Performance Evaluation of ACO based Metaheuristic Technique for Color Image Segmentation

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ABSTRACT

The aim of image segmentation is to make simpler presentation of an image into incredible which is meaningful as well as easy to understand. It is mainly utilized to know the location of objects, boundaries, lines etc in the digital images. Clustering technique is a method which shows the data set or pixels are replaced by cluster, pixels might be together because of the same color, texture etc. This paper represents the implementation of an ACO based metaheuristic for color image segmentation to differentiate the mixed regions.

Keywords

Image Processing, Image Segmentation Techniques, FELICM, Ant Colony Optimization.

1. INTRODUCTION

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 would be to simplify and/or change the representation of an image into something that's more meaningful and more straightforward to analyze. It forms a crucial preliminary step for subsequent object recognition and interpretation. Its goal would be to partition confirmed image into regions that have distinct objects. The most common kind of segmentation is on the basis of the assumption that distinct objects in an image have different and approximately constant colors.
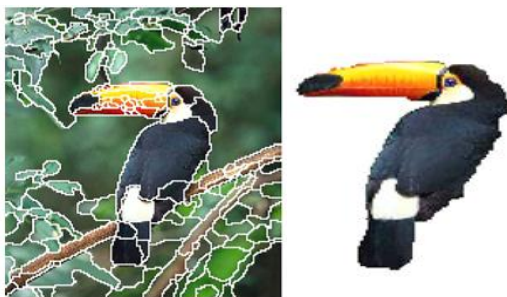

Fig: 1 (a)Mean Shift Segmentation (b) Segmentation Result

2. IMAGE SEGMENTATION TECHNIQUES

Based on different technologies, image segmentation approaches are currently divided into following categories, based on two properties of image.

2.1. Detecting Discontinuities

It means to partition an image based on abrupt changes in intensity [1], this includes image segmentation algorithms like edge detection.

2.2. Detecting Similarities

It means to partition an image into regions that are similar according to a set of predefined criterion [1]; this includes image segmentation algorithms like thresholding, region growing, region splitting and merging.

3. FELICM

Fuzzy C-Means that advantage and Local data is recognized as FELICM, it presents the pixels' weights inside local neighbor windows to reduce the edge degradation. This type of process can be utilized to conquer the isolated allocation of pixels with in sections of image.

3.1. Mean Shift

It's a way of clustering segmentation which is a non parametric iterative algorithm. It's applied during kernel thickness estimation. For every data point, mean transfer shows a window approximately as well as computes the mean of data point.

4. ANT COLONY OPTIMIZATION

This ACO algorithm is depending on meta-heuristic looking algorithm. This reflection is scrounging actions from ant varieties motivated and ant colony optimization approach improvement of random direct seek approach. Example, ants discover nearest course relating to the ant colony as well as a meals source by means of swapping specifics of your option that you should adopted. If the ants go through grub origin, they give secretions and incapacitated; such secretion chase can be applied near ants for convey collectively. Ant's probability would choose to adopt some sort of way relative to the amount from secretion. Applying straightforward responsive agencies permits the conversion through the natural for unreal auld like settlement. These factors interact personally through swapping data by means of surrounding alterations. It can be unreal pismire speak circuitously by means of unreal secretion chase. This offered near works on the particular list of ants acting forward to a picture determined through the local picture strength valuations edition. This kind of variance ensures a secretion matrix, while using like sizing picture, while in turn acts the particular boundary data and every picture place. Referable for big graphic sizing in order to cut calculation clip, the particular ant colony optimization approach depicted under was severally used upon non overlapping 128*128 graphic windows. Ant Colony Optimization is a loop approach.

5. RELATED WORK

Islam, Mohammed et al. [1] developed a method utilizing edge-based image segmentation methods for quality inspection that satisfies the professional requirements in pharmaceutical applications. The evaluation of an image with this might require complicated image processing techniques. Artan, Yusuf et al. [2] introduced a semi-supervised image segmentation method using machine learning techniques and super pixels. The proposed method yielded superior segmentation results over several semi-supervised methods including the popular random walker algorithm. Huilin, Gao et al. [3] presented a technique of CT image segmentation based on region growing method, and the application form of effective segmentation of the lung tissue to chest CT images. Weighed against any other segmentation methods, the outcome showed that the segmentation method that has been proposed in this paper does better in CT image segmentation. The outcomes obtained have the significance in clinical applications and auxiliary diagnosis. Ji, Hongwei [11] presented an auto-context model (ACM)-based automatic liver segmentation algorithm, which combined ACM, multiatlases and mean-shift techniques to segment liver from 3-D CT images. The proposed method evaluated on the datasets of MICCA liver segmentation challenge. Mohan, K. Raj, and G. Thirugnanam [12] proposed a dualistic sub-image histogram equalization based enhancement and segmentation techniques. The proposed method has been tested and evaluated on several medical images. Jabar, Farah HA et al. [13] aimed to segment the blood cell images of patients experiencing acute leukemia having an adaptive K-Means clustering along with mean shift algorithm. The integrated clustering techniques have produced comprehensive output images with minimal filtering process to remove the background scene.

6. GAPS IN LITERATURE

These are the gaps in existing research on image enhancement methods.

1. The effect of mixed regions on image segmentation has ignored in the most of the existing techniques.

2. The color images contains maximum information for efficient image segmentation but majority of researchers has ignored it during image segmentation

3. The use of the ant colony based edge detector has also ignored in the majority of existing research on image segmentation.
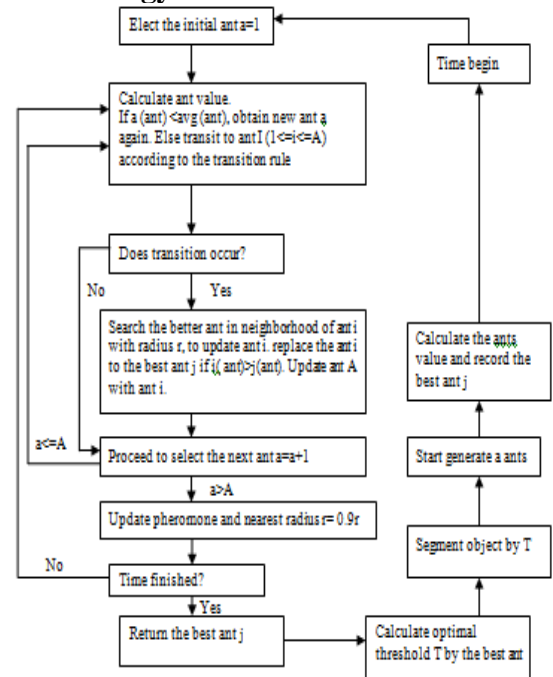
7. METHODOLOGY AND RESULTS
7.1. Methodology

Fig.2. Methodology used for purposed algorithm

7.2 Experimentation and results

For experimentation and implementation the proposed technique is evaluated using MATLAB tool u2013a. Here we will compare the Gray Stretch Based algorithm for image segmentation and Principal Component Analysis based gray stretch algorithm on the basis of various image quality evaluation parameters like BER. The existing methodology give good results in enhancing the image but it neglects certain regions in image such as mixed region and also effect of color is not taken into consideration. The proposed approach gives efficient results in improving the contrast of image and it uses Principal Component Analysis based on Grey Stretch Algorithm. The tabular and graphical comparison has been done between existing and proposed methodology on the basis of parameters like accuracy, normalized cross correlation, structural similarity index metric and bit error rate.

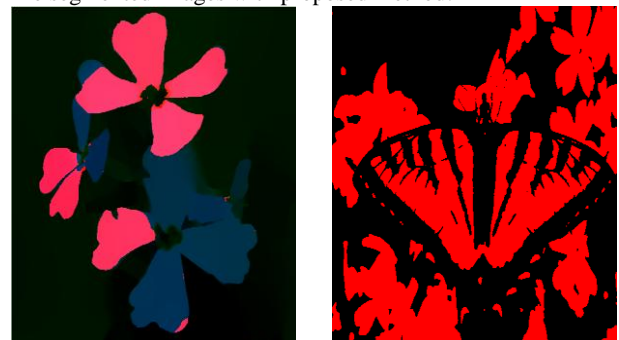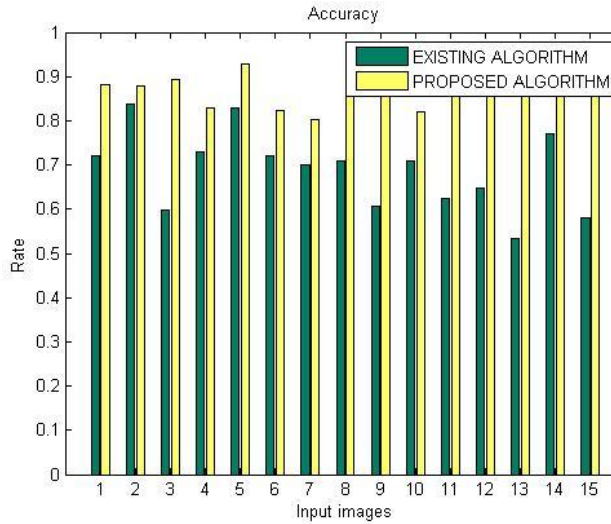The segmented images with proposed method:-

Fig 3: a) Image 1   b) Image 2

7.2.1. Accuracy

Accuracy for image 1 in proposed method is 0.7028 and 0.9791 for image 2.

Fig 4: Accuracy

Table 1 has shown the quantized analysis of the accuracy. The proposed algorithm is higher as compared to existing method.

Table 1 . Accuracy

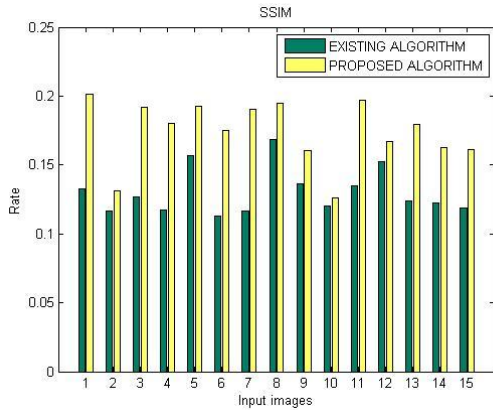| Image	Existing Results	Proposed Results
1	0.7222	0.8828
2	0.8389	0.7483
3	0.5971	0.8922
4	0.7300	0.8293
5	0.8297	0.9296
6	0.7220	0.7028
7	0.7000	0.8023
8	0.7105	0.9336
9	0.6077	0.8985
10	0.7092	0.8203
11	0.6245	0.9791
12	0.6471	0.9062
13	0.5343	0.8741
14	0.7710	0.9211
15	0.5799	0.9135

7.2.2. Normalized Cross Correlation-
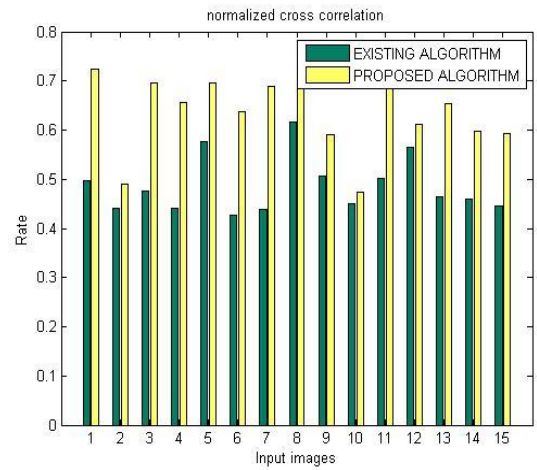
Fig 5: Normalized Cross Correlation

Table 2 has shown the quantized analysis of the normalized cross correlation. The proposed algorithm is higher as compared to existing method.

Table 2. Normalized Cross Correlation

Image	Existing Results	Proposed Results
1	0.4962	0.7245
2	0.4401	0.4895
3	0.4750	0.6951
4	0.4415	0.6563
5	0.5771	0.6955
6	0.4276	0.6382
7	0.4384	0.6889
8	0.6163	0.7040
9	0.5075	0.5906
10	0.4514	0.4736
11	0.5022	0.7108
12	0.5643	0.6112
13	0.4643	0.6544
14	0.4586	0.5976
15	0.4459	0.5924

### 7.2.3. Structural Similarity Index Metric –

Fig 6: Structural Similarity Index Metric

Table 3 has shown the quantized analysis of the SSIM. The proposed algorithm is higher as compared to existing method.

Table 3. Structural Similarity Index Metric

Image	Existing Results	Proposed Results
1	0.1329	0.2014
2	0.1169	0.1309
3	0.1268	0.1922
4	0.1173	0.1803
5	0.1565	0.1924
6	0.1133	0.1748
7	0.1164	0.1903
8	0.1682	0.1950
9	0.1361	0.1605
10	0.1201	0.1264
11	0.1346	0.1971
12	0.1527	0.1667
13	0.1237	0.1797
14	0.1221	0.1626
15	0.1185	0.1611

7.2.4. Bit Error Rate –
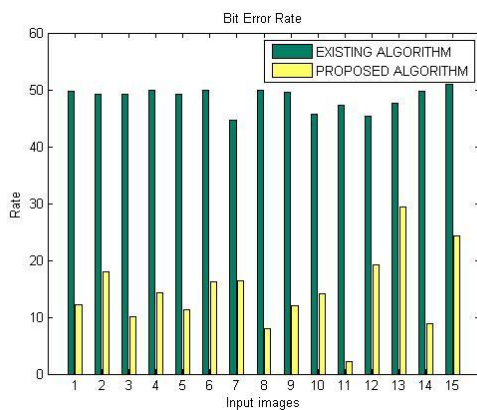
Fig 7: Bit Error Rate

Table 4 has shown the quantized analysis of the bit error rate. The proposed algorithm is higher as compared to existing method.

Table 4. Bit Error Rate

Image	Existing Results	Proposed Results
1	49.7894	12.2045
2	49.7365	18.0289
3	49.2240	10.0813
4	49.8897	14.2976
5	49.2089	11.3493
6	49.9795	16.3109
7	44.6594	16.3566
8	49.9135	8.0244
9	49.6193	11.9707
10	45.6523	14.0958
11	47.2365	2.2476
12	45.3514	19.1879
13	47.6506	29.4595
14	49.8232	8.8461
15	50.9227	24.2136

8. CONCLUSION

This paper represents the performance of ant colony based edge detector to differentiate the mixed regions i.e. proposed technique as well shows the Fuzzy C-Means with Edge and Local Information (FELICM), existing technique which introduces the pixels' weights within local neighbor windows to decrease the edge degradation. This approach has somehow used to overcome the isolated distribution of pixels inside segments of image and the comparison between the techniques i.e. proposed results has shown significant improvement. The implemented an ACO based metaheuristic for color image segmentation is done using parameters like accuracy, normalized cross correlation, structural similarity index metric and bit error rate. In the near future more evolutionary optimizations techniques will be used for color images for further enhancement.

9. REFERENCES

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