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A Review on Diabetic Retinopathy Segmentation Methods

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ABSTRACT

In day to day life new technologies are emerging in the field of image processing specially segmentation domain. Image segmentation is the key technique in image understanding and computer vision. Diabetic retinopathy is a complication of diabetes that affect the eyes. This further results into poor vision or blindness. The main focused aim is to segment the "EXUDATE" eye disease. Exudate is the leakage in the blood vessel into the retina. Doctors need to capture approximately 20 to 50 pictures of retina from different angle to identify the disease and its location. From the aforementioned techniques Color based method of segmentation was applied to segment the diabetic retinal images. But, the result was not so efficient to extract actual part of disease. So, the research further here, K-means, FLICM, KWFLICM etc. methods have been proposed and modified with Non-Euclidean Distance Metric to segment the image and provide the spatial detail of segmented result and the disease detected.

Keywords: Hough Transform, FCM, FLICM, KWFILCM.

I. INTRODUCTION

In day to day life new technologies are emerging in the field of image processing specially segmentation domain. Image segmentation is the key technique in image understanding and computer vision. The task of image segmentation is to divide an image into number of non-overlapping regions having same characteristic like Color, tone, texture etc. There are many techniques for image segmentation and they are Thresolding, Clustering, edge detection and region detection. Image segmentation is also useful in image compression and image analysis.

Here in this proposed system the image segmentation is done by introducing the clustering technique. There are lots of clustering techniques that were proposed for image segmentation. A new trade-off weighted fuzzy factor was defined to adapt the control over the local neighbour pixels.

Figure 1: Diabetic Retinopathy

This trade-off weighted fuzzy depends on the space distance of all neighbouring pixels and their grey level discrepancy.

Retinopathy is any damage to the retina of the eyes, which may cause vision impairment. Retinopathy often refers to retinal vascular disease, or damage to

the retina caused by abnormal blood flow. Age-related macular degeneration is technically included under the umbrella term retinopathy but is often discussed as a separate entity. Retinopathy, or retinal vascular disease, can be broadly categorized into proliferative and non-proliferative types. Frequently, retinopathy is an ocular manifestation of systemic disease as seen in diabetes or hypertension. Diabetes is the most common cause of retinopathy in the U.S. as of 2008. Diabetic retinopathy is the leading cause of blindness in working-aged people. It accounts for about 5% of blindness worldwide and is designated a priority eye disease by the World Health Organization.

II. RELATED WORKS

In [1] author name they have describe used the method is Morphology Operation and SVM. They get the 87% Of Accuracy & Identify 4-stages. When Image is noisy then it will not access.

In [2] author name they have described used the method is Image Thresolding and Edge Detection. They get the 90% Accurate. Overlapping Blocks, segmented Gives 80% Accuracy.

In [3] author name they have described used the method is SLIC Algorithm, LAB (Color model) and K-means… Using Classifier SVM get 90% Results. No Classifier the different Classes.

In [4] author name they have described used the method is FCM and GA (Genetically algorithm). Advantage is more Accurate. Paperier Specification No. Of Clustering.

In [5] author name they have described used the method is KNN, GMM and Bayesian combination of probabilistic classifiers (SVM+GMM, SVM+KNN). Get 94% Results.

III. SEGMENTATION METHODS

Figure 2: Segmentation Types

A. Region Based:

In region based technique the pixels are grouped for segmentation which belongs to the object. The area that is to be detected should be closed; there should not be any missing gap in this region segmentation. Boundaries are identified and on each and every step one pixel is related to the region. This pixel is considered for the segmentation. After identifying each pixel it is converted into vector.

B. Edge Based:

In edge detection technique the boundary is identified for the segment. The edges of the objet are detected to find the discontinuity in an image. Tracing the pixel value of an edge and then comparing it to the neighbour pixel value. SVM (support vector machine) is used for classifying the pixel value of discontinuity edges. It is not necessary to have a closed texture like region segmentation technique. There are many other sub techniques in edge detection: Canny edge detection, gradient operator.

C. Feature based clustering:

It is the process that make group of similar objects and is widely used technique for medical images. Clustering can be considered the most important

unsupervised learning problem; it deals with finding the structure in a collection of unlabelled data. Cluster is collection of the objects which are similar between them and are dissimilar to the objects belonging to other clusters. The simple graphical example is shown on fig 1.2 with the four clusters of data that are to be divided.

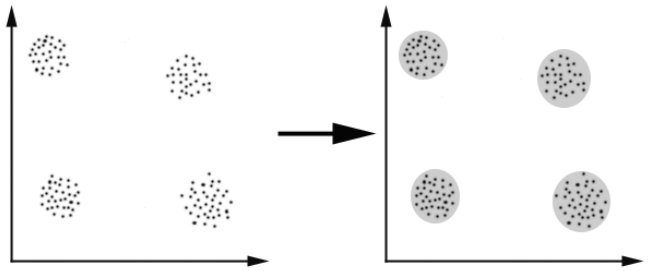

Figure 3: Four Cluster of data

Clustering algorithm is classified as listed below:

i. Exclusive clustering

ii. Overlapping clustering

iii. Hierarchical clustering

iv. Probabilistic clustering

In exclusive clustering the data are grouped in an exclusive way, so that if certain datum belongs to a definite clusters that it could not be included in another cluster. The separation of the point is achieved by a straight line on a bidirectional plane.

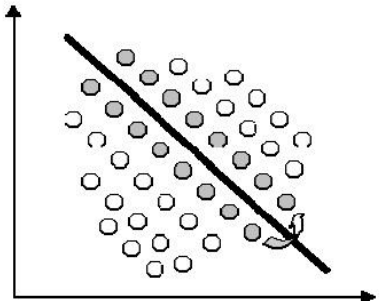

Figure 4 Clustering data

The overlapping clustering uses fuzzy sets to cluster data so that each point may belong to two or more clusters with different degree of membership. The data will be associated to an appropriate membership value. In hierarchical clustering it is based on union between the two nearest clusters.

In this tutorial we propose four of the most used clustering algorithms:

- K-means
- Fuzzy C-means
- Hierarchical clustering
- Mixture of Gaussians

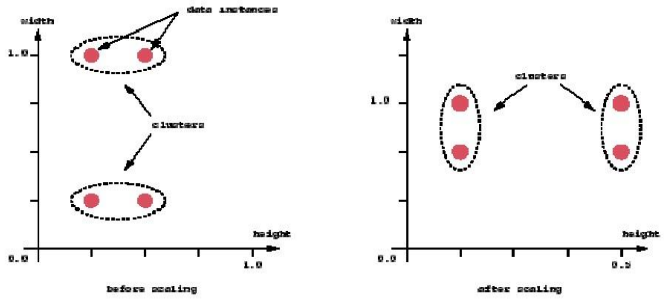

Figure 5: two clusters of an image before scaling and after scaling.

D. Fuzzy logic:

Fuzzy logic is a form of many-valued logic; it deals with reasoning that is approximate rather than fixed and exact. Compared to traditional binary sets (where variables may take on true or false values) fuzzy logic variables may have a truth value that ranges in degree between 0 and1.Fuzzy logic has been extended to handle the concept of partial truth, where the truth value may range between completely true and completely false. Furthermore, when linguistic variables are used, these degrees may be managed by specific functions.

Irrationality can be described in terms of what is known as the fuzzy objective. Fuzzy logic is the superset of Boolean logic that has been extended to handle the concept of partial truth- truth values between completely true or completely false.

In fuzzy logic exact reasoning is viewed as a limiting case of approximate reasoning. Any logic system can be fuzzified.

i. FCM

The algorithm implemented for the detection of the exudate disease by using the FCM algorithm. FCM clustering is an overlapping clustering algorithm in which each of the data point may belong to one or more cluster having different degree of membership. The features that are having same similarities are

grouped into the one cluster. Thus obtained similarities are defined by the distance of the feature vector to cluster centre. The Euclidean distance is used. The data is then associated to the membership value. The cluster centre is continuously updated when the difference between adjacent objective function is obtained close to zero or partially less then predefined value before.

ii. FLICM

By utilizing the meaning of Gki, we currently recommend a strong FCM structure to picture clustering, named fluffy nearby majority of the data C-Means (FLICM) grouping algorithm. It incorporates neighbourhood spatial and grey level data under its target function, characterized As far as.

Thus, the FLICM algorithm is provided for Likewise takes after.

1. Set the amount of the bunch prototypes, fuzzification parameter and the ceasing state €.
2. Instate haphazardly those fluffy segment grid.
3. Situated those circle counter b = 0.
4. Ascertain those bunch prototypes utilizing comparison.
5. Figure participation values utilizing mathematical statement.
6. Max {U(b) – U(b+1)} < € then stop, generally set b = b + 1 and try to step 4.

iii. KWFLICM

Situated the amount c's of the group prototypes, fuzzification parameter m, and window measure ni and the ceasing state ε. Instate haphazardly the fluffy group prototypes. Set those circle counter b = 0. Figure those exchange-off weighted fluffy variable will and the changed separation estimation, likewise depicted for following area. Upgrade those segment grid utilizing over comparison 3. Overhaul the group prototypes utilizing over mathematical statement 4. On max |Vnew – Vold |< ε at that point stop, otherwise, set b = b + 1 and try should repeated.

F. Hough Transform [5]

In automated analysis of digital images, a sub problem often arises of detecting simple shapes, such as straight lines, circles or ellipses. In many cases an edge detector can be used as a pre-processing stage to obtain image points or image pixels that are on the desired curve in the image space. Due to imperfections in either the image data or the edge detector, however, there may be missing points or pixels on the desired curves as well as spatial deviations between the ideal line/circle/ellipse and the noisy edge points as they are obtained from the edge detector. For these reasons, it is often non-trivial to group the extracted edge features to an appropriate set of lines, circles or ellipses. The purpose of the Hough transform is to address this problem by making it possible to perform groupings of edge points into object candidates by performing an explicit voting procedure over a set of parameterized image objects (Shapiro and Stockman, 304).

The simplest case of Hough transform is detecting straight lines. In general, the straight line y = mx + b can be represented as a point (b, m) in the parameter space. However, vertical lines pose a problem. They would give rise to unbounded values of the slope parameter m. Thus, for computational reasons, Dude and Hart [1] proposed the use of the Hesse normal form

r=x cos (theta) +y sin (theta),

Where r is the distance from the origin to the closest point on the straight line, and theta is the angle between the x axis and the line connecting the origin with that closest point.

It is therefore possible to associate with each line of the image a pair theta. The theta plane is sometimes referred to as Hough space for the set of straight lines in two dimensions. This representation makes the Hough transform conceptually very close to the two-dimensional Radon transform. (They can be seen as different ways of looking at the same transform [6]).

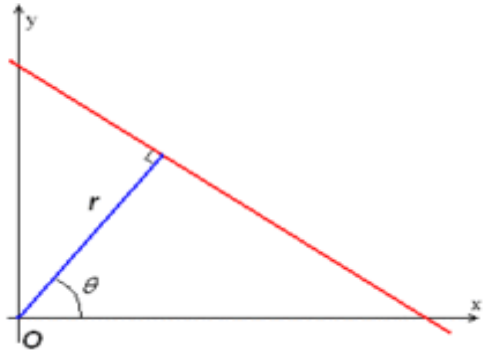

Figure 6: Hough Transform

Given a single point in the plane, then the set of all straight lines going through that point corresponds to a sinusoidal curve in the (r,θ) plane, which is unique to that point. A set of two or more points that form a straight line will produce sinusoids which cross at the (r,θ) for that line. Thus, the problem of detecting collinear points can be converted to the problem of finding concurrent curves [7].

IV. COMPARATIVE ANALYSIS

In this part of the paper describe about the different methods comparative study using its advantages and limitation so we can find the batter among all.

TABLE I
COMPARATIVE ANALYSIS

Methods	Advantages	Disadvantages
FCM	-Accurate -Works for well For noise free images	-Apriority specification of no of Clusters -Increase no of iteration. -Sensitive to noise
FLICM	-Enhance clustering performance -Image details preservation -Effective & Efficiency	-Works on Fixed distance. -Objective function is defined previously.
KWFLICM	-Better Segmentation -Better accuracy -Less elapsed time.	-At each iteration it's necessary to calculate for update trade of fuzzy Factor. -Works on adaptive distance.

V. CONCLUSION

From all the fuzzy clustering methods, for the detection of the exudate disease FCM method was applied. This method is an iterative based and takes much time to compute. It was concluded from the survey and research and also by practical performance that detection of this retinopathy is must. So, the proposed algorithm KWFLICM algorithm will be used for the robust detection and better performance. Thus this could be achieved by going step by step i.e. by applying the FCM method and then KWFLICM. So its prove that KWFLICM will gives rise to accuracy.

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