Improved Color Image Segmentation Using Fuzzy Weighting And Edge Preservation

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Abstract:-This paper has proposed a new EPS and FELICM approach to improve the accuracy of the color segmentation procedure further. The motivation behind the proposed approach is simple and effective. If segmented area between the FELICM and Principle component analysis is same then it will be added into the final output image. If the segmented area is not same then according to the variance based theory the minimum variance among two segmented outputs will be selected. After this procedure color labeling will be done to color the segmented area in given image. The comparative analysis has shown the significant improvement of the proposed technique over the available one.

Index Terms: *Color Segmentation, EPS, FELICM, FUZZY.*

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1. OVERVIEW

Image segmentation plays an important role in image analysis and computer vision. The goal of image segmentation is partitioning of an image into a set of disjoint regions with uniform and homogeneous attributes such as intensity, color, tone etc. The main goal of image segmentation is to cluster of pixels in the relevant regions. [1]

Clustering is a popular unsupervised classification method and has found many applications in pattern classification and image segmentation. Clustering aims to organize data into groups called clusters, such that data within a cluster are more similar to each other than they are to data in other clusters. [9] Clustering is one such exploratory tool for deducing the nature of the data by providing labels to individual objects that describe how the data separate into groups. Clustering has also been shown to improve the performance of other algorithms or systems by separating the problem-domain into manageable sub-groups a different algorithm or system is tuned to each cluster. [2]

2. SEGMENTATION TECHNIQUES

2.1 Fuzzy segmentation: The Fuzzy C- means is the most widely used algorithm in image segmentation because it has robust characteristics for ambiguity and it can maintain much more information than hard segmentation methods. [9]. The Fuzzy C- means (FCM), algorithm, proposed by Bezdek, is the most widely used algorithm in image segmentation because it has robust characteristics for ambiguity and it can retain much more information than hard segmentation methods. Fuzzy logic is conceptually easy to understand and is flexible. The advantage of Fuzzy systems is that they are easy to understand, because the membership functions partition the data space properly [4]. It incorporates the information about spatial context in a novel fuzzy way for the purpose of enhancing the changed information and of reducing the effect of speckle noise [5] [7].

2.2 Watershed Segmentation: Watershed algorithm is a method drawing on the side of mathematical morphology for image segmentation, due to its fast calculation speed and accurate closed positioning of the contour and so is attracting attention from the topography of its basic idea, image as natural landscape is covered by water, pixel gray value indicates altitude, a local minimum value and the area affected are known as the catchment basins, and the border is known as a watershed [8]. Watershed transformation is an effective means of image segmentation; image analysis has been widely used in the field [10]. It treats a grayscale image as a 3D topography surface, starts the region growing from the surface minima detected by image gradient [6].

2.3 Threshold Segmentation: Thresholding is a simple shape extraction technique. Global threshold segmentation just defined one threshold to segment the whole image. This algorithm had a marked result on the image with significant difference between the background and ROI in gray value. The dynamic threshold segmentation algorithm divides the image into multiple regions and sets the appropriate threshold for each region to segment image [3] [11].

2.4 Region Based Segmentation: Region-based segmentation is use to image characteristics to map individual pixels in an input image to sets of pixels called regions that may correspond to an object or a meaningful part of one. The objective of region-based method is a group of pixels with similar properties to form a region. The various techniques are: Local techniques, Global techniques and Splitting and merging techniques. Region splitting and merging techniques starts with splitting an image into small regions and continued

till regions with required degree of homogeneity becomes produced. [12]

3. PROPOSED ALGORITHM

3.1 Problem definition

The survey has shown that the most of the existing techniques have focused on the complex regions. Therefore not much work has been done for the images with mixed regions. The effect of the regions on the segmentation has been neglected by many researchers. The effect of the color on the segmentation results has also been neglected by many researchers.

3.2 Proposed algorithm

The proposed method of image segmentation process is described following steps provided below.

Step 1: We have used an RGB image as input color image. The original image is extracted into individual red (R), green (G), and blue (B) color channels.

Step 2: The EPS is applied on the RGB image to smoothes missing information as holding the sharp edges and successfully remove noise without blurring inter-region edges in the image.

Step 3: Now apply Rgb2hsv transforms colors from RGB space (red/green/blue) into HSV space (hue/saturation/value).Value (brightness) gives the amount of light in the color; hue describes the dominant wavelength and Saturation is the amount of Hue mixed into the color.

Step 4: PCA is applied on all the blocks of the HSV image and the data set is reduced. It is useful for the compression and classification of data.

Step 5: Apply variance based integration on segmented outputs by PCA and FEILCM.

$If\ seg_{img\,1}.object(i*i) == seg_{img\,2}.object(i*i)$

$add\ to\ the\ output\ O(x,y)$

$else$

$If\ VAR(seg_{img\,1}.object(i*i)) >$

$= VAR(seg_{img\,2}.object(i*i))$

$add\ seg_{img\,2}\ the\ output\ O(x,y)$

$else$

$add\ seg_{img\,1}\ the\ output\ O(x,y)$

End

End

Step 6: In edge pixel processing, calculate the average value of the HSV image is formed by the PCA and FEILCM.

Step 7: Finally applied the color labeling on the HSV image plane to color the segment image.

4. EXPERIMENTAL DATA

These are some following images which helps to compare the results of proposed algorithm with existing approch.

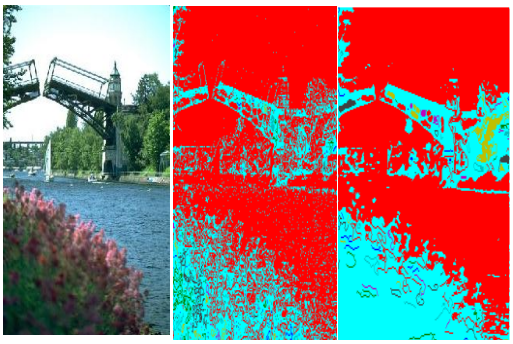

Fig-4.1 (a) Original image (b) Result of existing approach (c) Result of Proposed method

This Figure shows better human visibility of original image by using proposed algorithm as compared to previous technique and provides better visibility results with improved smoothness.

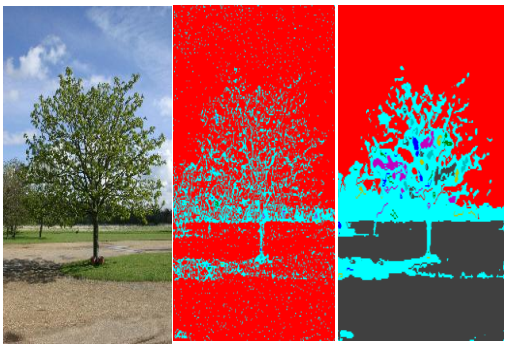

Fig-4.2 (a) Original image (b) Result of existing approach (c) Result of Proposed method

This Figure shows better human visibility of original image by using proposed algorithm as compared to previous technique. This method can efficiently enhance the overall quality and visibility of local details.

5. PERFORMANCE EVALUATION

This section contains the cross confirmation between base paper and Proposed techniques. Some well-known image performance metrics for digital images have been selected to prove that the performance of the proposed method is quite better than the other methods.

5.1 MSE Analysis:

The mean square error is the cumulative squared error between the compressed and the original image.A lower value for MSE means less error.

Table-5.1 illustrates the evaluatation of existing and proposed methods. By using proposed algorithm, the results of MSE

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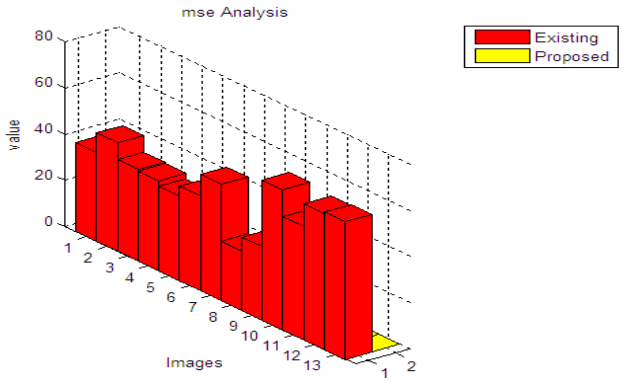
becomes lower than previous results. So the main goal as mean square error is less in every case.

Table-5.1: Mean Square Error Evaluation

Images	Existing	Proposed
1	38.5153	0.0853
2	46.9401	0.0988
3	39.6273	0.1315
4	38.9478	0.1226
5	36.5078	0.1036
6	40.7366	0.0747
7	50.1306	0.0900
8	25.5319	0.0571
9	31.6851	0.1313
10	60.4337	0.0468
11	48.7385	0.1254
12	58.7723	0.0644
13	59.3384	0.0137

The following graph represents the information of mean square error and evaluates it within two statements. Red bar reveal the existing method and Yellow bar define the proposed method which are improved as compared to earlier ones. This decrease represents improvement in the objective quality of the image.



Graph-5.1: MSE of previous results and proposed results for different images

5.2 PSNR Analysis:

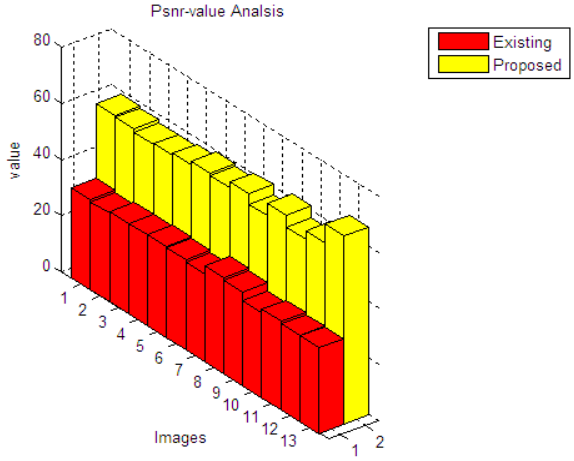
Peak signal to noise ratio is defined as a term for the ratio between the maximum possible power of a signal and the power of corrupting noise that affects the fidelity of its representation, due to its dynamically property. It is an approximation to human perception of reconstruction quality.

Table-5.2 shows the comparison of Peak signal to noise ratio between existing and proposed method. By using proposed algorithm the value of PSNR becomes higher as compared to previous results.

Table-5.2: Peak Signal to Noise Ratio Evaluation

Images	Existing	Proposed
1	32.3085	58.8542
2	31.4494	58.2169
3	32.1849	56.9745
4	32.2600	57.2804
5	32.0649	59.4326
6	32.5409	58.0118
7	31.1638	58.6233
8	34.0940	60.6016
9	33.1563	56.9826
10	30.3520	61.4620
11	31.2861	57.1819
12	30.4731	60.0759
13	30.4314	66.7858

The following graph shows the representation of PSNR value analysis between previous and proposed techniques. Red bar reveal the existing method and Yellow bar define the proposed method which are better as compared to previous ones.



Graph-5.2: PSNR of previous results and proposed results for different images

5.3 RMSE Analysis:

The root mean square error is a frequently used measure of the difference between predicted value and observed values.

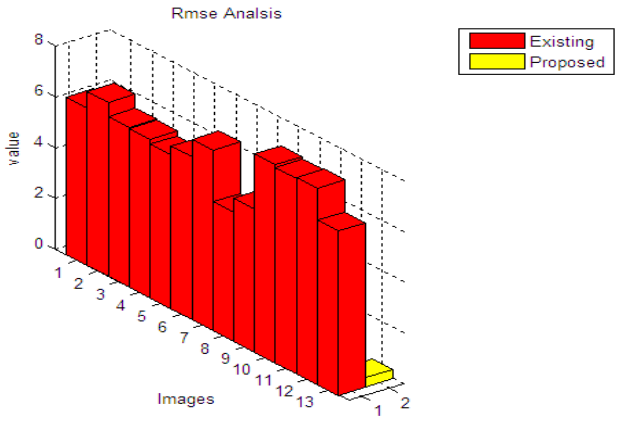
Table-5.3 shows the comparison of Root mean square error between existing and proposed method. By using proposed algorithm the value of RMSE becomes lower as compared to previous results.

Table-5.3 shows the comparison of Root mean square error between existing and proposed method. By using proposed algorithm the value of PSNR becomes higher as compared to previous results.

Table-5.3: Root Mean Square Error Evaluation

Images	Existing	Proposed
1	6.2061	0.2921
2	6.8513	0.3143
3	6.2950	0.3627
4	6.2408	0.3501
5	6.0422	0.3218
6	6.3825	0.2733
7	7.0803	0.3000
8	5.0529	0.2389
9	5.6289	0.3623
10	7.7739	0.2163
11	7.6663	0.2538
12	7.7031	0.1172
13	6.4495	0.3603

The following graph demonstrates the representation of RMSE value analysis between previous and proposed techniques. Red bar reveal the existing method and Yellow bar define the proposed method which are superior as compared to previous ones.



Graph-5.3: RMSE of previous results and proposed results for different images

4. Entropy Analysis:

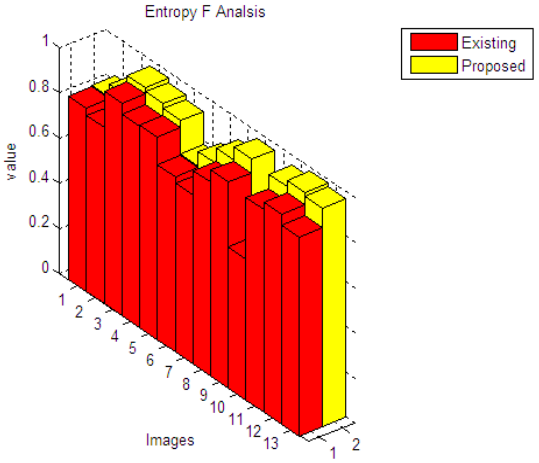
Entropy is a measure of the efficiency of a particular data items.

Table-5.4 shows the comparison of Entropy analysis between existing and proposed method. By using proposed algorithm the value of Entropy becomes higher as compared to previous results.

Table-5.4: Entropy Analysis Evaluation

Images	Existing	Proposed
1	0.8115	0.8215
2	0.7782	0.8769
3	0.9390	0.9684
4	0.8917	0.9489
5	0.8963	0.9275
6	0.7749	0.7818
7	0.7442	0.8414
8	0.8546	0.9110
9	0.9087	0.9700
10	0.8913	0.9559
11	0.8774	0.9647
12	0.9274	0.9829
13	0.7407	0.8024

The following graph shows the representation of entropy value analysis between previous and proposed techniques. Red bar reveal the existing method and Yellow bar define the proposed method which are advanced as compared to prior ones.



Graph-5.3: Entropy of previous results and proposed results for different images

6. CONCLUSION

Clustering based methods are a procedure in which a image or say pixels are converted into clusters may belong together because of the same color, texture etc. The review has shown that the earlier methods have intensive on the composite regions. Therefore not much work has been done for the pictures with blended locales. The impacts of the districts on the division have been ignored by numerous analysts. The impact of the color on the division results has additionally been dismissed. This paper has proposed a new EPS and FELICM approach to improve the accuracy of the color segmentation procedure further. The motivation behind the proposed approach is simple and effective. If segmented area between the FELICM and Principle component analysis is same then it will be added into the final output image. If the segmented area is not same then according to the variance based theory the minimum variance among two segmented outputs will be selected. After this procedure color labeling will be done to color the segmented area in given image. The proposed technique has been designed and implements using MATLAB toolbox. The comparative analysis has shown the

significant improvement of the proposed technique over the available one.

This work has not considered the use of adaptive thresholdoing to segment the given image. Therefore in near future we will try to find adaptive thresholding using evolutionary optimization.

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