

ABSTRACT

The pixels of an image are grouped into several regions for segmentation. In segmentation technique the texture feature parameter is an image analysis technique in the field of Computer vision. In the Segmentation field, there are many techniques are used to segment the images .The proposed approach is to analyze and compare the gray level texture feature techniques, number of clusters, Fuzzy C means, and to find which algorithmic approach provides better results in image segmentation.

KEYWORDS: Feature Extraction, Fuzzy C Means, K means, Watershed segmentation.

INTRODUCTION

Texture image consists of integration objects within a single image. In Figure 1 a variety of texture images are represented . Despite the large variation in image pattern, humans can easily predict them for segmentation. In Figure 2, human vision is difficult to interpret the variation in image. To Segment the images, we consider several factors such as similarity of patterns, proximity and continuity in pattern, parallelism, closure and familiarity and these factors are used as base parameter for image analysis technique. The clustering in computer vision is called Segmentation in which an image is sub divided into different regions. To analyze a parameter using image processing an image segmentation leads to a difficult task [1],[2].

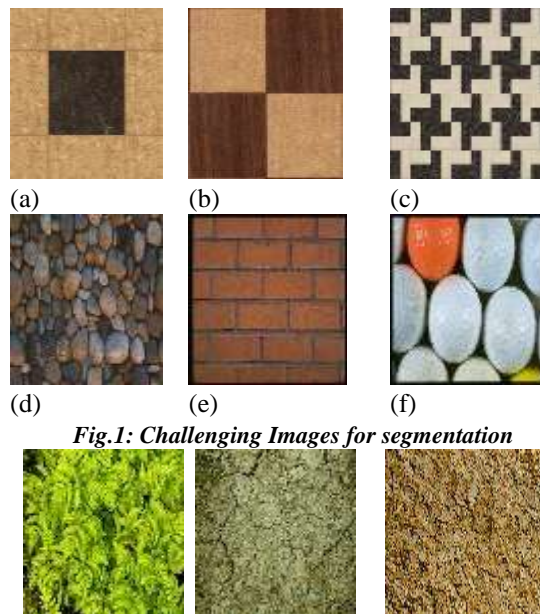


Fig.1: Challenging Images for segmentation

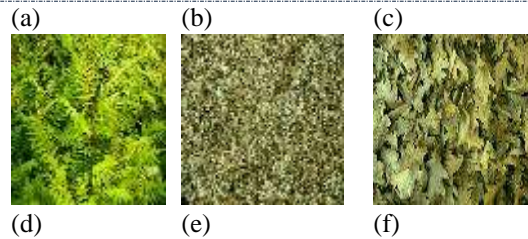


Fig.2: Challenging Images for segmentation

PREVIOUS METHODS

The texture of a region is analyzed using different statistical approaches which are either First Order or Second Order. The impact of basic Statistical approaches leads to high characterizations of textures in an image. The gray level histogram describes the texture of an image. Structural approaches are used to determine the basic texture parameters and to analyze the texture region based on predefined rules. Spectral analyses are used for determining the directionality of periodic Patterns in an image [10]. The Combination of Statistical and FCM techniques provide many advantages. Statistical Features are extracted by using the sliding window technique. The pixel based FCM is used to segment the image and also use the statistical feature and the window sizes impact drawback on analysis [3],[4],[5]. The principled information-theoretic approaches are used in which image texture and boundaries are combined. Gaussian distribution and adaptive chain codes are used to encode the boundary and texture information in texture region of an image. The image regions are partitioned in order to obtain maximum lossy compression with different window sizes[8]. Texture analysis techniques are categorized into structural, statistical, model-based and transform

ANALYZED TECHNIQUES

Texture Feature Extraction

Texture feature of an image are extracted using the following techniques.

1. *Grey Level Co-Occurrence Matrix:*

The statistical method of analysing the texture of an image is that it considers pixel spatial relationship with grey level. A grey level co-occurrence matrix and grey level spatial dependence matrix are used to extract the texture features [7], [8], [9]. The texture features are determined by considering the occurrence of pixel pairs with the values which specifies the grey level in spatial relationship of an image and extracting the parameters from the matrix [6]. The statistical parameters such as ASM or Energy, Contrast, Homogeneity, Entropy and, Correlation are determined from the co-occurrence matrix[12]. The texture features are determined from the energy measures. The high value of energy parameter indicates the grey levels are constant or periodic. The ASM parameter of an image can be represented as

$$ASM = \sum_{i=1}^L \sum_{j=1}^L (GLCM(i,j))^2 \dots\dots\dots (1)$$

Contrast can be analyzed based on coarse texture in an image and high value of contrast is available in coarse texture. The contrast in terms of grey level indicates the large variation of the grey level in an image [11]. It is calculated as

$$Contrast = \sum_{i=1}^L \sum_{j=1}^L (i - j)^2 GLCM(i, j)) \dots\dots\dots (2)$$

In an image the homogeneity measures indicate the homogenetic character of a pixel. The impact of increase in Homogeneity measures indicates the same combination of pixel pairs [12].

$$Homogeneity = \sum_{i=1}^M \sum_{j=1}^N \frac{(GLCM(i,j))^2}{1+(i-j)^2} \dots\dots\dots (3)$$

Entropy character in an image determines the degree of disorder or non-homogeneity of pixel pair in the image. The co-occurrence matrix provides large values of entropy and to obtain the uniform texture character the entropy is considered small.

$$Entropy = \sum_{i=1}^L \sum_{j=1}^L GLCM(i, j) \times \log(GLCM(i, j)) \dots\dots\dots (4)$$

The grey level parameters on adjacent pixels determine the correlation texture of an image. The correlation of an image is given as

$$\text{Correlation} = \frac{\sum_{i=1}^L \sum_{j=1}^L (ij)(GLCM(i,j) - \mu_1 \mu_2)}{\sigma_i \sigma_j} \dots \dots \dots (5)$$

2. Fuzzy Clustering:

The soft way of clustering in an image is fuzzy clustering. The data elements depend on more than one cluster and it varies with respect to a set of membership levels. In this clustering technique the strength of data elements are analyzed and assigning membership levels and elements to more than one cluster [11]. In FCM algorithm is most commonly used to partition of N elements in an image as C clusters with respect to cluster parameters. This algorithm impacts on cluster centers $x = \{x_1, \dots, x_n\}$ and a partition matrix adds weight to each element w_{ij} which represent the degree in which the element depends on clusters. Fuzzy C means algorithm minimizes the objective functions and the standard function differs from k-means values by adding membership values u_{ij} with fuzzifier m . The parameter m represents the level of cluster fuzziness. The value m is chosen either small or large based on weightage w_{ij} . The crisp partitioning of an image depends on the membership values and normally the membership value is assigned as 2.

3. Fuzzy c-means clustering

In this clustering technique different clusters are assigned with center data points which belong to individual clusters instead of belonging to particular clusters. This clustering provides a lesser degree at edge instead of center. The image with x data points assigns a set of coefficients which provide the Kth cluster as $w_k(x)$. The centroid of an image is estimated as the mean cluster of all points, cluster weights T_d with the degree depends on the cluster of an image: $x = \{x_1, \dots, x_n\}$. The weight $w_k(x)$ has an impact of cluster centers and the parameter m has a greater control on weights added to cluster center.

4. Algorithm

- Choose the number of clusters based on image size.
- Assign the coefficients to each points in the cluster based on cluster points.
- The algorithm steps are repeated until the threshold limit is converged.
- Estimate the centroid for individual clusters
- For each point within the cluster, compute the coefficient. In this clustering algorithm the variation of intra cluster is minimized and the major drawback is the results of the cluster depend on the impact of weights. The partial membership data are included based on the Gaussian function with respect to the algorithm. Under noisy condition this clustering algorithm provides better accuracy.

5. K-means clustering:

In K-means clustering the nearest mean is depends on n cluster on k clusters with respect to each observation Coarseness, Directionality, Contrast are used to analyse the features of image and this features provide data set for k means cluster.

Algorithm:

- Select a value for c .
- Select the cluster center.
- Determine the features for every pixel (mean feature F).
- Define a similarity measure between the cluster center and features (Euclidean Distance).
- Calculate the cluster center of the new cluster.
- Repeat steps 4 and 5 until the cluster center stops changing.

The clustering can be improved by assuming that neighboring pixels having the probability of falling into the same cluster. In image segmentation the observations are based on the pixels in the image plane and segmented into K non-continuous regions.

Algorithm:

- Select a value for K.
- Apply the K-means and Connected Components Algorithm.
- Merge the components with minimum size compared to adjacent component.
- Segmentation of the object and the background.

EXPERIMENTAL RESULTS

The proposed image clustering technique is verified in MATLAB software and the features are compared with conventional clustering techniques. Table-1 represent the fuzzy c means clustering techniques and the number of

cluster involved is 2. First step to convert the grey after then find the cluster based on number of cluster. C1 and C2 represent the mean cluster value in an image. Table 2 shows the result for gray level texture features. Table 3 shows the results for k means clustering algorithm. In this algorithm, number of cluster used 3. First step to convert the grey after that find the cluster based on number of cluster and analyze the mean cluster value.

Table 1
Result for Fuzzy C means clustering algorithm




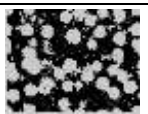
























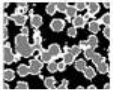

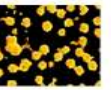
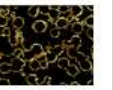



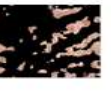

Original Image	No of Clusters		Segmented image using FCM
	2		
	C1	114.8562	
	C2	171.2316	
	2		
	C1	55.2504	
	C2	183.7555	
	2		
	C1	39.6425	
	C2	110.6997	
	2		
	C1	171.8466	
	C2	215.2342	
	2		
	C1	55.4710	
	C2	86.5131	
	2		
	C1	109.9732	
	C2	147.9980	
	2		
	C1	73.6355	
	C2	155.1934	

Table-2
Result comparison for Gray Level Co-Occurrence matrix

Original Image	TEXTURE
	Contrast-0.204 Correlation-1.054 Energy-0.231 Homogeneity-0.928 Entropy-7.254
	Contrast-0.212 Correlation-1.038 Energy-0.289 Homogeneity-0.911 Entropy-6.698
	Contrast-1.354 Correlation-0.954 Energy-0.132 Homogeneity-0.812 Entropy-6.459

Comparison between the segmentation techniques such as k means and the GLCM, K means provide the best details of texture feature. Similarly, comparison between the K means and C Means clustering algorithm, FCM provides the accuracy values.

Table-3
Result for K means Clustering

Original Image	No of Clusters			Indexed image	C1 Image	C2 Image	C3 Image
	3						
	C1	130.895	144.0013				
	C2	131.127	146.6851				
	C3	129.987	140.7190				
	3						
	C1	138.814	131.4028				
	C2	141.109	139.2079				
	C3	141.913	145.9884				
	3						
	C1	131.244	168.2511				
	C2	137.503	200.1916				
	C3	123.027	140.7964				
	3						
	C1	136.512	139.7453				
	C2	142.435	143.4846				
	C3	131.137	136.3746				

CONCLUSION

Texture feature is a very vital feature for object recognition. In this paper, the different techniques in image segmentation and their features are analyzed. The five parameters such as Contrast, Correlation, Energy, Homogeneity and Entropy are found by using GCLM technique. By using K mean, Fuzzy C means calculate the cluster mean from the each cluster. Similarly, modify the number of clusters to find the cluster mean from each cluster. In future, these techniques will apply for the video sequences and also consider another one of the additional feature is color for improve the efficacy and accuracy

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