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Implementation of Image Segmentation Using Window Based Method Through K-Means Algorithm

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Abstract*— The key step of Segmentation in previous to the stage other operations like depiction, appreciation, prospect thoughtful, indexing. Image segmentation is the classification of all the same regions in the image. This is proficient by segmenting a picture into subsets and presently handover the entity pixels to module. Now the idea is to use shape in object classification field. The propose method is to compute size of shape as a feature for each pixel to get information of the image. This information can be used further in its detail analysis or decision making systems by classification techniques. Shape requires an area to compute it. Hence, window based method is used for each pixel in the image. The possible windows have been distinct in which existing pixel is placed at different positions and shape is computed for each window representation. The shape defines a connection of that pixel with its neighbours. After obtaining the shape of feature vector of pixels, k-means classification technique is used to classify these vectors in k number of classes. Hence, the selection of window size has trade of between computation time and image quality. All the experiments have been performed on both gray and color scale images in MATLAB version 7.14.

Keywords*— Segmentation, module, feature vector, k-means classification, window based method,

I. INTRODUCTION

In our daily life, each of us above all receives processes, and scrutiny an enormous quantity of various kinds of in sequence. Any choice has based on this scrutiny. Image is an incredibly dominant medium which represents the information and process in a packed in and well-organized way. It is not only major source of in sequence, but is also used for communication among people and for interaction between humans and machines. Common digital images contain huge amount of information in very small space. An image can take and send by using any communication average in a small number of seconds contains as much information. This is why there is an imperative need for repeated and influential image analysis methods. Analysis and understanding of an image is the input difficulty in many request areas such as remote sensing, astronomy, medical imaging, etc

II. RELATED WORK

Clustering is a classification technique. Given a vector of N measurements describing each pixel or group of pixels (i.e., region) in an image, a similarity of the measurement vectors and therefore their clustering in the N-dimensional measurement space implies similarity of the corresponding pixels or pixel groups. Therefore, clustering in measurement space may be an indicator of similarity of image regions, and may be used for segmentation purposes.

The vector of measurements describes some useful image feature and thus is also known as a feature vector. Similarity between image regions or pixels implies clustering (small separation distances) in the feature space. Clustering methods were some of the earliest data segmentation techniques to be developed.

Similar data points grouped together into clusters. Most popular clustering algorithms suffer from two major drawbacks

- First, the number of clusters is predefined, which makes them inadequate for batch processing of huge image databases
- Secondly, the clusters are represented by their centroid and built using an Euclidean distance therefore inducing generally an hyperspheric cluster shape, which makes them unable to capture the real structure of the data.
- This is especially true in the case of color clustering where clusters are arbitrarily shaped

K-Means Algorithm Properties

- There are always K clusters.
- There is always at least one item in each cluster.
- The clusters are non-hierarchical and they do not overlap.

III. PROPOSED WORK

The Segmented image require feature vector on the source of which pixel classification can be performed. If we depend only intensity values of image. Then it will not give the better segmentation result. Therefore, it requires some other features which are inherent in the image. The moment is an invariant feature used in the object recognition. The main aim

of this dissertation is to classify each pixel of an image by novel feature. The idea of novel feature is to compute each pixel using window based method and then assign class labels using k-means classification technique.

A. **Pixel based Classification**

Supervised classification algorithms are applied in pixel-based classification. In this work, maximum likelihood classifier is implemented. For being compared with object-base techniques, the same classes with the same colour information are designed in both classification approaches.

The maximum likelihood decision rule is based on a normalized (Gaussian) estimate of the probability density function of each class

Without noise

In pixel based classification, the intensity value of pixel is used as feature and in colour image the intensity values of pixel is used as feature vector ,then if we want to classify then we use K-Mean for classification.

With Noise

The segmentation results by pixel based classification show degradation due to noise. Therefore require another feature which gives better result or less sensitive to noise. The moment is considered as good feature, used in object recognition so far.

B. **Proposed Method for study of Pixel based Classification**

Without noise:

Our Proposed work is pixel based classification, which shows netter results in pixel based classification but there is not so much difference in results.

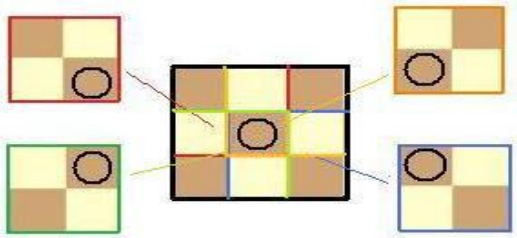
With noise:

If we introduce the noise then noise affects the intensity value of pixel. Image noise is the random variation of brightness or colour information in images produced by sensors and circuitry of a scanner or digital camera. The principal sources of noise in digital images arise during image acquisition (digitization) and/or show. There are various types of noise.

1) Gaussian noise arises in an image due to factors such as electronic circuit noise and sensor noise due to poor illumination
2) Salt and Pepper noise is found in situations where quick transients, such as faulty switching take place during imaging

C. **Window based classification Method:**

An overlapping window based method is applied on each pixel to compute moment. All possible windows have been defined in which current pixel is placed at different positions of window and moment value is computed for each window representation.



The window size is one of the crucial parameter in this work. There is no specific method to estimate window size which will be suitable for different types of images and fulfil all requirements. The purpose of considering different window size is to analyze their effects on execution time and various features of image. The window size will also affect the value of moment.

D. **Proposed Algorithm**

Initialization: (a) Choose high*est label as no. of cluster*
(b) Window size M*M (2×2, 3×3, 4×4)

1. Find out object or shapes in an image and label them as 1,2,3….k

2. For each pixel in image.

- For each possible window representation of this pixel
  - Compute Statistical Moment values using pixels of this window
  - Store label corresponding to pixel

3. Use *k-Means classification technique* to classify pixel using feature vectors of all pixel comprises of mean, variance, skewness, label. After this classification we get the segmented of the image ..

E. Features of Different window sizes.

The affect of window sizes with moments on the segmented image as: Smaller window size preserves edge information in segmented image

- As window size increases, smoothness of area considered by that window increases and sharpness of area decreases
- As window size increases, the computational time of proposed algorithm increases.
- As window size increases, the noise tolerance of proposed algorithm increases.

E. **Method Used**

The approach is used in image segmentation. There are various approaches used in both the cases. The first case is when ground truth is available and the other is when not available.

IV. SIMULATION RESULT

A. **Parameter used for pixel based Segmentation are:**

- **Mismatching Rate** -It denotes how many percentage of labels differ in two labeled matrices obtained by k Means classification technique.
- **Misclassification Rate (MCR)** –The number of misclassified pixel divides by total number of pixels multiply with 100.
- **MCR = (Number of misclassified pixel/ Total number of pixels)*100.**
- **Computational Time:** Total time CPU taken by proposed method for computation.

B. **Comparison between input images and output images with different window sizes**

Input Images **Segmented Images**

1) Misclassification Rate between different Window Sizes

Table I and fig 1 contain the misclassification rate between segmented image and ground truth image. we can conclude that our proposed algorithm assures the better quality of segmented image. Segmented images are more near to the original images.

TABLE I
MCR between ground truth & segmented Image

Image_name	MCR_2×2	MCR_3×3
Image 1	0.70	0.72
Image2	1.89	1.90

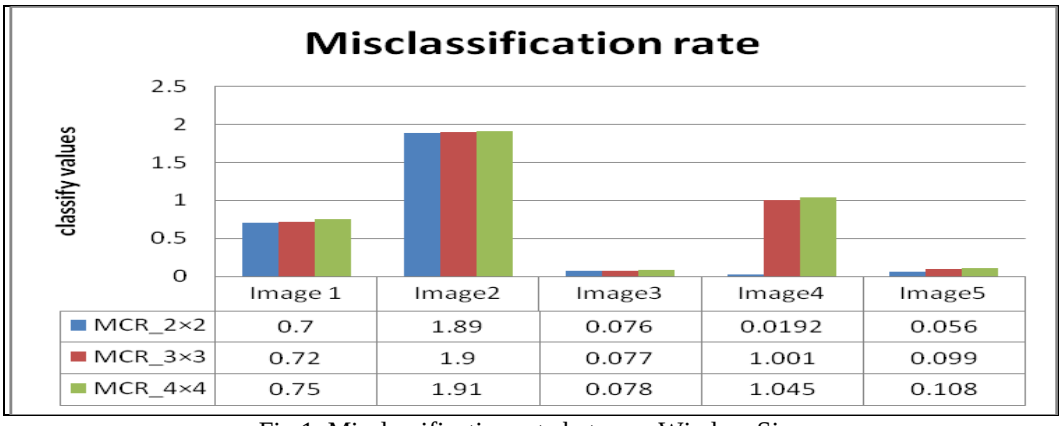


Fig 1. Misclassification rate between Window Size

2) Mismatching Rate between different Window Sizes

Table II and fig 2 contains the mismatching rate between segmented image and ground truth image.

TABLE II
MMR between ground truth & segmented Image

Image_name	MMR_2×2	MMR_3×3
Image 1	1.12	1.56
Image2	0.56	1.23

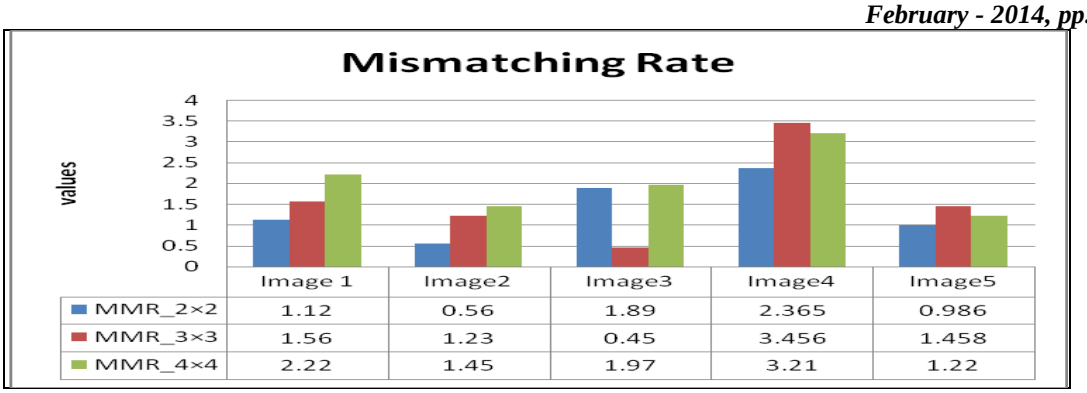


Fig 2**.** Represent the Mismatching Rate between Shape

3) CPU Time Utilization Comparison

Table III
CPU time Utilization

Image_name	**CPU_time_2×2 in sec**	**CPU_time_3×3 in sec**
Image 1	77.767	82.74
Image II	69.56	72.89

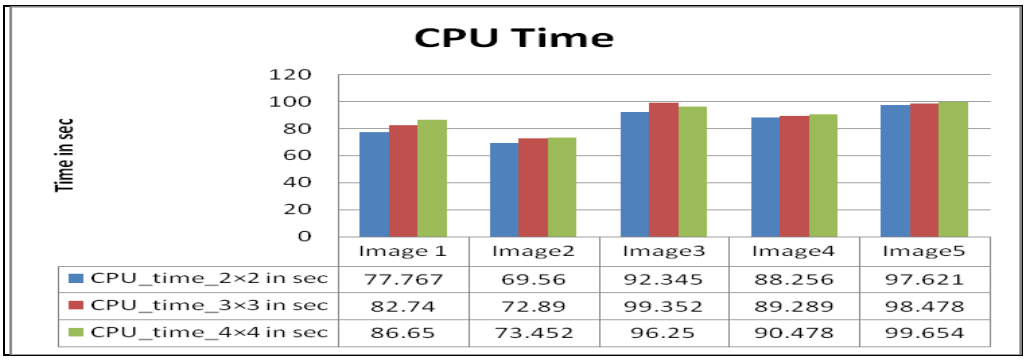


Fig 3. Represent Time Comparison

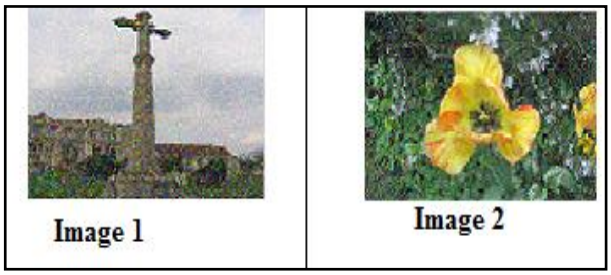
C. **APPLY NOISE**

Image noise is the random variation of brightness or color information in images produced by sensors and circuitry of a scanner or digital camera [8] .The principal sources of noise in digital images arise during image acquisition (digitization) and/or transmission.There are various types of noise. The noise used here are:

- Gaussian Noise arises in an image due to factors such as electronic circuit noise and sensor noise due to poor illumination.
- Salt and Pepper Noise is found in situations where quick transients, such as faulty switching take place during imaging.

INPUT IMAGES

SEGMENTED IMAGE



1) Misclassification Rate between Window Sizes for Noisy image

Table IV
Misclassification rate for Noisy image

Image_name	**MCR_2×2**	**MCR_3×3**
Image 1	2.16	2.99
Image2	1.11	1.67

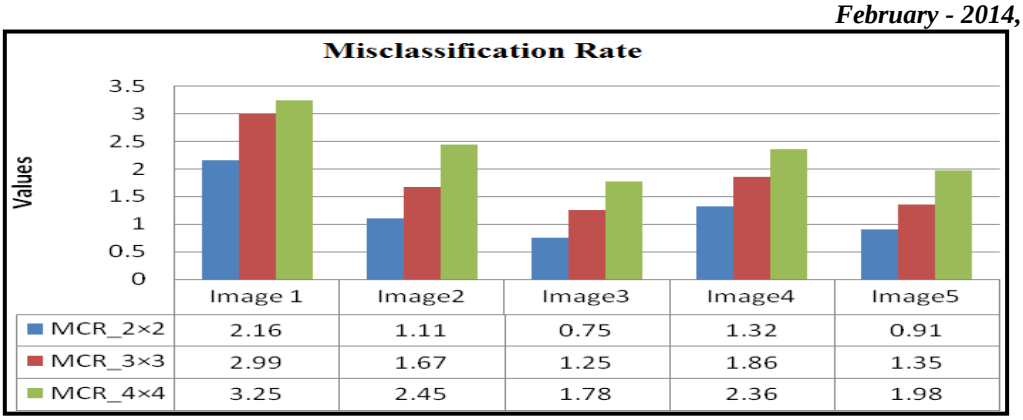


Fig 4. Misclassification rate between Window Size

2) Mismatching Rate for noisy image

Table V
Mismatching rate for Noisy image

Image_name	MMR_2×2	MMR_3×3
Image 1	2.23	2.96
Image2	2.19	2.89

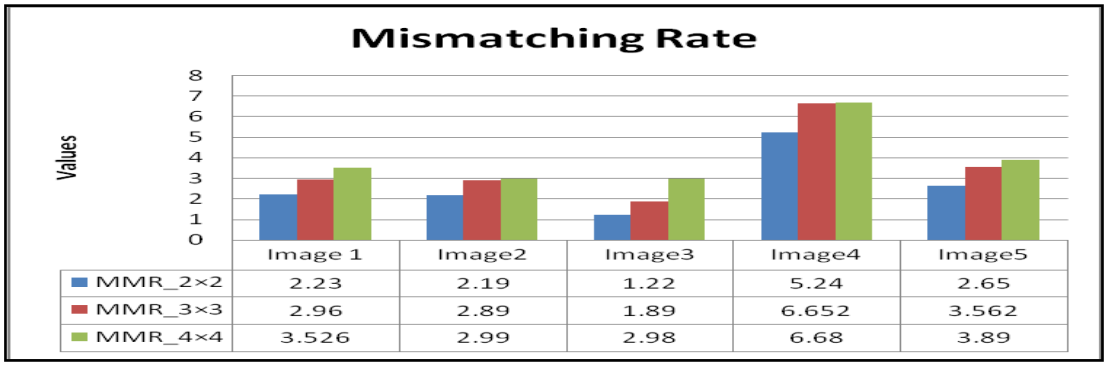


Fig 5. Represent the Mismatching Rate between Shape

3) CPU Time utilization after noice

Table VI
CPU time Utilization for noisy image

Image_name	CPU_time_2×2 in sec	CPU_time_3×3 in sec
Image 1	121.35	95.65
Image2	79.23	95.326

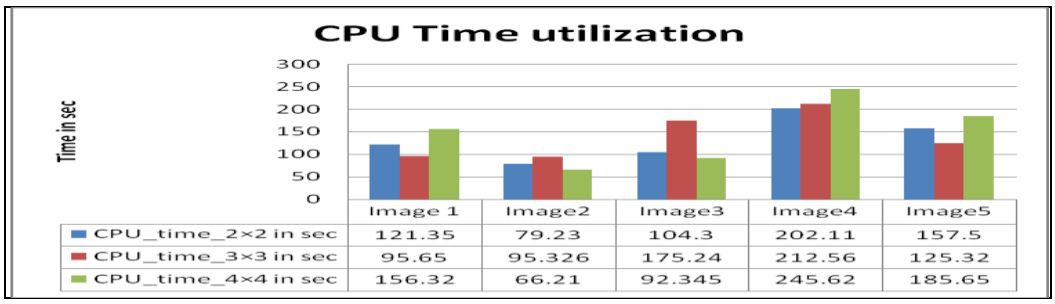


Fig 6. Represent Time Comparison

V. CONCLUSIONS & FUTURE WORK

Proposed method, a new color and shape based image segmentation scheme provides better results. K-means classification has been used to classify pixels into the respective segmented region. Feature vector for k-mean classification is comprised of moments and label. Window based method is used with different window sizes to get accuracy in segmentation. The window size will affect the segmented image described As window size increases, the noise tolerance of proposed algorithm increases smaller window size preserves edge information in segmented image. Future work of this scheme is concentrating on the other features of the image for segmentation.

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