Comparison of K-mean and Fuzzy K-mean algorithms for color image segmentation

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Abstract— In this paper we describes the comparison of the K-mean and Fuzzy K-mean algorithm for the color image segmentation based on their inter cluster distance, intra and inter cluster correlation and computational speed by using both the difference squared and absolute difference then deciding the which algorithm is works effectively with minimum computational speed.

Keywords— K-mean,Fuzzy K-meann, color image Segmentation,

I. INTRODUCTION

Image segmentation is a major Research topic in the field Image processing. Most of the computer vision image analysis problem requires segmentation stage in order to detect object and divide the image into region which can be consider as homogeneous according to color, motion, texture etc..[1]

Cluster analysis or clustering is the task of grouping a set of objects in such a way that objects in the same group (called cluster) are more similar (in some sense or another) to each other than to those in other groups (clusters)

II. IMAGE SEGMENTATION

It is the process of partitioning a digital image into multiple groups or segments. The main goal of segmentation is simplify the image or change the representation of an image into more easier to analyze[3] and must be meaning ful. Image segmentation is used to locate lines, curves etc in images. Image segmentation is the process of giving a label to every pixel in an image. Image segmentation is the first step in image analysis and pattern recognition. It is a critical and essential component of image analysis system, is one of the most difficult tasks in image processing, and determines the quality of the final result of analysis. Image segmentation is the process of dividing an image into different regions such that each region is homogeneous.

Image segmentation methods can be categorized as below

- Region Based Methods
- Edge Based Methods
- Hybrid Techniques

A. Region Based Techniques

Region based methods are based continuity. These techniques divide the entire image into sub regions depending on some rules like all the pixels in one region must have the same gray level. Region-based techniques rely on common patterns in intensity values within a cluster of neighboring pixels[2]. The cluster is referred to as the region, and the goal of the segmentation algorithm is to group the regions according to their anatomical or functional roles.

B. Edge Based Techniques

Segmentation Methods based on Discontinuity find for abrupt changes in the intensity value. These methods are called as Edge or Boundary based methods. Edge detection is the problem of fundamental importance in image analysis. Edge detection techniques are generally used for finding discontinuities in gray level images[4]. Edge detection is the most common approach for detecting meaningful discontinuities in the gray level. Image segmentation methods for detecting discontinuities are boundary based methods

Edge detection can be done using either of the following methods Edges are local changes in the image intensity. Edges typically occur on the boundary between two regions. Important features can be extracted from the edges of an image (e.g., corners, lines, curves). Edge detection is an important feature for image analysis. These features are used by higher-level computer vision algorithms (e.g., recognition).

Edge detection is used for object detection which serves various applications like medical image processing, biometrics etc. Edge detection is an active area of research as it facilitates higher level image analysis. There are three different types of discontinuities in the grey level like point, line and edges. Spatial masks can be used to detect all the three types of discontinuities in an image.

B. Hybrid Techniques

This hybrid Techniques consider both edges and regions.

III. TECHNIQUES USED FOR COLOR IMAGE SEGMENTATION

The following two techniques are used for color image segmentation.
A. **Image Segmentation by Using K-mean Clustering**

K-Means clustering generates a specific number of disjoint, flat (non-hierarchical) clusters. It is well suited to generating globular clusters\([5]\). The K-Means method is numerical, unsupervised, non-deterministic and iterative.

**Step 1:** Read the image  
**Step 2:** Convert the image to color space  
**Step 3:** Apply the K-mean algorithm for classification.  
**Step 4:** label each pixel in image for the output of the K-mean algorithm  
**Step 5:** using cluster create a image by applying color

B. **Image Segmentation by Using Fuzzy K-mean Clustering**

data clustering method in which each data point belongs to a cluster to a degree specified by a membership value. FCM is used in many applications like pattern recognition, classification, image segmentation, etc. FCM divides a collection of n vectors c fuzzy groups, and finds a cluster center in each group such that a cost function of dissimilarity measure is minimized. FCM uses fuzzy partitioning such that a given data point can belong to several groups with the degree of belongingness specified by membership values between 0 and 1.

**Step 1:** Initialize the membership matrix U with random values between 0 and 1.  
**Step 2:** Calculates c fuzzy cluster center \( c_i \), \( i = 1, \ldots, c \), using the following equation,  
\[
 c_i = \frac{\sum_{j=1}^{n} u_{ij} \cdot x_j}{\sum_{j=1}^{n} u_{ij}} 
\]

**Step 3:** update the membership degree.  
**Step 4:** repeat these step until Delta value became less 1.

IV. **Experimental Result**

The Result obtained on six color images Hamsa which is represented a color of images from the segmentation point of view A number of experimented conducted in all of which the computation were carried out by using the RGB color space. Fuzzy k-mean automatically Determines the cluster. The below fig shows the Maximum cluster obtained by the Fuzzy k-mean algorithm according to fig 1 it obtains the 12 cluster as shown fig 2.
From the above Fig 4 most of the inter cluster of K-means led to the higher value than the Fuzzy K-mean algorithm this true for both of the (Squared and absolute) methods. We can also compare these algorithms by using the correlation between the inter and intra cluster results as shown below fig 5.

The K-mean method led higher magnitude than the Fuzzy K-mean method. This due to nature of the methods execution. The K-mean method is iterative techniques it keeps iterating until cluster center coverage compare to above result K-mean algorithm produces the effective result in most of the case so it is not ignore because only computational speed in high.

V. CONCLUSION

This paper compares K-means and fuzzy K-means for color image segmentation. The algorithms are developed in JAVA for analysis and comparison. K-means clustering produces fairly higher accuracy and requires high computation speed. Fuzzy K-means clustering produces close results to K-means clustering yet it requires less computation speed than K-means because of the fuzzy measures calculations involved in the algorithm.

REFERENCES:


