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Segmentation of 2-D images on color basis with various techniques

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BSTRACT-Image Segmentation has become a major issue in the various fields for instance in scene alysis,Pattern recognition and image analysis etc. Image segmentation has become another important sue in the field of image processing and computer vision. Image segmentation, as its name Implies it the process of division of an images according to its relative characters.eg its objects and color esent in that particular image. There are several different techniques for the segmenantation of an age. This review is based on the watershed segmentation and MATLAB tool is being used. atershed segmentation has efficient results which is completely based on the contrast of an image. In se of acquisition of an image, image contrast has been degraded as well. There are various proaches which works better than the watershed segmentation like random walk approaches. This is probabilistic approach which helps in the improvement of image contrast in the order of degradation an image.

Index Terms- Color Image Segmentation, Clustering, Image Processing, K-Mean Clustering, L*a*b* Color space,Watershed algorithm.

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I. INTRODUCTION

Image segmentation is an important aspect of image processing research. This can be defined as the process of partitioning a digital image into many segments which may carry more purposeful information and hence make it easy to analyze[1]. Image segmentation is the process of dividing an image into uniform regions in order to find out meaningful information from the disjointed images. These regions can be considered homogeneous according to a given criterion such as color, motion, smoothness, etc. Image segmentation is always the researcher's first choice due to its dominant rule in image processing research. Clustering can be defined as unsupervised study where data items are partitioned into different groups called as clusters by keeping in mind two attributes: (1) High Cohesion and (2) Low Coupling [1]. According to the first attribute, data items belonging to one particular cluster must show high similarities. And, the second property says that data items of one cluster should not be identical to data items of the other clusters[2]. Segmentation is an important tool in many areas including trading, health care, image processing, remote sensing, traffic image, content based image, pattern identification, video and computer vision etc. A particular type of image segmentation method can be develop in application including the detection, identification, and measurement of objects in an image[3].

For segmentation,there are many techniques which can be applied on image. ButtheClustering methodology is used.

Unsupervised methods can be partially or completely automatic. User involvement might be necessary at some point in the process to improve performance of the methods, but the outputs should be more or less human independent. An unsupervised segmentation method automatically partitions the images without the need of operator involvement. Nodoubt, these architectures might be implemented using application specific a initial knowledge at design stage especially. anatomical, physical or biological knowledge. Clustering can be defined as an unsupervised learning technique, where to classify pixel,one needs to know the number of clusters in advance. A same condition is defined among pixels, and then identical pixels are grouped to form clusters[3]. The methodology which is used to separate the data into different groups known as clusters is known as clustering . But on doing so, two properties are considered: 1. High Intra cluster property 2. Low Inter Cluster Property. According to the first property, objects in the identical cluster should have high similarity and the second property says that objects of one cluster should be not be identical from the objects residing in another cluster. Clustering is found to be very known technique for the image segmentation task.K-Means algorithm among the available ones is adopted because of its simplicity[1].

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As L*A*B* color space is seen to be more identical to the way the human eyes perceive color, so, we choose this color space for our color image segmentation task. In lab color space,L states as Lightness, a & b for color opponent dimensions, depends upon non linearly compressed co-ordinates.Lab can be utilized to form proper color balance corrections by altering output curves in the a & b components,or by aligning the lightness contrast using the l component.

II. LITERATURE REVIEW

In this section, the various research conducted in this field is discussed

Vijay Jumb et al[3],an approach for color image segmentation is presented. In this technique foreground objects are differentiate clearly from the background. As the HSV color space is similar in the manner, human eyes recognize color, therefore,in this technique first RGB image is converted to HSV (Hue, Saturation, Value) color model and V (Value) channel is derived, because Value corresponds directly to the concept of intensity/brightness in the color basics part. After that an Otsu's multi-thresholding is applied on V channel to get the best thresholds from the image. The output of Otsu's multi-thresholding may composed of over segmented regions, hence K-means clustering is applied to combine the over segmented areas. At last, background subtraction is done along with morphological processing. This suggested system is applicable on Berkley segmentation database. The proposed method is compared with three different kinds of segmentation algorithms that assure accuracy and quality of different types of color images. The experimental results are acquired using metrics for instance PSNR and MSE, which proves the proposed algorithm, produces better results as compared to other algorithms**.**

Thodeti Srikanth et al[4], authors proposed that Image segmentation and its performance evaluation are very complex but important issue in computer vision. The goal of segmentation is to cluster pixels into important image regions, particularly, regions corresponding to individual surfaces, objects, or natural parts of objects. With the advancement in computer processing capabilities and the increased application of color image, the color image segmentation are more concerned by the researchers. Color image segmentation methods can be seen as an extension of the gray image segmentation technique in the color images, but

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many of the original gray image segmentation methods are not directly applicable to color images. This call for improving the method of original gray image segmentation method according to the color image which have the properties of rich information or research a new image segmentation method it specially applied to color image segmentation.This article proposes a color image segmentation method of automatic seed region developing on foundation of the region with the fusion of the watershed algorithm with seed region growing algorithm which is based on the earlier seed region developing algorithm**.**

N.R.Pal et al[5], the author proposed that many image segmentation methods are available in the literature. Some of these techniques use only the gray level histogram, some use spatial details while some use fuzzy set theoretic approaches. Most of these techniques are not acceptable for noisy environments. Some efforts have been made with the help of Markov Random Field (MRF) model which is vigorous to noise, but is computationally involved. Neural network architectures which are helpful to get the results in real time because of their parallel processing ability, have also been applied for segmentation and this work fine even when the noise level is very high. The writings on color image segmentation is not that rich as they are for gray tone images. This paper analyze and summarizes some of the methods. Efforts have been made to consider both fuzzy and non-fuzzy techniques along with color image segmentation and neural network based techniques. Appropriate attention is paid to segmentation of range images and magnetic resonance images. It also emphasis the issue of quantitative evaluation of segmentation results.

Ajay Desai et al[6], the authors described that a combined multidimensional image segmentation algorithm is suggested, which unifies edge and region-based methods with the morphological algorithm of watersheds. An edge-saving statistical noise reduction technique is used as a preprocessing stage in an attempt to calculate an accurate estimate of the image gradient. Then, an initial splitting of the image into primitive regions is found by applying the watershed transform on the image gradient magnitude. This initial segmentation will be the input to a computationally productive hierarchical (bottom-up) region merging process that creates the final segmentation. The final process uses the region adjacency graph (RAG) representation of the image areas. At each step, the most identical pair of regions is determined (minimum cost RAG edge), the regions are combined and the RAG is updated. Earlier, the above is implemented by storing all RAG edges in a priority queue.A significantly efficient algorithm is proposed, which additionally maintains the so-called nearest neighbor graph, due to which the priority queue size and delay time are drastically decreased. The final segmentation provides, due to the RAG, one-pixel wide, closed, and accurately localized

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surfaces. Experimental results obtained with two-dimensional/three-dimensional (2-D/3-D) magnetic resonance images are presented.

Dibya Jyoti Bora et al[1], the author proposed that Color image segmentation is very emerging field for researchers in Image processing. Clustering is a frequently chosen methodology for this image segmentation work. But for a effective segmentation, there arises the need of an optimal technique. In this paper,an unified approach for color image segmentation which is a new of its kind is proposed. Here, we combines the popular k-means algorithm and watershed algorithm. But, here we chose 'cosine' distance measure for k-means algorithm to optimize the segmented output of the later one. Also, as color space has a leading impact on color image segmentation task, so, HSV color space for our proposed approach is adopted. Since usually the noise arises during the segmentation process, so the obtained segmented image is filtered by median filter to make the output image clearer and free from noise. The output of the proposed technique is found to be quite satisfactory.

Dibya Jyoti Bora et al[2], the authorsproposed that In computer vision, image segmentation is always selected as a major research topic by researchers. Due to its vital scope in image processing, there arises the need of a better image segmentation method. Clustering can be defined as an unsupervised study with its use in almost every field of science and engineering. No-doubt many researchers are using clustering in image segmentation process there is also a need of improvement of such approaches. In this paper, a novel technique for clustering based image segmentation is proposed. Here, we give importance on color space and adoptedl*a*b* for this task. The popular hard clustering algorithm K-means is used, but as its performance is dependent on choosing an appropriate distance measure, so, "cosine" distance measure is adopted. Then the segmented image is filtered with sobel filter. Then, the image is evaluated with marker watershed algorithm to have the final segmented output of original image. The MSE and PSNR values are analyzed to observe the performance.

II. BASIC THEORY

A. LAB COLOR SPACE

In lab color space,L states as Lightness, a & b for color opponent dimensions, depends upon non linearly compressed co-ordinates.Lab can be utilized to form proper color balance corrections by altering output curves in the a & b components,or by aligning the lightness contrast using the l component. **CIE L*a*b* (CIELAB)** is a color space specified by

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the International Commission on Illumination.It explains all the colors percievable to the human eye and was created to serve as a device-independent model to be used as reference.

The three coordinates of CIELAB represent the lightness of the color (**L*** = 0 yields black and **L*** = 100 show diffuse white; specular white may be larger), its position between red/magenta and green (**a***, negative values shows green while positive values shows magenta) and its position between yellow and blue (**b***, negative values shows blue and positive values shows yellow). The asterisk (*) after L, a and b are pronounced star and are section of the full name, since they depict L*, a* and b*, to distinguish them from Hunter's L, a, and b. The L*a*b* model is a three-dimensional model, it can be shown properly only in a three-dimensional space. Two-dimensional depictions comprises chromaticity diagrams: parts of the color solid with a fixed lightness. It is crucial to realize that the visual depiction of the full gamut of colors in this model are never accurate; they are there just to help in understanding the concept.

B. *K- MEANS ALGORITHM*

This is a famous hard clustering algorithm best known for its simplicity. Usually hard clustering algorithm includes less mathematical computation in comparison to soft clustering algorithm. In soft clustering algorithms, it is also a unfavourableissue to determine the fuzziness factor. Due to these reasons, we have moved towards hard clustering algorithm and adopted K-Means algorithm. The main steps involved in K-Means algorithm are[1]:

[a]At first, we choose k initial clusters(randomly chosen)

[b] Then we assign all the objects to their nearest clusters.

[c] Re compute the centre of each cluster

[d]Repeat [b] and [c] until the centroids do not change or memberships finalize.

C. *WATERSHED SEGMENTATION*

Watershed transformation is a morphological based tool for image segmentation. In grey scale mathematical morphology the watershed transformation for image segmentation is originally proposed by Digabel and Lantuejoul (1977) and later improved by Li et. al. (2003). The watershed transform can be classified as a region-based segmentation approach.But the problems corresponding with watershed algorithm is the over segmentation problem. The

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over segmentation problem means development of too many regions.This problem of over segmentation can be solved with the following two methods:
(1) Hierarchical watershed segmentation
(2) Watershed by markers

In hierarchical approach, a tree of regions is generated from the result of the watershed.First, the regions and watershed are merged. Next, the hierarchical segmentation process merges the regions with lowest boundries. Finally, a tree which provides us the possibility to explore the different levels of fusion regions is obtained.

In our approach, Watershed by markers algorithm is being choosed.

The Marker-Controlled Watershed Segmentation consists of the following steps:
1. First, a segmentation function is computed which is an image whose dark regions are those objects we have to segment.

2. Foreground markers are computed. These are connected blobs of pixels in between each of the objects.

3. Then calculate background markers. These are pixels that are not part of any object.

4. Modify the segmentation function such that it has only minima at the foreground and background marker locations.

5. Finally the watershed transform of the changed segmentation function is calculated.

D. Random Walk

A process of image enhancement and that can be use to enhance the image if the image is degraded is defines as random walk. This method depends upon the random walk of a particle. In this method a seed point or starting point is found from where the particle can start its move. Where the seed point is located is irrelevant. All object pixels will be visited anyway. The resultant image through this method holds the number of times the particle is visiting a pixel (Erikson, 2005). The move of the particle is start from the seed point and the particle is jumped to a random position in its neighbor based on the condition that the random gray level is less than the gray level of the randomized position. Erikson (2005) proposed that if a a particle from a seed point p wants to jump to a random position q. it must satisfied the below condition

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if z1 < f (x1, y1) where z1 is the uniform random number. And f (x1, y1) is random position in the image.

Otherwise if z1 ≥ f (x1, y1) makes a new randomization until a move can be made

The numbers of iterations are dependent on the size of image. A rule of thumb is used, which is Niter > 100 × number of pixels in object.

IV. FUTURE WORK

This section outlines the future plan, which defines how to future expand this research.In this paper, An approach for clustering based image segmentation is presented**.**The goal of image segmentation process is to identify the segments of the image according to the image characteristic e.g., image color, objects shape etc. The simplified working of the image segmentation system is stated here. The most important step is the imageacquisition. Any deficiency during the image acquisition can cause many problems in the result. The image used in this process is taken from image library. The input images are of low contrast. This segmentation process deals with the problem caused by these low contrast images by applying a preprocessing step using random walk. This step enhances the contrast of the input image so that the gradient of the image is strong enough to properly segment the image by using the watershed. After preprocessing step the gradient of the image is finding by converting the input image to grey scale. And this gradient of image is used as the input the image. The results show the improvement in the segmentation results using random walk.

In the future,the techniques can be further utilized with 3-d images that may result in better and more efficient cluster and segmentation from an image which will reduce the elapsed time of the system.

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