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COLOR IMAGE SEGMENTATION TECHNIQUE USING COOPERATIVE BACTERIAL FORAGING ALGORITHM.

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ABSTRACT:

Image segmentation is a crucial and challenging problem in image processing and often a basic step for high level analysis. The intent of image segmentation is to divide an image into different classes based on features, such as color, intensity or histogram, where each pixel in the image should go to one class and only one class. According to the thresholds the segmented results whether or not consistent to the image is also an issue should be considered.Here wepropose a new method for color image segmentation using multilevel thresholding. This paper proposes multilevel thresholding for color image segmentation using Cooperative Bacterial Foraging Algorithm (CBFA), which mixedcell-to-cell communication, bacterial chemo taxis, and an adaptive foraging mechanism to enhance original Bacterial Foraging Algorithm (BFA) which is motivated by the social foraging behavior of Escherichia coli(E. Coli Bacteria).

I.INTRODUCTION:

Image segmentation is a technique to divide an image into multiple segments and extract the meaningful objects, which is the difficult step in image processing and image analysis. The aim of dividing an image into different regionis to make an image more meaningful and easier to analyze and understand. Here and now image segmentation has been universally used in many practical applications such as medical imaging, remote sensing, Optical Character Recognition(OCR) and object detection.

The intention of segmentation is to clarify the image and change the representation of an image into something that is moreimportant, useful and easier to study or examine. Image segmentation is mostly used to detect objects and background in images. More precisely, image segmentation is the mechanism of assigning a label to each pixel in an image such that pixels with the same tag share certain visual characteristics. Image segmentation is an important signal processing tool that is universally occupied in many applications including medical imaging, remote sensing, Optical Character Recognition (OCR) and object detection.

The basic method of image segmentation is thresholding. From a grayscale image, thresholding can be used to generate binary images. The idea use in this method is to select the threshold value. Lots of conventional methods are used in engineering including the k-means clustering, Otsu's method that uses maximum entropy and maximum variancemethod. The main intent is that, the proposed segmentation can be work effectively for image, based on automatic thresholding and color model based image segmentation.Image segmentation is considered as an important basic operation for interpretation of acquired images and for meaningful study or analysis of the images. It is a classic inverse problem which consists of achieving a compact region-based description of the image scene by decomposing it into meaningful or spatially coherent regions sharing similar attributes.

One of the key problems in color image analysis is that of segmentation. Image segmentation is a technique and process which divide the image into different feature of region and extract out the interested target. Properties like intensity, texture, depth, gray-level, color help to recognize similar regions; such properties are usedto form groups of regions having a similar meaning. Segmentation is a valuable tool in several fields including industry, health care,pattern recognition, image processing, content based image, remote sensing, traffic image, videos and computer vision.After complete study of different methodshere we will projected the new thresholding mechanism. To achieve thresholding, global and local analysis, and assessment of the color image data will be explored. Main aim of our work is to develop a segmentation mechanism for color images based on multilevel thresholding. To accomplish the main goal of the work focus is on automatic thresholding by representing image into completely different color models [Yuan and Chen, 2009].

III.PROPOSED SYSTEM DESIGN

Here weproposecolor image segmentation technique using CBFA. Here we extend original Bacterial Foraging Algorithm (BFA)and invent Cooperative Bacterial Foraging Algorithm (CBFA) for the segmentation of an image, wecombined cell-to-cell communication,bacterial

chemo taxis, and an adaptive foraging mechanism. The suggested algorithm can take less CPU processing time, gives us superior quality more convenient segmentation, which is proved by comparing CBFA with other algorithm. In this paper, the innovative Cooperative Bacterial ForagingAlgorithm is applied to find the optimal thresholdvalues by applying two manipulated steps, namely acell-to-cell communication and a self-adaptive foragingstrategy, which is extended by the classical BFA algorithm.

The proposed method which is proved that the Multi-levelthresholding method based on Cooperative Bacterial ForagingAlgorithm (CBFA) forcolor image segmentation is considered as an optimizationproblemcan execute faster than the othertraditional algorithmsand is more stable.

1. COLOR IMAGE SEGMENTATION STEPS:

A] THE CONVERSION OF COLOR SPACE:

Here RGB components of color image are converted to HSV vector. The conversion formula of RGB and HSV is shown in Eq. (1):

$$\begin{cases} S = 1 - \dfrac{3}{R+B+G}[\min(R,G,B)] \\ H = \cos^{-1}\left\{\dfrac{(R-G)+(R-B)}{2\sqrt{(R-G)^2+(R-B)(G-B)}}\right\} \\ R \neq B \text{ or } R \neq G, \text{if } B > G, \quad H = (2\pi - H) \\ V = \dfrac{R+B+G}{3} \end{cases} \quad (1)$$

B] MULTILEVEL THRESHOLDING FOR IMAGE SEGMENTATION:

We get three separate vectors of HSV for solving the problem for multilevel thresholdvaluesand then apply CBFA (Cooperative bacterial foraging algorithm) to each vector to get the corresponding segmentation image at the three vectors.Combine the three vector results, and then get the final segmentation image.

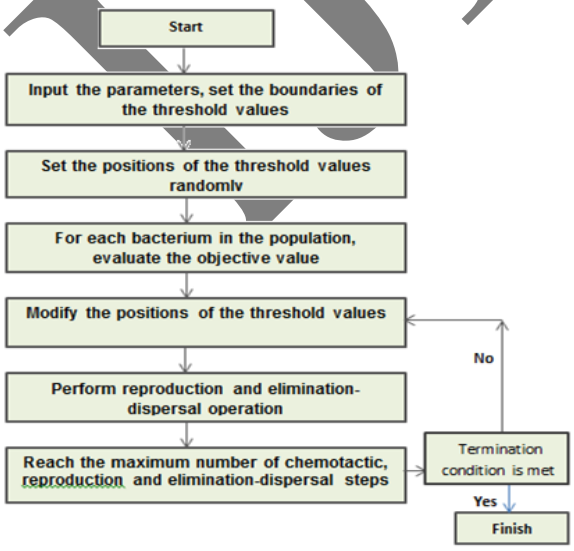

Fig: Flow Chart for CBFA

FOUR MAIN STEPS IN CBFA:

- **CHEMOTAXIS:**

  This procedure reenacts the development of an E.coli cell (Bacteria) through swimming and tumbling by means of flagella. Naturally an E.coli bacterium can move in two diverse ways. It can swim for a timeframe in a similar heading(direction) or it might tumble (by and large unique bearing), and exchange between these two methods of operation for the whole lifetime[10].

- **SWARMING:**

  It is always wanted that the bacterium that has searched the most advantageous path of food should try to attract other bacteria so they reach the desired place more quickly.Swarming makes the bacteria bunch up into groups and hence move as a concentric pattern of groups with high bacterial density [10].

- **REPRODUCTION:**

  The least healthy bacteria eventually die while each of the healthier bacteria (thoseyielding lower value of the objective function) asexually divided into 2 bacteria, which are thenplaced in the same location. This keeps the swarm size as it is[10].

- **ELIMINATION/ DISPERSAL:**

  Quick changes in the local environment where a bacterium community lives may occur due to various reasons e.g. a significant local rise of temperature may kill a group of bacteria that are currently in a region with a high concentration of nutrient gradients. Events can take place in such a fashion that all the bacteria in a region are killedor a collection is dispersed into a brand new location [10].

We are testedthe performance ofthe proposed algorithmwith different standardtest images and compared the result with traditional Bacterial ForgingAlgorithm.According to results the Cooperative Bacterial ForagingAlgorithm is better than the other algorithms, not only in termsof solution quality, but also in terms computational efficiencyandstability, especially when the image segmentation of themulti-level is processed, the inventedtechnique for imagesegmentation based on the Cooperative Bacterial ForagingAlgorithm (CBFA)gives usimproved performance to find the superiorthresholds in less CPU processing timewith more stability.

Fig: BFA ofLighthouse, (a) Original (b)(c)(d) The result of segmentation with 2, 3, 4thresholds.

Fig:CBFAofLighthouse, (a) Original (b)(c)(d) The result of segmentation with 2, 3, 4 thresholds.

Fig: BFA ofTulips, (a) Original (b)(c)(d) The result of segmentation with 2, 3, 4 thresholds.

Fig: CBFA ofTulips, (a) Original (b)(c)(d) The result of segmentation with 2, 3, 4 thresholds.

Standard deviation and CPU Processing Time:

In statistic, the standard deviation(STD, also represented by the Greek letter sigma **σ**) is a measure that is used to quantify the amount of variation or dispersion of a set of data values. A low standard deviation indicates that the data points tend to be close to the mean (also called the expected value) of the set, while a high standard deviation indicates that the data points are spread out over a wider range of values.We are going compare BFA and CBFA according to STD(Standard Deviation) and CPU Processing Time. According to results CBFA is more stable than BFA because CBFA has less STD (Standard Deviation) values. Also it required less CPU processing time for image to find multi-level thresholds in comparison to the (Bacterial Foraging Algorithm) BFA.

The given image contains multiple features. The pixels of the image would be divided into n classes. In order to judge the stability of the algorithm, the standard deviation can be calculated by the STD, which is defined as:

$$STD=\sqrt{\sum_{i=1}^{n}\frac{(\sigma_i-\mu)^2}{N}}$$

Assuming$\sigma_i$as the best fitness value of the i[th] runs of thealgorithm, μ as the average value of $\sigma_i$and N as therepeated times of each algorithm

Table: STD OF DIFFERENT METHODS

Test image	Thresholds	STD of BFA	STD of CBFA
Lighthouse	2	0.3676	0.3567
	3	0.3742	0.3424
	4	0.3269	0.3236
Tulips	2	0.3597	0.3580
	3	0.3479	0.3466
	4	0.3429	0.3369

Table: CPU PROCESS TIME OF DIFFERENT METHODS

Test image	Thresholds	Computational time of BFA	Computational time of CBFA
Lighthouse	2	2.7260	0.9365
	3	4.6353	3.5999
	4	9.1040	8.8013
Tulips	2	1.0519	0.9103
	3	3.9908	2.0551
	4	6.7200	5.6430

Our proposed system is more useful to solve the problem as compare to conventional Bacterial Foraging Algorithm such as BFA and this method is more suitable when the image segmentation of multilevel is under consideration, which can find the better thresholds in less CPU processing time with more stability.

IV.CONCLUSION

The thresholding method is universally used for the segmentation of images due to its accuracy, simplicity, and robustness. Efficiently selecting the optimal threshold to group pixels within meaningful regions is the key of the thresholding method.Here we propose a new color image segmentation technique, based Cooperative Bacterial Foraging Algorithm which aim to use maximum number of features of the same color image in order get a more valuable and accurate segmented effect.Here useful conversion of color spaces is done. Here we perform feature(RGB component) extraction and color space conversion to HSV. Then we make use of the CBFA algorithm which determine threshold automatically from the picture content and perform the segmentation. According to results CBFA is more stable than BFA because CBFA has less STD values. Also it required less CPU processing time for image to find multi-level thresholds in comparison to the BFA method.

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