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Iris Eye Segmentation and by multiple FCM

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Abstract:-In this research, the fuzzy c-means (FCM) technique applied toeye's iris segmentation and with multiple and evaluation the accuracy of results.

Keywords: FCM, Iris eye, Digital Image Processing, segmentation, Matlab.

I. INTRODUCTION

1- Biometrics

Biometrics (or biometric authentication) refers to the identification of humans by their characteristics or traits. Biometrics is used in computer science as a form of identification and access control [1]. It is also used to identify individuals in groups that are under surveillance. Biometric identifiers are the distinctive, measurable characteristics used to label and describe individuals [2].

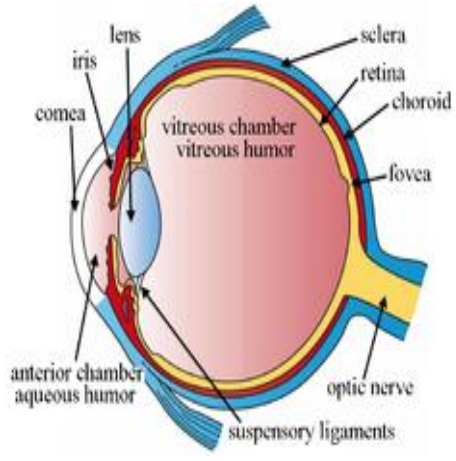
Biometric identifiers are often categorized as physiological versus behavioral characteristics [3]. Physiological characteristics are related to the shape of the body. Examples include, but are not limited to fingerprint, face recognition, DNA, Palm print, hand geometry, iris recognition, retina and odor/scent. Behavioral characteristics are related to the pattern of behavior of a person, including but not limited to: typing rhythm, gait, and voice [2]. Some researchers have coined the term behavior metrics to describe the latter class of biometrics [4].

More traditional means of access control include token-based identification systems, such as a driver's license or passport, and knowledge-based identification systems, such as a password or personal identification number [2]. Since biometric identifiers are unique to individuals, they are more reliable in verifying identity than token and knowledge-based methods; however, the collection of biometric identifiers raises privacy concerns about the ultimate use of this information [2, 5].

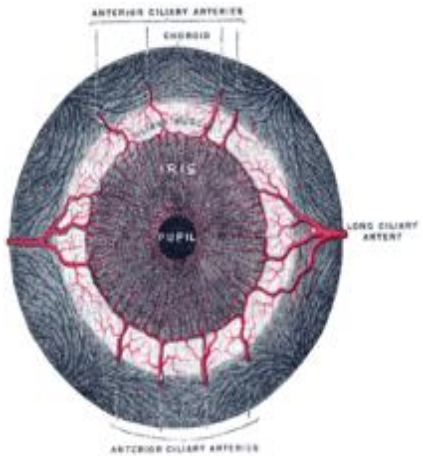
II. IRIS RECOGNITION

The Iris is located behind the cornea and in front of the crystalline lens. The Iris divides the space behind the cornea into the anterior and posterior chamber, which contains aqueous fluid. The Iris is a colored tissue which extends from the ciliary body and is apparent at all times. The color of the Iris is determined genetically. [6]

The purpose of the Iris is to constrict or enlarge the aperture of the pupil. By doing this it determines the amount of light that enters the pupil. In bright light the muscles of the Iris constrict the amount of light entering the pupil, and in low light the muscles enlarge the pupil to allow more light to enter[6]. Figure (1) shows structures of the eye and iris, and examples of iris [7, 8, 9].



(a)



(b)

(c) gray **brown** **green** **blue**

Figure (1) (a) Structures of the eye, (b) Iris, front view (c) An examples of a iris

III. IMAGE SEGMENTATION

Image Segmentation is the process of partitioning a digital image into multiple segments (sets of pixels, also known as super pixels). The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics.

The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image (edge detection). Each of the pixels in a region is similar with respect to some characteristic or computed property, such as color, intensity, or texture. Adjacent regions are significantly different with respect to the same characteristic(s). [10, 11]

IV. FUZZY C-MEANS (FCM) TECHNIQUE

The logic fuzzy and digital image processing techniques play an important role in the fields of medicine types both in terms of diagnosis or treatment, with and put a lot of software to control over how the performance of the means of science and technology that have become available to workers so as to provide the amount bulk of the scientific potential in Stenographer Levy shortly purpose and it greatly facilitates the diagnosis. [12]

The geometric center and the scope of each sub class are calculated adaptivelytoreducethecostfunction in fuzzy c-means clustering [13].This method employs the membership function μ_{mn} to find the degree of membership of nth object to them-th cluster. The cost function in fuzzyc-means clustering is [13]:

$$J = \sum_{n=1}^{N} \sum_{m=1}^{C} \mu_{mn}^{l} ||i_n - v_m||^2 \quad \ldots (1)$$

Where, Nis the image pixel, is the center value of m-th cluster, presents the total number of image pixels and denotes total clusters. (l>1) controls the fuzziness of the result ant segmentation. The membership function sare accountable to the following constraints:

$$\sum_{m=1}^{C} \mu_{mn} = 1; 0 \leq \mu_{mn} \leq 1; \sum_{n=1}^{N} \mu_{mn} > 0 \quad \ldots (2)$$

The membership functions and the geometric centers can be updated in each iteration as follows:

$$\mu_{mn} = \frac{||i_n - v_m||^{-2/(l-1)}}{\sum_{k=1}^{C} ||i_n - v_k||^{-2/(l-1)}} \quad \ldots (3)$$

$$v_i = \frac{\sum_{n=1}^{N} \mu_{mn}^{l} i_n}{\sum_{n=1}^{N} \mu_{mn}^{l}}$$

In order to incorporate the spatial information in to the fuzzy clustering technique, Chuang et al. [14] proposed the following fuzzy membership functions:

$$\mu'_{mn} = \frac{\mu_{mn}^{p} h_{mn}^{p}}{\sum_{k=1}^{C} \mu_{kn}^{p} h_{kn}^{p}} \quad \ldots (4)$$

Where p and q control the respective contributions and the variable h_{mn} includes the spatial information.

V. RESULTS AND DISCUSSION

1. Algorithm and Results

Figure (2) show the general algorithm of present study.

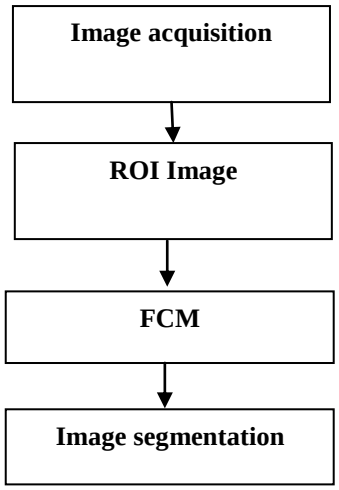
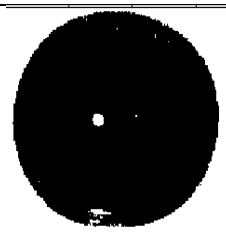
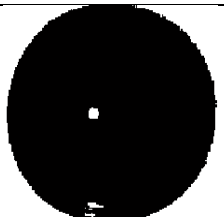
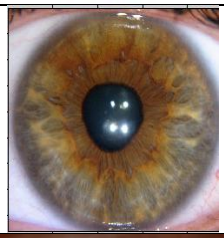
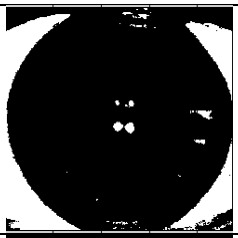
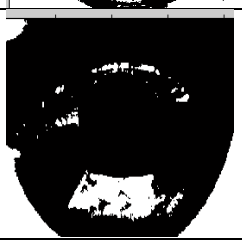


Figure (2) Algorithm scheme illustrates the current study

Figure (3) show the results of FCM application with the images samples of irises human eye.

No.	Original image	FCM1	FCM2	FCM3
1.				
2.				
3.				

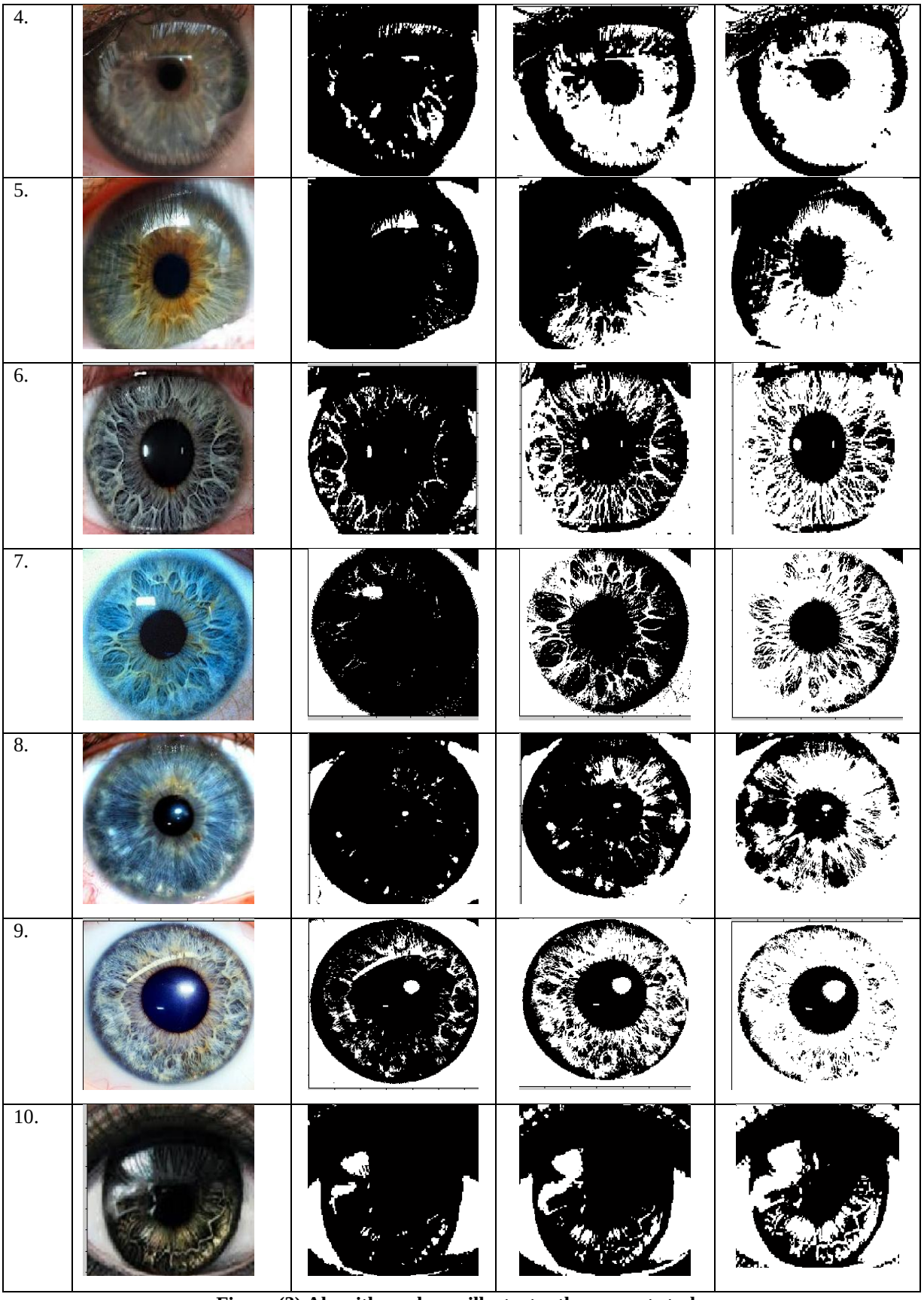


Figure (3) Algorithm scheme illustrates the current study

Table (2) shows the Results of the application of FCM segmentational gorithm with (25) images representing the irises. Our FCM algorithm was implemented in MATLAB.

Table (2)

No. image	FCM1		FCM2		FCM3	
	Iteration count	obj. fcn	Iteration count	obj. fcn	Iteration count	obj. fcn
1.	**1**	**2937.982714**	**12**	**414.274014**	**25**	**412.490762**
2.	**1**	**11791.860070**	**16**	**2999.116295**	**33**	**2993.763293**
3.	**1**	**1208.573425**	**20**	**372.052345**	**41**	**371.983357**
4.	**1**	**751.624070**	**20**	**228.584372**	**41**	**228.425655**
5.	**1**	**3405.280719**	**11**	**775.337023**	**23**	**773.764884**
6.	**1**	**4383.128560**	**17**	**1074.919033**	**34**	**1074.792780**
7.	**1**	**1153.563214**	**15**	**487.215489**	**30**	**391.254801**
8.	**1**	**5672.197708**	**15**	**1227.396679**	**31**	**1227.121581**
9.	**1**	**9402.423147**	**21**	**2350.188146**	**42**	**2349.677084**
10.	**1**	**3283.185220**	**17**	**2190.148270**	**34**	**2004.185220**

The outputs of segmentation and classifies ofimages with one representing weed stem and zerorepresenting other objects. Performances of the classifierswere evaluated using the misclassification rate (MCR). The MCR is defined as the ratio between thenumber of non-stem pixels misclassified as stem pixels andthe total number of non-stem pixels in the image. [15]

To measure the segmentation accuracy, we also apply the quantitative evaluation of performance by defining the misclassification ratio (MCR), which isgiven by:[15]

$$MCR = \frac{\text{number of misclassfe d pixels}}{\text{total number of pixels}}$$

Table (3) shows the value of MCR of FCM level for images.

Table (3)

No. image	FCM1	FCM2	FCM3
1.	28.25%	10.01%	6.11%
2.	21.35%	9.21%	6.45%
3.	19.78%	11.74%	4.86%
4.	19.56%	12.89%	5.03%
5.	27.45%	10.23%	4.89%
6.	28.01%	9.41%	6.01%
7.	28.30%	9.11%	5.79%
8.	36.25%	12.78%	4.89%
9.	30.56%	11.54%	4.23%
10.	17.78%	10.89%	4.78%

VI. CONCLUSIONS

In this paper, the fuzzy C-means technique applied to segmentation of iris image, given good results with level increases.

From the results show the process, the color of iris has a clear impact in the process of segmentation. Blue color of iris shows a clearer segmentation of other colors.

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