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Perceptual Color Image Segmentation through K-Means

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ABSTRACT

Image segmentation refers to partitioning of an image into meaningful regions. Color image segmentation is an important task for computer vision. Generally there is no unique method for segmentation. Clustering is a powerful technique in image segmentation. The cluster analysis is to partition an image data set into number of clusters. In this paper presents k-means clustering method to segment a color image into perceptual partitions.

Keywords: Segmentation, HVS, Clustering, K-Means, Pixel.

1. INTRODUCTION

Image segmentation was, is and will be a major research topic for many image processing researchers. The reasons are obvious and applications endless: most computer vision and image analysis problem require a segmentation stage in order to detect objects or divide the image into regions which can be considered homogeneous according to a given criterion, such as color, motion, texture etc[3]. Clustering is a technique to partition the data into distinct groups in the feature space. The clustering task separates the data into number of partitions. That is volumes in the n-dimensional feature space. These partitions define a hard limit between the different groups and depend on the functions used to model the data distribution.

There are many methods of clustering developed for a wide variety of purposes. K-means is the clustering algorithm used to determine the natural spectral groupings present in a data set [2][5][10]. As k-means approach is iterative, it is computationally intensive and hence applied only to image sub areas rather than to full scenes and can be treated as unsupervised training areas [6].

2. BACK GROUND

The object recognition process constitutes of various phases: Image acquisition, segmentation, feature-extraction and recognition. Segmentation phase is an important activity in the process whose accuracy consists the overall efficiency of the recognition process. The easiest way to achieve a better efficiency is to follow the natural process adopted by the humans, the Human Vision System.Color difference between the object and rest of the image is one of the key features HVS uses in segmenting out the object of interest from the rest of the image. This makes the color information available in the image, an important feature for computer vision. The color information can be made available in a variety of ways. This section surveys the different color models and their pros and cons for the object recognition process.

2.1 RGB:

This is a 3-D color space and any color is given an s combination of red, green and blue colors with appropriate intensities. This space is machine friendly for image acquisition and display of color images .But for analyzing and processing the image perceptually in this domain is complicated. High uncorrelated features of this domain force one to compuborily use all the 3 components-red, green and blue, simultaneously making the process to have higher time and space complexities.

2.2 CIELAB:

In an attempt to make perceptual image processing less costly, CIE come out with a color space L a* b*[1][4][8].In this domain, feature a* represents redness-greenness, b* for yellowness-blueness and L is the intensity component. This allows the color information to be compressed to 2 features, there by the complexities can be reduced.

2.3 HSV:

This color space condenses the whole color information into 2 features-hue and saturation. The third component is the value that presents the intensity. Here feature represents the pure color and saturation gives how much white is added to the pure color [7][9]. The Human Vision System (HVS) uses hue on the primary source of visual information for distinguishing between object in this scene. This allows one to use only the hue feature for processing in most of the perceptual segmentation phase, making time and space complexities of the segmentation very low.

3 PROPOSED METHOD

Color information in RGB format is incomplete process to all 3 color planes is not used. Using all 3 planes is very complicated task.Hyperplane in 3 dimensional space has to be determined for segmentation. It would be easier, if all color information is available in single plane. This initiates one to use the HSI model.

3.1 HSI

The ultimate goal of any segmentation process is to simulate the Human Vision System

(HVS).The HVS is an excellent system that perceives pseudo-homogeneous (correlated) partitions in spite of non-homogeneity. The main reason for this behavior is the knowledge back up built by the HVS from the past experiences. It is still hidden from the researchers regarding how the knowledge bank is built and used by the human brain.Typically the raw image data are provided in RGB color space which is perceptually a non uniform space. By perceptually uniform we mean the equal perceptual difference between colors does correspond to equal distance in the color space. RGB space is suitable for the electronic displays but is not appreciated by the HVS.

In order to compress all the chromatic information in a single stimulus, the researches found that the HSI (Hue, Saturation, and Intensity) color space comes to aid. Here the different value of hue express the different colors perceived while the saturation gives the amount of dilution Added to a pure color and the intensity gives the achromatic information of all color. The hue is defined using both a*& b* together

$$H=\arctan(a^*/b^*)$$

The saturation is given by $s=\sqrt{(a^*)^2+(b^*)^2}$

Figure shows the relation between the CIELAB, HSI color space with the color processing by the HVS through the 3 types of cones (L, M&S) present in the retina. With the HSI space, when the image is to be segmented on perceptual basis, most of the times only the hue information will suffice. This makes this color space more useful in economizing the space & time complexities of the segmentation algorithm.

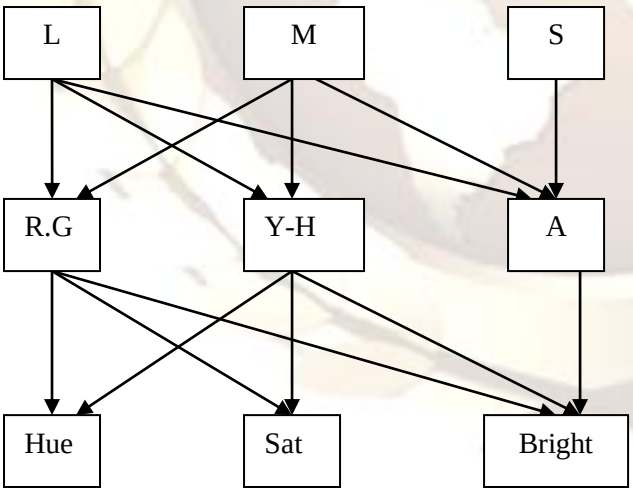

Figure 1: Relation of color spaces with Human Vision System

3.2 K-means

Most of the cases the object of interest differs form rest of the image only in color. Hence it is beneficial to segment the image on the basis Hue.HSI model is more nearer to human presumption. RGB model is good for displays. Most of times image contains one object of interest, necessitating us to segment image into 2 partitions. One partition containing object of interest. Let us call it as foreground, and the other contains rest of the image i.e. background.When the distribution of the color information in the image is clustered, K-means method is a better choice for the segmentation.When the image contains more than one object of interest with different color properties. K-means is used to segment it. K-means clustering algorithm can be extended for multiple clusters.

3.2.1 K -means Algorithm

1. Decide the number of partition k& initialize mean for k partition.
2. For every point in image
   a) Find the partition nearest to the point
   b) Add the point of to the partition
   c) Update mean
3. Repeat step 2 till reaches equilibrium.

4 .PERFORMANCE EVALUATIONS:

This proposed method has been used to segment an image into number of partitions based on the k-means. The proposed algorithm was applied to the below images i.e. For fig2 & fig3.Results obtained for 4 clusters. so, image can be segmented into 4 partitions. Here first image shows original, second hue and followed by 4 partitions.

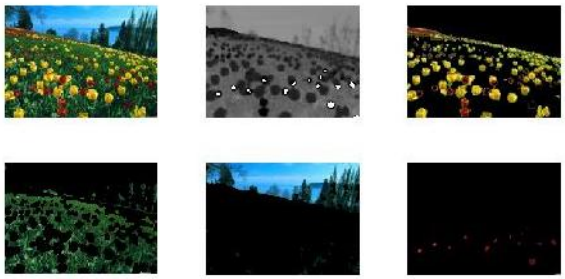

Figure 2: segmentation of a natural mage:
Top row: Original, Hue, One partition
Bottom row: Other three partitions

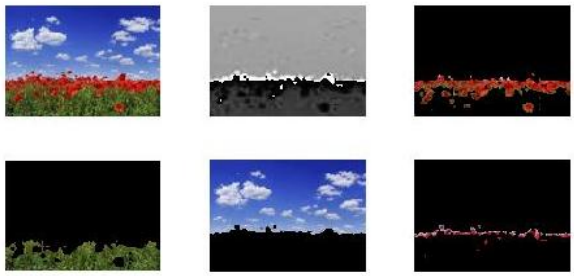

Figure 3: segmentation of a natural image

First image shows Original, Second shows its hue and followed by 4 partitions.

The original image is in the form of pixels and it is converted into a feature space (HSI).The similar points i.e. the points which have

similar color are grouped together using k-means clustering method. At each partition it displays an image which has similar color, i.e. clearly shown in above.

5 CONCLUSIONS:

The image segmentation is done using k-means clustering. So it works perfectly fine with all images. The clarity in the segmented image is good. Compared to other segmentation techniques. The clarity of the image depends on the number of clusters used. The k-means method is numerical, unsupervised, nondeterministic and iterative. For small number of k, k-mean computation is faster.

Higher time complexity of the k-means techniques is a drawback. This technique uses only the color feature for segmentation and spatial correlation is not used this work is in progress to reduce the time complexity and includes spatial correlation through the image of deformable models.

REFERENCES:

[1] Adrian Ford and Alan Roberts, "Color space conversions" Westminster university, London, 1998.

[2] Anil.Z Chitade,Dr.S.K.Katiyar,"color based image segmentation using K-means clustering", International journal of engineering science and technology,vol 2(10),2010,5319-5325.

[3] Chinki Chandhok,"color image segmentation using K-means clustering",Inter ational journal of VLSI and Signal processing application,vol 2,issue3,june2012,ISSN 2231-3133,(241-245).

[4] Marko Tkalcic, Jurij.F.Tasic"color spaces –perceptual, historical and application background".

[5] B.Nagajyothi, Dr.G.R.Babu and D.I.V.Murali Krishna,"color image segmentation using clustering techniques."International journal of computer electronics and electrical engineering (ISSN; 2249-9997), vol2, issue 1.

[6] Schmid.P"image segmentation by color clustering,http://www.schmid-saugeon.Ch/publications.html,2001.

[7] Stockman.G, Shapiro.L,"computer vision" prentice hall, New Jersey (2001).

[8] Symon D'O.CattANIL Z CHITADEon.color;"color space and the human visual system", school of computer science university of Birmingham,England,Technicalreport,1315-2TT,May 1996.

[9] A.Vadivel, M.mohan, Shamik Sural and A.K .Majumdar."Segmentation using saturation thresholdingand its application in content based retrieval of images".

[10] J.P.Wang"stochastic relaxation on partitions with connected components and its applications to image segmentations".PAMI, vol20, no.6, P.619'36, 1998.

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