International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 03 Issue: 12 | Dec -2016 www.irjet.net p-ISSN: 2395-0072

# HIERARCHICAL APPROACH BASED ON COLOR IMAGE SEGMENTATION USING HOMOGENEITY

**S. S BEULAH BENSLET**

*Assistant professor*
*Department of computer science*
*Nanjil Catholic College of Arts and Science, Kaliyakavilai, K.K.Dist, Tamil Nadu, India*

---

**Abstract - :** *The Hierarchical approach on color image segmentation segments the given input image by different separations based on the unsupervised and supervised segmentation concepts. Segmentation sub divides an image into its constituent regions or objects. Segmentation of non-trivial images is one of the most difficult tasks in an image processing. This segmentation process is the pre-process for lot of image processing application. The segmentation process groups the related data so that the image is divided as sub regions.*

*Three segmentation algorithms were used*

- ✓ *Image segmentation by Homogeneity method*
- ✓ *Image segmentation by K-means method*
- ✓ *Image segmentation by Region division method*

*The first method is working based on image Homogeneity. The second method is based on assigning feature vector to clusters with minimum distance assignment principle. The third method works on the mean and standard deviation features. All the three methods were analyzed by standard analytical methodologies*.

***Key Words***: **Thresholding, Histogram, Image Segmentation, Monochrome segmentation, Color edge Detector, Homogeneity method, K-means method, Region division method**

## 1. INTRODUCTION

Digital image processing encompassesses a broad range of hardware, software and theoretical underpinning. The major application is rather easy to conceptualize without any prior knowledge of image concepts. There are several techniques in digital image processing. One such image processing technique is segmentation of image. Image segmentation serve as the key of image analyses and pattern recognition.

The process of dividing an image into different regions such that each region is homogeneous, but the union of nay two regions is not. Color of an image carries much more information than the grey level. Color image segmentation methods are mainly extended from monochrome segmentation approach by being implemented in different color spaces. Gray level segmentation methods are directly applied to each component.

Modeling of color images has received less attention. The color image segmentation approach can be divided into the following categories:

- ➢ Statistical approaches
- ➢ Edge Detection approaches
- ➢ Region Splitting and Merging approaches

Statistical approach is one of the defining qualities of texture in the spatial distribution of gray values. Histogram thresholding is one of the widely used techniques for monochrome image segmentation. The features are multiful for color images. Since the color information is represented by tristimulus R, G and B or some linear or non-linear transformation of RGB, representing the histogram of a color texture in a 3-dimensional array and selecting in the histogram is not a trivial job.

The color information is represented by tristimulus RGB representing in 3D array. The efficient methods for storing and processing the information of the image in 3D color space by using a binary tree to store 3D histogram of a color image. Each node of a tree includes RGB values as the key and the number of points whose RGB values are within a range centered by the key value and also detect some clusters in the

3D color space. It provides segmentation approach using 2D projection.

Histogram thresholding is the other way to project the 3D space into a lower dimensional space such as 2D or even 1D. Projections of 3D normalized color space on to the 2D planes are used. It provides segmentation approach using 2D projection of color space. It suggests a multidimensional histogram thresholding scheme using thresholding values obtained from three-color spaces (RGB, YIQ and HSI).

This method used a mask for region splitting and the initial mask included all pixels in the images. For many mask, histogram of the nine redundant features(R, G B, Y, I, Q, H, S I)of the masked images are computed , all peaks in these histograms are located, the histogram with the best peak is selected and a threshold is determined to split the masked image into two sub regions for which two new masks are generated for further splitting. This operation is repeated until no mask left unprocessed, which means none of the nine histograms of existing regions can be further thresholded and each region is homogeneous. By using local and global information the homogeneity feature can be calculated. The histogram analysis is applied to both the homogeneity domain and the color feature domain

### 1.1 RELATED WORKS

The related works developed in image segmentation are:

1. Color Segmentation Using Perceptual Attributes
   In this the perception HIS is employed for image segmentation. In analogy to human color perception three problems occurs in color segmentation when using the attributes. First hue is meaningless when the intensity is very high or very low. Second hue is unstable when the saturation is very low and third saturation is meaningless when the intensity is very low or very high
2. Color Edge Detector: An Overview and Comparison
   Color edge detection is performed on the basis of fuzzy membership function for regions obtained in fuzzy segmentation algorithm. By considering only the membership function, ignoring final step of defuzzification and connected component extraction.
3. On Unsupervised Segmentation of Colored Texture Images
   The Orthogonal polynomial based computational model for color texture image segmentation is detected based on a complete set of difference operators. The operators are employed to represent a color image region as a linear combination of the operators responses towards texture noise. The simple statistical design is used for separating out the responses towards color texture from the responses towards noise.
4. A Color Texture Based Visual Monitoring System for Automated Surveillance
   The original images are in RGB which is then transformed to XYZ color space using the equation x=X/X+Y+Z and y=Y/X+Y+Z. A visual monitoring system incorporates color and texture processing principles for segmentation and classification. Emphasis has been given to the segmentation subsystem which is directly applicable to environments were detection and measurements of change in the sense environment is of primary importance.
5. Box Counting Approach to Segmentation
   Fractal dimension can be derived from the Euclidean end space. The box counting approach is used to estimate the fraction dimension. A seed block which embodies information about color feature and fractal dimension is used by using region growing method. Fractal dimension can also be estimated from the least squares linear fit method. It gives very good estimate of fractal dimension and improves efficiency from the original method.
6. Color Information for Region Segmentation
   I1, I2, I3 model was obtained by experimental evidence that is good approximation for KL transform.
   It works as follows:
   A mask corresponding to the whole image is placed at the bottom of the stack
   If stack is empty then stop. Otherwise one mask is taken from the top of the stack
   Histogram of color feature is the region SR computed
   If any of the histogram shows the conspicuous peaks, pair of the cut off value which separates a peak in the histogram is determined at the position of values and the image of the color feature corresponding to that histogram is thresholded using the cut off values.
   Connected regions are extracted for each connected region, a region mask is generated and it pushed on to the stack
7. Stable Segmentation using Color Information

A feature F was found on the basis of 300 pictures by considering about thousand color features. A neural network with single perception is the solution. The threshold was found with minimum point of very well separated bi model histogram built for F

8. Color Image Segmentation using Modified HIS System
   The objective of color segmentation is to divide an outdoor image into road and non-road regions. Assuming the road appear bright and with low saturation and non- road areas correspond with low intensity and high saturation.
9. Color image Segmentation using regression analysis in RGB space
   A Starting from small blocks, merging of uniform block is made. It is driven by a quad tree structure. Uniformity is defined by exceeding a threshold for the dominant feature. If the uniformity criteria are satisfied then the classification according to the co relation of RG plane is performed.
   Histogram and regression parameters are computed recursively.
   The maximum blocks obtained in this process become seads. Region growing is attempted by merging seads first from the same level of quad tree and next from the lower ones. Experimentally was found that the high qualidation and the slope of regression line between 0.3 and 1.35 discriminates the fluid from other similar in hue feature areas.
10. Edge based color segmentation in the CIE space
    The CIE color space is selected for image segmentation. First , the edges are detected separately in every channel due to the following scheme. The first derivative of the image function is computed in one channel applying the channel modifier operator. Then a threshold function is applied to the results instead of computing the maxima of first deviation. In addition, the zero crossing of the second derivative of the image function is computed to get a second set of edge elements. The two pixels which are adjacent to the ends of an edge and which show the strongest amplitude are added to the contours to fill the gap.

### 1.2 DIGITAL IMAGE PROCESSING

The field of image processing continues, as it has since the early '70s, on a path to dynamic growth in terms of popular and scientific interest and number of commercial application. The discipline of image processing covers a vast area of scientific and engineering knowledge. It is built on a foundation of one-and two-dimensional signal processing theory and overlaps with such discipline as artificial intelligence; information theory etc., In the last category, the objective is to obtain a symbolic description of the scene, leading to autonomous machine reasoning and perception.

Image processing and analysis can be defined as the act of examining images for the purpose of identifying objects and judging their significance. A digital image can be considered as a matrix whose row and column identify a point in the image and the corresponding matrix element values identifies the gray level at that point. In most generalized way, a digital image is an array of numbers depicting spatial distribution

## 2. IMPLEMENTATION

Segmentation process is the pre-process for lot of image processing application. The segmentation process groups the related data so that the image is divided as sub regions.

### A. IMAGE SEGMENTATION BY HOMOGENEITY METHOD

| Input Image | Segmentation Methods | Time taken (in seconds) |
|---|---|---|
| Flower.bmp | Homogeneity segmentation Method | 0.088821 |
| | K-Means Segmentation Method | 2.176533 |
| | Region Division Method | 0.402718 |

The original texture of an image is inputted. Calculate the homogeneity feature and creates the homogeneity histogram. Apply peak-finding algorithm to the homogeneity histogram and perform segmentation in the homogeneity domain. The original texture is divided into several uniform regions. Then calculate hue, remove singularity and compute histogram for each region. Next apply peak-finding algorithm to the histogram and perform segmentation based on the histograms. Finally merge the color region

which is done by comparing all sub regions with similar color.

### B. IMAGE SEGMENTATION BY K-MEANS METHOD

| Input Image | Segmentation Methods | Time taken (in seconds) |
|---|---|---|
| Lotus.bmp | Homogeneity segmentation Method<br>K-Means Segmentation Method<br>Region Division Method | 0.098216<br>2.155319<br>0.386285 |

The K-mean algorithm assigns feature vector to clusters by the minimum distance assignment principle, which assigns a new feature vector to the cluster such that the distance from the feature vector to the center is the minimum over all k clusters. The k-means method is also called as c-means.

The k-means algorithm partitions a collection of N vectors into a groups(clusters $G_i$, i=1,-------- c). The aim of this algorithm is to find clusters for each centers .The k-means algorithm put the first k feature vector as initial clusters. It assigns each sample vector to the clusters with minimum distance assignment principle. It computes new average as new center for each clusters.

### C. IMAGE SEGMENTATION BY REGION DIVISION METHOD

| Input Image | Segmentation Methods | Time taken (in seconds) |
|---|---|---|
| Lena.bmp | Homogeneity segmentation Method<br>K-Means Segmentation Method<br>Region Division Method | 0.093750<br>2.155360<br>0.387031 |

This method is used to segment the color image into the required size. The statistical feature used in region division method of image segmentation includes mean and standard deviation. The statistical feature are observed as the feature of object pixel colors. Based on some classification of pixel clusters for foreground image and background image can be made as follows:

1. Pixel presenting fore ground colors will have distinctively higher feature values than their back ground hence high standard deviation
2. Pixels representing an image object have relatively low mean and standard deviation.
3. Pixel representing a back ground object have relatively close to zero standard deviation and lighter back ground color.

## 3. CONCLUSIONS

The image segmentation methods are employed for different images and get the segmented output at the expected level. Based on time taken the K-means segmentation method takes more time and Homogeneity method takes less time. Based on segmentation count the Homogeneity Methods segments into more group and K-Means segment Method and Region Division Method segments into less groups. By considering all the aspects of benefits the, Image segmentation method by Homogeneity " is concluded as the best method because it is an unsupervised one and its power of performance is very high. Another thing is this method recognized small objects, the time taken is very less. The quality of segmentation is much improved by identifying significant local information more efficient. Hence Homogeneity method is the best one

## REFERENCES

[1] B.Madelprot Fractal geometry of nature, Freeman,1982
[2] S.Peleg, J.Naor,R.Hartley and D.Avinar Multiple Resolution texture analysis and classification, IEEE Trans. Pattern Anal Machine in tell Vol.6,pp.518-523,1984.
[3] A.P.Penteland Fractal based description of natural scenes, IEEE Trans. Pattern Analysis and Machine nin tell vol.6,pp.661-674,1984
[4] J.Gangepain and Roques-Carmes Fractal approach to two dimensional and three dimensional surface roughness , wear,vol.109,pp.119-126, 2010.
[5] L. Luo, T. F. Abdelzaher, T. He, and J. A. Stankovic. Envirosuite: An environmentally immersive

programming framework for computer vision graphics and image processing Trans. 543–576, 2006.
[6] M. Buettner, G. V. Yee, E. Anderson, and R. Han. X-MAC:Color texture segmentation for clothingin computer-aided fashion design system. 2004 August, p. 60–61.
[7] Srivastava, M., Muntz, R., and Potkonjak, M. Smart Kindergarten: Color edge detection and segmentation using vector analysis Proceedings of the ACM SIGMOBILE 7th Annual International Conference on Mobile Computing and Networking, p. 132– 138, July 2001.
[8] Jain ,A.K and Farrokhnia.F Unsupervised texture segmentation using Gabor filters , pattern recognition,vol.24,no 12, 1991,1167-1186
[9] L.Ganesan and P.Bhattercarya A statistical design of experiments approach for texture description, pattern recognition, vol.28, no 1, pp.99-105,2005
[10] R.M Riseman and M.A Arbib Computational Techniques in the visual segmentation of static scenes, Computer vision graphics and image processing, vol.67, no 5, pp221-226,1004.