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PERFORMANCE EVALUATION OF IMPROVED IMAGE SEGMENTATION USING FUZZY BASED MODIFIED MEAN SHIFT AND MST

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Abstract

The quantity of segmentation is serious in supreme errands challenging image analysis. The attainment or disappointment of the assignment is often a straight implication of the attainment or else disappointment of division. However, a dependable besides exact division of an image remains definite hard to achieve through decorously instinctive properties. Segmentation is generally the major stage in some determination to inspect an image regularly. All segmentation methods consume its particular aids and confines. No method is finest for all kind of images, certain methods are finest appropriate aimed at low concentration images, certain remain finest aimed at composite contextual images. The modified mean shift and minimum spanning tree based segmentation agonizes since numerous issues. Specifically this method is not well appropriate for composite contextual images. Consequently in directive toward decrease this subject, this paper has focused on unsupervised object based image segmentation, using a fuzzy based modified mean shift (MS) and a minimum spanning tree (MST) based clustering method of remotely sensed satellite images and at last performance is evaluated using various parameters.

Keywords: Image segmentation, PSNR, MSE, Accuracy, Efficiency

1. INTRODUCTION

An image remnants not impartial an arbitrary gathering of pixels, it remains an evocative preparation of areas and substances. Bell Labs and University of Maryland, also rare new places on-going towards grow numerous methods for digital image processing [1]. In digital image processing, they usage computer procedures toward accomplish image processing. Really digital image processing consumes numerous compensations above the analog image processing, mainly it offers a great amount of procedures towards remain castoff with the contribution facts, another we can evade certain processing difficulties like generating noise then signal distortion during signal processing. The purpose of image segmentation is to group pixels of an image addicted to image sections. Image segmentation is a central however quiet stimulating problem in computer visualization and image dispensation. In specific, it remains a vital method for several uses such as object recognition, target tracking, content-based image recovery and medical image processing, etc. [2]. Normally, the objective of image segmentation is towards divider an image hooked on a definite amount of portions which contains several features like (color, texture, etc.) and now for the moment to assembly the expressive parts composed for the suitability of perceiving. The consequence of image segmentation is a usual of sections that jointly cover the whole image. Edge detection is some of the supreme commonly castoff methods in digital image processing. Segmentation aims at dividing pixels into similar region. Fuzzy segmentation in go splits pixels addicted to fuzzy sets means every pixel might fit somewhat to numerous groups and sections of image.

2. LITERATURE SURVEY

Aly, et al. [2011] [1] has discussed the evaluation of the diverse approaches for segmentation methods. The discussion is valuable aimed at defining the suitable usage of the image segmentation methods then for refining their accuracy and performance besides too aimed at the key impartial, which planning novel procedures. Peng, et al. [2011] [2] has discussed the automatic image segmentation problem in a region merging style. With a primarily over-segmented image, in which the several sections through similar color remain noticed, image segmentation is achieved through iteratively integration the sections rendering to a numerical check. Around two vital subjects in a section merging procedure: instruction of merging and the preventing measure. In the proposed algorithm, these two issues are solved by a novel predicate. Senthilkumaran, et al. [2009] [3] has discussed the key goal is toward analysis the concept of edge detection aimed at image segmentation by soft computing method established on the Fuzzy logic, Genetic Algorithm and Neural Network. Hong, et al. [2009] [4] has discussed an overall knowledge technique by way of an outline aimed at automatically originating membership purposes and fuzzy if-then rules since a set of assumed training instances toward quickly form a model fuzzy expert arrangement. Janakiraman, et al. [2007] [5] has discussed image segmentation based on minimal spanning tree and

cycles. A new graph notional method aimed at image segmentation remains offered here. Projected process remains capable toward find almost appropriate section limitations of groups then remains appropriate to some image field. Haxhimusa, et al. [2005] [6] has discussed evaluating Minimum Spanning Tree Based Segmentation Algorithms. This was done using gray value images and consequence displays that the segmentation consequences of these approaches have a substantial alteration. Agarwal, et al. [2005] [7] has disussed Modeling Fuzzy rules with description logics also display in what way fuzzy membership purposes besides fuzzy rules can be demonstrated through means of suitable explanation reason then in what way this can be working on behalf of request replying. Malik, et al. [2001] [8] has discussed a procedure aimed at dividing gray-scale images into separate sections of intelligible illumination and texture. Natural images comprise together surfaced and un-textured sections, consequently the signs of outline and surface alterations are abused concurrently. Alcalá, et al. [1999] [9] has discussed techniques for learning and tuning fuzzy rule-based systems for linguistic modeling and their application. Mallinson, et al. [1999] [10] has discussed fuzzy rules for pattern classification also defines the usage of a hybrid fuzzy-genetic programming scheme toward determine designs in great catalogues. This is done through developing a sequence of flexible size fuzzy rules which simplify since an exercise set of categorized modules.

3 PROPOSED WORK

After reviewing various documents we have find that the modified mean shift and minimum spanning tree based segmentation suffers from various issues. Especially this approach is not well suitable for complex background images. And the integration of fuzzy with modified mean shift is also ignored in the literature. So to overcome this problem we follow the proposed method.

The following steps are involved in the proposed methodology:

Step 1: firstly take multispectral image as an input image.

Step2: Then apply modified mean shift based segmentation algorithm on the original image to segment an image into spectral domain.

For n data points xi, i=1,…, n in the D-dimensional space

$$m_h G(x) = \frac{\sum_{i=1}^{n} x_i g(\|\frac{x-x_i}{h}\|^2)}{\sum_{i=1}^{n} g(\|\frac{x-x_i}{h}\|^2)} - x$$

Here G(x) is the kernel (window), x is the center of the window and h is the bandwidth parameter .So, the MS remains the variance among the weighted mean, by kernel G as per the weights and x as the center of the kernel (window).

Step3: After that fuzzy c means based segmentation algorithm is applied on the segmented image and extract the features from the image.

$$J_{FCM} = \sum_{k=1}^{n} \sum_{i=1}^{c} (v_{ik}) q \, d^2(x_k, v_i)$$

Here x={x1, x2, x3,…….,xn}⊆ R; dataset
N is the number of data items
C is the number of clusters
v_{ik} is the degree of membership of x_k in ith cluster
Q is the weighting exponent of each fuzzy member
v_i is the prototype of center cluster i
$d^2(x_k, v_i)$ is the distance between x_k and cluster v_i.

Step 4: Then Minimum Spanning tree algorithm based on the segmentation is applied on the segmented image.

$$w(x_i, x_j) = 1 - exp\left(-\frac{\|x_i - x_j\|^2}{2\sigma^2}\right)$$

In this x_i, x_j are nodes and w represents the weight between x_i, x_j

If data points are similar in nature then the value of the w will decreased otherwise the value of the w will increase.

Step 5: then at last final proposed segmented image is obtained.

4 RESULTS & DISCUSSIONS

In this section we apply different algorithms on the images and get the results of the algorithms.

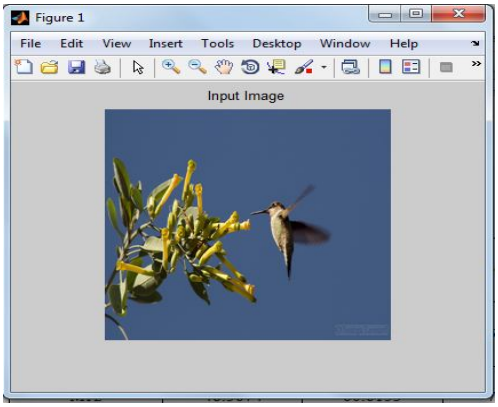

Figure 1 INPUT IMAGE [IMG1]

Figure 1 is the input image on which we apply different segmentation algorithms like mean shift based algorithm, fuzzy c means algorithm and proposed algorithm and get the results in the form of segmented images.

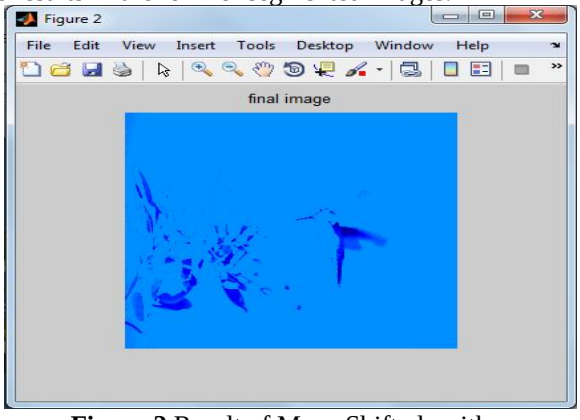

Figure 2 Result of Mean Shift algorithm

Figure 2 is the result obtained from figure 1 when we apply mean shift based segmentation algorithm.

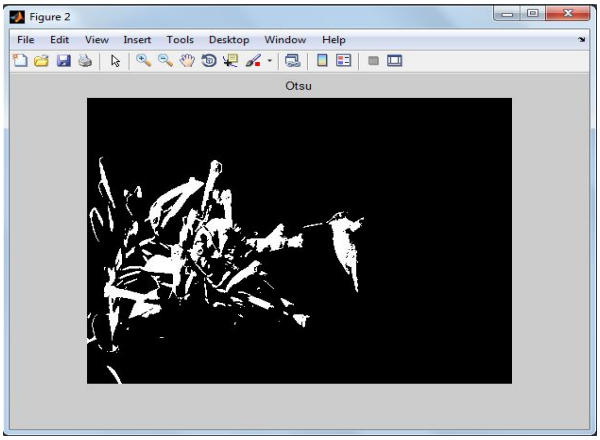

Figure 3 OTSU Image

Figure 3 represents the OTSU image which is obtained when we apply fuzzy c means segmentation algorithm on the input image or figure 1.

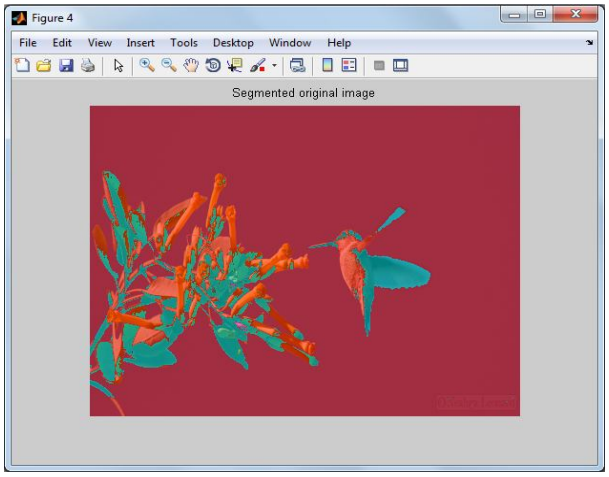

Figure 4 fuzzy segmented image

After obtaining figure 3 otsu image. Fuzzy segmented is obtained when we apply fuzzy c means algorithm.

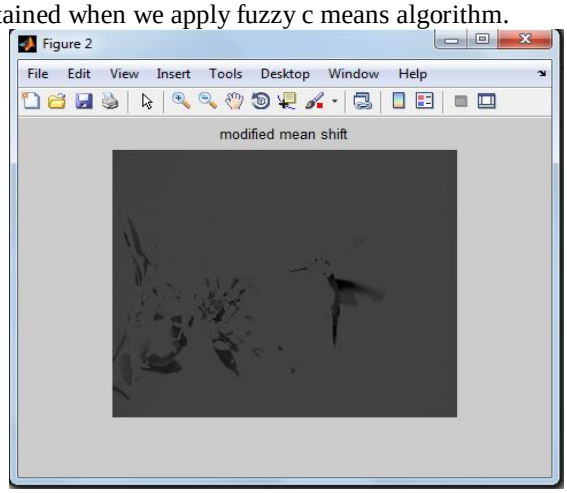

Figure 5 Result of Modified Mean Shift algorithm

Figure5 represents the segmented image which is obtained when modified mean shift algorithm is applied on the original image which acts as an input image for the fuzzy segmented algorithm.

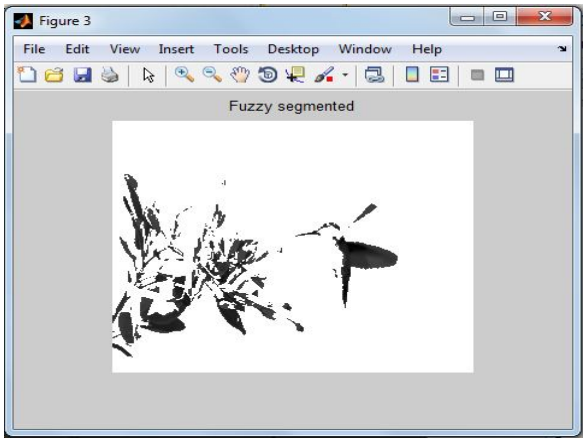

Figure 6 Result of fuzzy c means algorithm

Figure 6 is obtained after applying fuzzy c means algorithm on the segmented image obtained from modified mean shift algorithm.

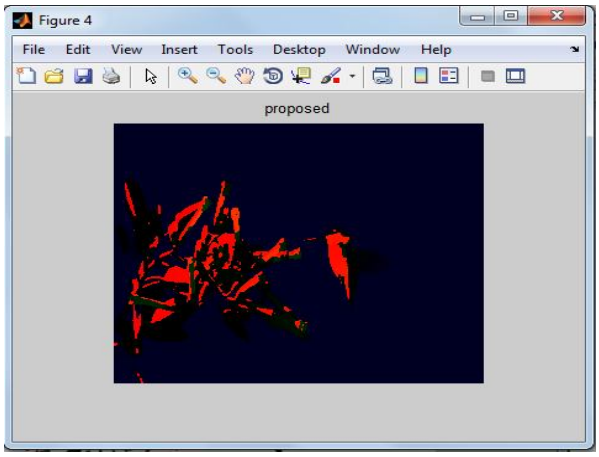

Figure 7 Result of MST algorithm

Figure 7 is the proposed image when minimum spanning tree algorithm is applied on the fuzzy segmented image which covers the whole features of the image.

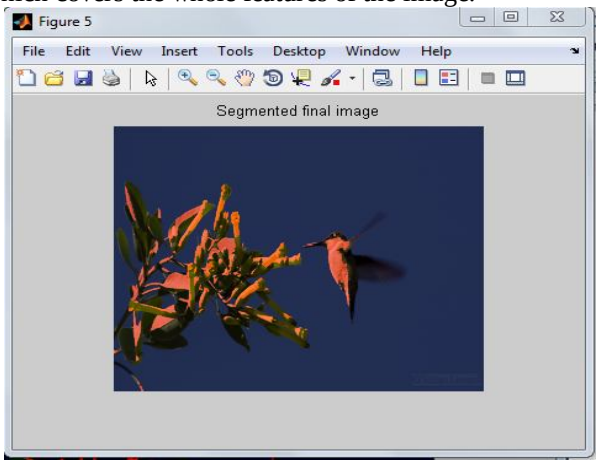

Figure 8 Final Segmented Image

Figure 8 is the final segmented image which represents the effects of segmentation on the original image.

5 PERFORMANCE EVALUATION

Table 1: MSE Analysis

IMAGE	MEAN SHIFT	FCM	PROPOSED
IMG1	0.0194	0.0119	0.002048
IMG2	0.1126	0.0069	0.000519
IMG3	0.0910	0.0280	0.024140
IMG4	0.1609	0.0917	0.058674

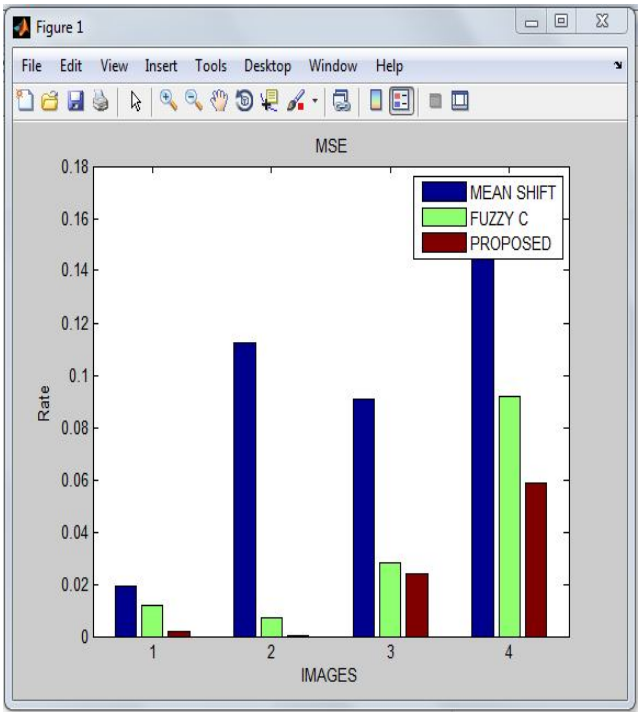

Figure 9 MSE Analysis

Table1 and figure 9 represents the comparison between mean shift algorithm, fuzzy c means algorithm and proposed algorithm on the basis of Mean Squared Analysis (MSE).

Table 2: PSNR Analysis

IMAGE	MEAN SHIFT	FCM	PROPOSED
IMG1	56.6996	58.5448	65.1895
IMG2	50.0734	60.6153	70.3699
IMG3	50.8787	55.3195	55.8827
IMG4	48.7266	50.8490	52.5325

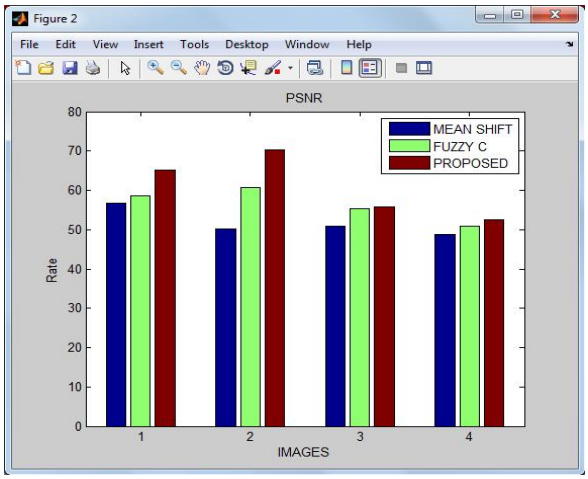

Figure 10 PSNR analysis

Table 2 and figure 10 shows the comparison between three algorithms by using PSNR parameter and the result shows that proposed algorithm gives more accurate results next fcm and at last mean shift algorithms because proposed algorithm attains highest values for PSNR parameter.

Table 3: Accuracy analysis

IMAGE	MEAN SHIFT	FCM	PROPOSED
IMG1	0.9417	0.9594	0.9993
IMG2	0.7826	0.9406	0.9986
IMG3	0.8944	0.9453	0.9910
IMG4	0.5172	0.9439	0.9859

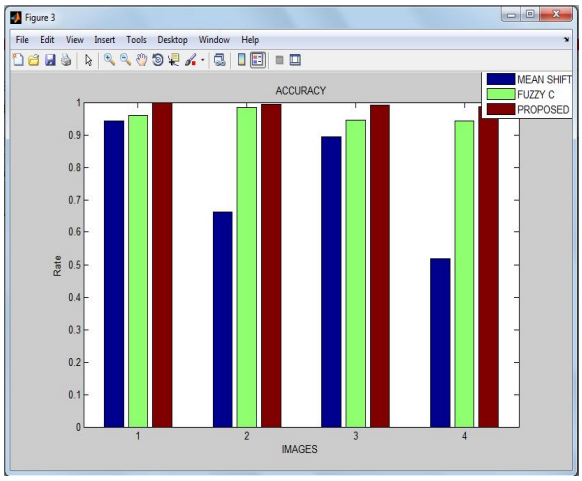

Figure 11 Accuracy Analysis

Table 3 and figure 11 shows the comparison between three algorithms by using accuracy parameter and the result shows that proposed algorithm gives more accurate results next fcm and at last mean shift algorithms because proposed algorithm attains highest values for accuracy parameter.

Table 4: Efficiency Analysis

IMAGE	MEAN SHIFT	FCM	PROPOSED
IMG1	0.8903	0.9772	0.9984
IMG2	0.7278	0.9499	0.9980
IMG3	0.8897	0.9749	0.9835
IMG4	0.4819	0.9179	0.9792

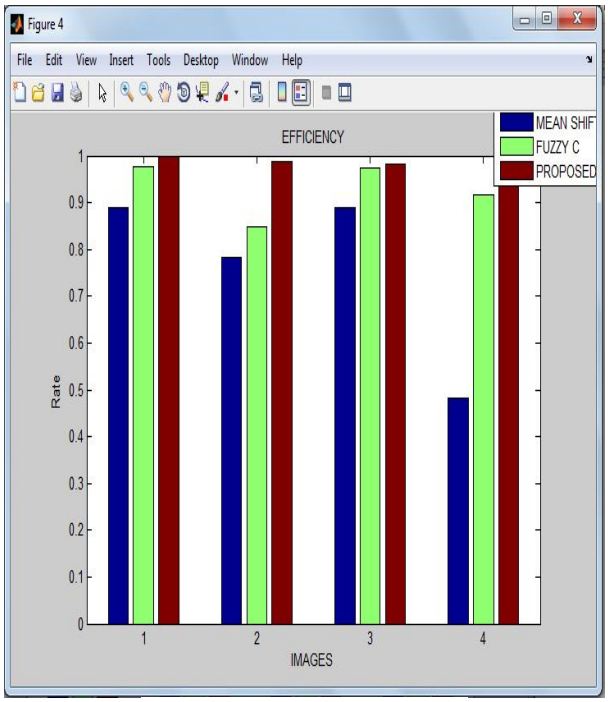

Figure 12 Efficiency Analysis

Table 4 and figure 12 shows the comparison between three algorithms by using efficiency parameter and the result shows that proposed algorithm gives more accurate results next fcm and at last mean shift algorithms because proposed algorithm attains highest values for efficiency parameter.

Table 5: MSI Analysis

IMAGE	MEAN SHIFT	FCM	PROPOSED
IMG1	0.8188	0.8276	0.9976
IMG2	0.6730	0.8620	0.9973
IMG3	0.8851	0.8427	0.9759
IMG4	0.4466	0.9778	0.9725

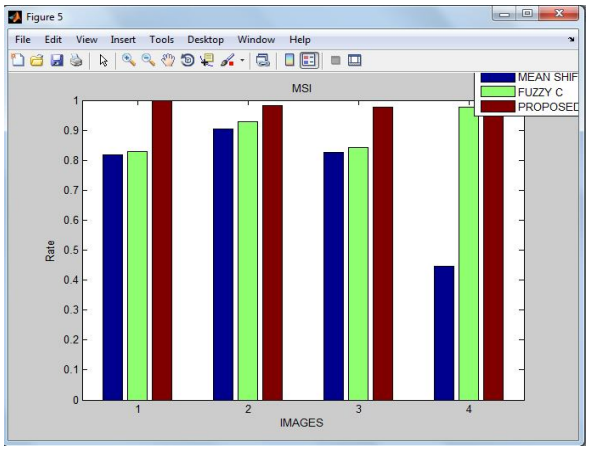

Figure 13 MSI Analysis

Table 5 and figure 13 shows the comparison between three algorithms by using mean silhouette index based analysis parameter and the result shows that proposed algorithm gives more accurate results next fcm and at last mean shift algorithms because proposed algorithm attains highest values for mean silhouette index parameter.

6 CONCLUSION

Segmentation splits the image hooked on many pieces rendering to their features corresponding gray-level, color, texture, intensity etc. also these units cover the entire image or signify the entire image. FCM spirals sound significances on behalf of coincided datasets since in this procedure every statistics fact not limited toward specific group somewhat than statistics fact can fit towards more than one group rendering towards the grade of association. Mean Shift remains a way that conserves the gap of the images. Mean Shift is a liberal way on behalf of division founded on clustering. Now this process we do not require need of preceding awareness of exactly how various quantity of groups are desired because it is a non-parametric iterative method. This paper has executed Fuzzy C means and Mean Shift based segmentation in MATLAB with the help of image processing toolbox. The proposed technique has been designed and implemented in the MATLAB using image processing toolbox. Various kinds of multispectral images will also be considered for experimental purpose. The comparisons using various parameters like MSE, PSNR, accuracy, efficiency and MSI have clearly shown that the proposed technique overtakes above the available methods.

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