshold is set. Whenever the number of pixels in the white area is greater than this threshold the disease is said to be detected otherwise not.

4. RESULTS

Thus, the final optic disc swelling is detected from the diseased patient. The accuracy of the proposed work tends to be 92% and the sensitivity is around 40% and specificity is around 92%.The detected swelling is shown in the figure 4.

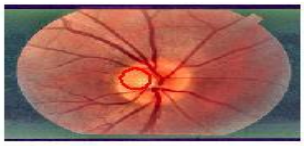

Fig-4: OD Swelling detected

5. CONCLUSIONS

Thus, the proposed method can detect the various patients' retinal disease at the less time period. In future by increasing the training and testing periods more number of diseases can be found at the same time using retinal images.

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