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GKFCM Clustering and Classification for Low Intensity Inhomogeneity Glaucomatous Retinal Images

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Abstract: *In the current scenario, the possibilities for the cause occurred in retina create a huge impact in day today nature. The proposed algorithm will bring a heavy monitoring of our cornea part of the body in the initial stage. The Technique follows with the feature Extraction of the Grey scale low intensity images to identifies the smoothen region of the image (640x480). Such that which will be fed as input to the clustering part(GKFCM) Gaussian Kernel Fuzzy C means clustering help in detecting the affected area of the retinal image in a simplified technique using the method call as cup and segment schema extraction, between two perspectives. This implementation of analysis is carried over for collection of images in the database (100 images), as a verification the overall clustered data will be fed as input to the SVM (support vector machine) which helps in identifying the region of affected area in prior, the performance measures paved a high powerful technique compared to the existing methodology, which yields the overall positive ration as nearly to 97% through the collected Database*.

Keywords: *GKFCM, SVM.*

1. INTRODUCTION:

Diabetes is one of the most common causes of blindness among the people of working groups. It causes cataract, glaucoma and damage of the blood vessels inside the eye, such condition is called "Diabetic Retinopathy'. Diabetic Retinopathy is an acute retinal disorder which causes manifestation of diabetes on the retina. About 210 million people all over the world have Diabetes Mellitus; among which 10 - 18% of people are suffering from Diabetic Retinopathy. So for the prevention of Diabetic Retinopathy and gradual vision loss, early detection and diagnosis of Diabetic Retinopathy is required. Diabetic Retinopathy is mainly identified due to the development of microaneuryms, haemorrhages and exudates. Microaneuryms are mainly tiny swelling in the venous end of the retinal capillaries which lead to haemorrhages. It can be identified as small red spots in the retinal image. Exudates are mainly occurs when fat or lipids leaks from the ruptured blood vessels or aneuryms, it appears as yellow lesions. The degree of disease can be determined from the severity of the development of microaneuryms and exudates. If the exudates move to the macular region of the eye it may lead to total vision loss. Glaucoma is a group of eye diseases that gradually steal sight without warning. There is no cure for glaucoma yet. However, medication or surgery can slow or prevent further vision loss. The appropriate treatment depends upon the type of glaucoma.. A multi resolution sliding band filter (SBF) is applied for OD (Optic Disc) segmentation. A low resolution SBF and a high resolution SBF are used to obtain a set of pixels associated with the maxi-mum responses giving a coarse estimation of the OD boundary. Morphological and edge detection methods followed by Circular Hough-Transform can be applied to get a circular OD boundary estimation. A location methodology based on a voting-type algorithm is used to find the location of OD. OD contour was estimated by the Hausdorff based template matching between the detected edges and, edges and the template of circle with different sizes.

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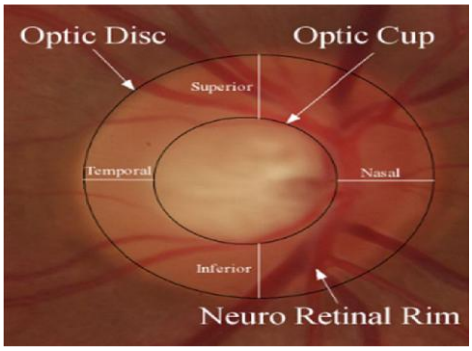

Figure1. Typical Neuro Retinal Image with Glaucoma affected.

This shape-based modelling of the OD region fails to illustrate shape irregularity which typically arises due to some pathological changes. Level sets were applied to detect the exact contour of OD[4].

2. OBJECTIVE:

The main objective of the workflow is to identified the most vulnerable part in the eyes, with respect to glaucoma, here saturation of state will be in between the cup an disk level set fragment to identify these level set features, it is recommended to identify the features behind these states for that it is required to go with the Gaussian level set clustering framework. By using MATLAB, the fundus retinal image is processed by using different operations and ruptured blood vessels and exudates is detected and made visually cleared for the ophthalmologists to study. To collect the main set of features and to re-estimate the vulnarity of affected area.

3. LITERATURE SURVEY:

An artificial data generator called GLOR is presented which is based on a Monte Carlo method and designed for the training of machine learning classifiers for glaucoma diagnosis[2]. The generated population is characterized by the functional and structural data of eyes. In this study, these parameters are provided by High Definition Optical Coherence Tomography (HD-OCT) [5] and by Standard Automated Perimetry (SAP) instruments. In most of the countries people are affected with the diabetic illness, such that reflects in eye disease permanently, so that this will not help them to identify the cure for the illness in future the proposed method help to estimate the category of the illness factor as a ratio by the relative checking with mutual fix. So as in return glaucoma area with the affected region can be addressed and it will be cured, which was estimated in the below scenarios.

4. PROBLEM DEFINITION:

The patients with diabetes are at risk, they should check up their eyes in a regular interval for the diagnosis of diabetic retinopathy. Since Proliferative diabetic retinopathy does not show any symptoms until they are in last stage of vision loss. By the proposed technique, it is easy to estimate the patient continuity of eye spectrum with every month, and the diabetic level can be maintained properly by actual traceability of cup and disk area thoroughly, which indeed helps the patient to step up with the low risk in future.

5. METHODOLOGY:

Diabetic image processing is achieved with the help of morphological operation for the images such as digitalized dilation, erosion thinning and brightening of the image [7]. Which identifies the important part of the low inhomogeneity area, such that the proposed algorithm identifies the affected area based on the morphological operation result. Diabetes Retinopathy detection methodology follows from the elimination of optic disk then

detection of blood vessels exudates in the fundus retinal image. The images are used to identify as JPEG format from the Hospitals, in the range (640*480*3). The overall workflow is given as below.

6. PREPROCESSING:

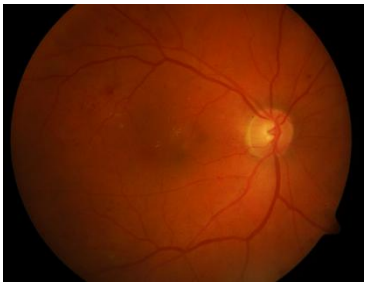

Figure 2. The input image of Glaucoma affected with cup and disk part.

Step 1: Each image is converted into the grey colour space. We use jittered sampling to select a small subset of pixels in the colour image as samples.
Step 2: Next, we go through each pixel in the gray-scale image in scan-line order and select the best matching sample in the colour image using neighbourhood statistics.
Step 3: The best match is determined by using a weighted average of pixel luminance and the neighbourhood statistics.
Step 4: The chromaticity values (x,y) of the best matching pixel are then transferred to the gray scale image to form the final image.
Step 5: Colour transfer using sample blocks involves the same for the whole image matching procedure but only between the source and target sample blocks.

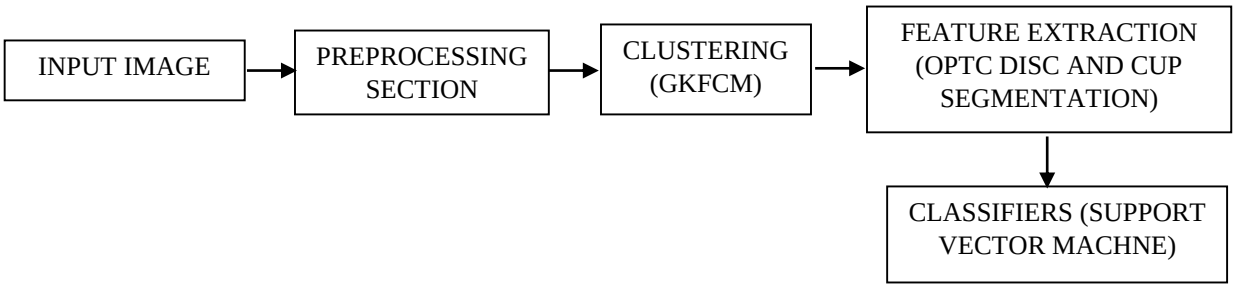

Figure3. The control flow part of the system.

The Flow of the pre-processing block with the full proposed system for the glaucoma part identification of cup and level set disk segmentation is given above.

7. ADAPTIVE HISTOGRAM EQUALIZATION:

Adaptive histogram equalization (AHE) is a computer image processing technique used to improve contrast in images [8]. It differs from ordinary histogram equalization in the respect that the adaptive method computes several histograms, each corresponding to a distinct section of the image, and uses them to redistribute the lightness values of the image. It is therefore suitable for improving the local contrast of an image and bringing out more detail. However, AHE has a tendency to over amplify noise in relatively homogeneous regions of an image.

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8. MORPHOLOGICAL OPERATION:

In Morphological operation it is worked based on the two factors such as dilation and erosion part of the images which given the continuity or closed part of the image, so that the lowest brightness region in the image part will be in closer and it forms the area [1][2][7]. This will be applicable for the eroded region. It is stated as the value of the output pixel is the minimum value of all the pixels in the input pixel's neighbourhood. In a binary image, if any of the pixels is set to 0, the output pixel is set to 0.

9. GAUSSIAN KERNEL FUZZY C MEAN CLUSTERING:

The objectives of clustering algorithms overlap image segmentation problems. So, medical image segmentation problems directly apply cluster analysis developed in machine learning and pattern recognition area. FCM is one of the most popular algorithms in fuzzy clustering, which has been widely applied to medical image segmentation problems. It attempts to minimize the cost function. FCM can be robust to noise and outliers when replacing a new kernel-based metric in the original Euclidean norm metric of FCM. The reason is that an exponential-type distance is bounded and monotone increasing, based on the concept of machine learning with a learning capability to improve the performance of clustering results. zen and yang proposed Gaussian Kernel-Based Fuzzy C-Means (GKFCM) clustering to estimate the parameter σ automatically. GKFCM can learn the other parameters by a prototype-driven learning scheme. There is no need to select the parameters in advance with prior knowledge. Moreover, it is slightly faster than KFCM. The advantage of GKFCM is to perform clustering and to estimate parameter simultaneously.

10. LEVEL SET SEGMENTATION IN INTENSITY INHOMOGENEITY:

Level-set-based segmentation methods provide a natural and flexible way to handle many radiology image s in which objects to be segmented have irregular shapes and complicated topologies. They try to identify each ROI using a certain region descriptor such as intensity mean or a Gaussian distribution to move the active contour. Intensity inhomogeneity affects efficiency of region based level set segmentation methods. Moreover, defining a region descriptor for inhomogeneous images is very difficult, to address the issues with perspective related to the cup and disk area it is helpful to look on the identification part such by the proposed method.). It applies the power of curve evolution by level set to increase the efficiency of segmentation by GKFCM clustering. It starts with a GKFCM clustering, whose results are applied to initiate level set segmentation, estimate controlling parameters, and regularize level set evolution in intensity inhomogeneity. The GKFCM clustering, with the ability of selecting suitable parameters by a prototype-driven learning,

GKFCM Methodology for the updation of the cluster region is given as follows:

Compute φ^S $using$

$$n_i = \min i^{'} \approx i\ (1 - \frac{k\left(a_{i'}, a_i\right)}{1} max\, k(1 - \ k(a_k, x)$$

$$\mu_{ij} = \frac{\left(1 - k\left(x_j, a_i\right)\right) + \ n_i \left(1 - k\left(x_j, a_i\right)\right) 1^{-\frac{1}{m}-1}}{\sum_{k=1}^{c} \left(1 - k\left(x_{j,} a_i\right)\right) + n_i \left(1 - k\left(x_j, a_i\right)\right) 1^{-\frac{1}{m}-1}}$$

STEP1: Compute φ^S $with$ a^{s-1} and n_i $using$, i = 1,…C j = 1,…..n, k(x,y) = exp(x-y)^2

STEP2: Update φ^S $with$ a^{s-1} and n_i $using$

$$a_i = \sum_{j=1}^{n} \mu_{ij}^{n}\, k\left(x_j, a_i\right) x_j \ + \ n_i\, k(x_j, a_i) x_j) \ / \ \sum_{j=1}^{n} \mu_{ij}^{n}\, k\left(x_j, a_i\right) x_j + n_i\, k(x_j, a_i) x_j)$$

Else s = s+1 and return to step c in algorithm

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All the derivative factor used here are the machine varying parameter help to find the normal and the affected clustered part of the region most.

11. SUPPORT VECTOR MACHINE CLASSIFICATION:

Learning and Generalization

This supervised learning help us to identify the most nominal area of the region in the images, such that all the support vectors are will be iterated with the threshold identification values, Multilayer perceptron (MLP) properties include universal approximation of continuous nonlinear functions and include learning with input-output patterns and also involve advanced network architectures with multiple inputs and outputs. There can be some issues noticed. Some of them are having many local minima and also finding how many neurons might be needed for a task is another issue which determines whether optimality of that NN is reached [1][6].

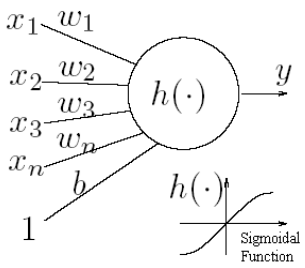

Figure 4. Simple Neural Network

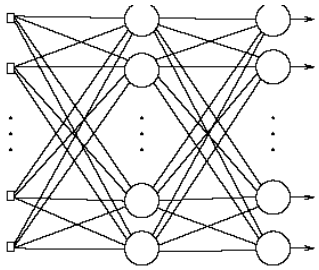

Figure 5. Multilayer Perceptron**.**

These are simple visualizations just to have a overview as how neural network looks like. The closest point identification in SVM is used by Rank Matrix calculation which is given as: Distance of closest point on hyper-plane to origin can be found by maximizing the x as x is on the hyper plane [3]. Similarly for the other side points we have a similar scenario. Thus solving and subtracting the two distances we get the summed distance from the separating hyper-plane to nearest points. Quadratic optimization problem to solve the tuning parameters, in linear quadratic approach, such that the correct side and other side of the hyper-plane part can be estimated. The wrong side of the hyper plane without violating the constraint. Now we might end up having huge slack variables which allow any line to separate the data, thus in such scenarios have the Lagrangian variable. The Kernel Function are used here to find the Gaussian polynomial of the function which tries to attain the system to do the iteration for the multiple times and to figures the training and testing part of the cup and disk area to be maintain with the high level accuracy.

12. CUP AND DISK SEGMENT EXUDATE DETECTION:

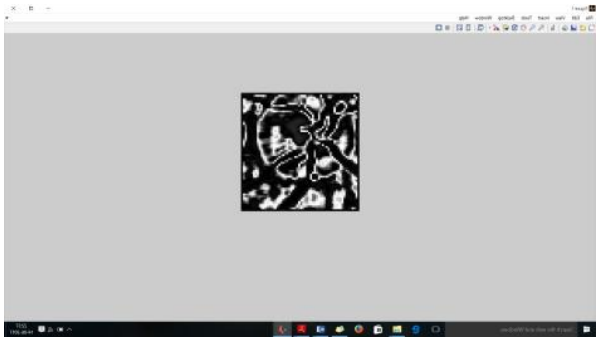

Figure 6. Primary Clustered Indexed image

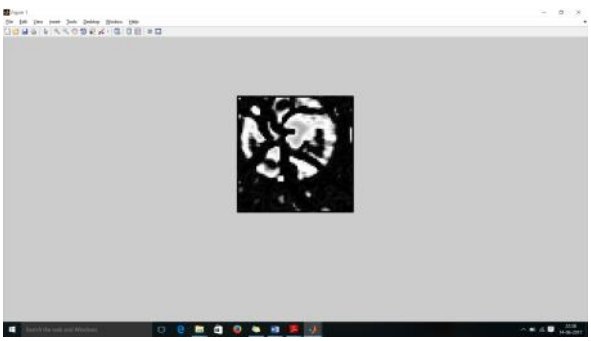

Figure 7. Primary Clustered Indexed image

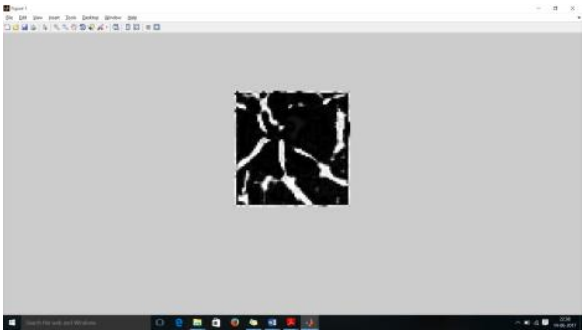

Figure 8. Primary Clustered Indexed image

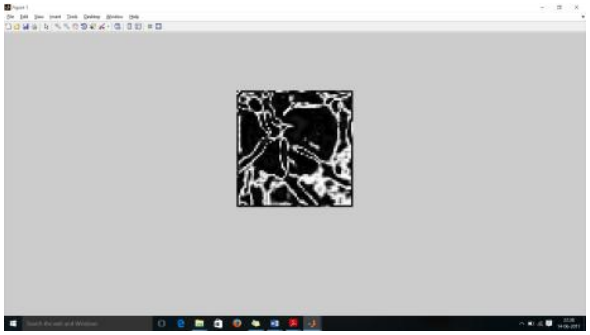

Figure 9. Primary Clustered Indexed image

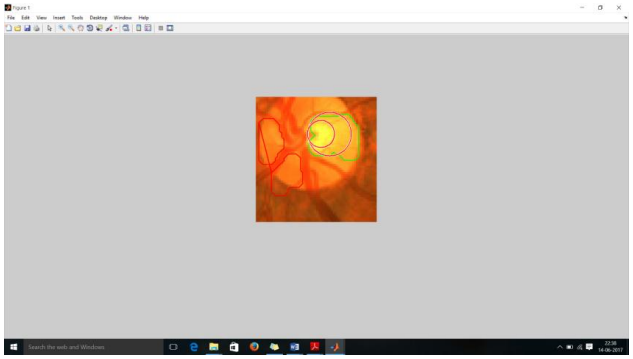

Figure 10. Cup and Disk Extracted region for the affected patient using Clustering and Classification part.

13. CONCLUSION:

This paper present the ocular disease of the cup and disk segmentation of the image, in this approach the overall clustering and classification algorithm. Thus overall work flow leads to the identification of the hidden and small affected region which helps the patient to avoid from the risk less situation. To measure this the approach system included an implicit region based method, with the threshold equalizer and the Level set clustering which has such controlling parameters to make the decision according to the criteria raised and has the clustered algorithm even to make the machine to learn all the information of the patient as the features for the identification of the person to be affected or he is normal condition, this level of survey to be identified in future for more than 1000 specimens, to identify the robustic of the algorithm.

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