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Color Image Segmentation with Different Image Segmentation Techniques

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Abstract— This paper deals with different image segmentation techniques to enhance the quality of color images. The technique follows the principle of clustering and region merging algorithm. The system is combination various stages like histogram with hill climbing techniques; auto clustering includes k means clustering, the consistency test of regions, and automatic image segmentation using dynamic region merging algorithms. The different techniques of image segmentation include thresolding, clustering, region merging, region growing, color segmentation, motion segmentation and automatic image segmentation. This paper mention different methods for efficient segmentation which is combination of different algorithms. Here the given image gets converted into histogram. The histogram is graphical representation of input image. The peaks from histogram diagram are detected using hill climbing algorithm; this gives the rough number of clusters for the further steps. The clusters are form usingefficient K means clusteringalgorithm. The regions having homogenous or similar characteristics can be combining with the nearest neighbor algorithm and dynamic region merging algorithm .This segmentation technique is useful in field of image processing as well as advance medical use.

Keywords— DP, NNG, Kmeans, SPRT, RAG, Hill climbing techniques,DRM.

INTRODUCTION

The image quality is an important issue since the use of images for practical purposes is increasing day by day. Image segmentation collects the useful pieces of the image [2] and uses it according to the application. There are different methods to segment the data. The efficient combination of the methods is used here for better segmentation results. The result imagerepresent segmented image which is useful for variety ofapplications. The image segmentation operation follows certain properties or attributes like intensity of colour, edgepattern, colour hue, edges, texture etc. [1]

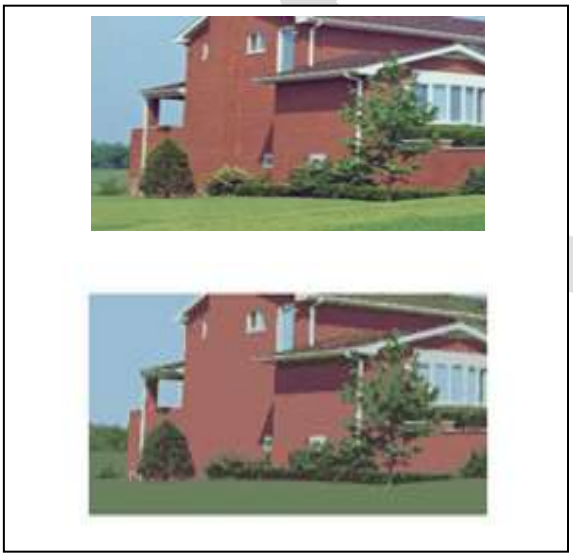


Fig 1.Original image with segmented image

As shown in the figure the segmented image is output of the system, which is output and is improved image. The system uses automatic image segmentation technique. The best example of automatic image segmentation is the use of dynamic region merging. The basic goal of these image enhancement techniques is to improve the images so that so they will be better to use as input to image analysis. This system converts given input image into corresponding histogram graph first, secondlyAuto clustering operation use for detection of the peaks. The detected peak gives number of clusters to be form as an input for the actual clustering.Then it gets

converted into clusters by using hill climbing algorithm. The homogenous features are captured with K means clustering. The actual merging is performed with the help of region adjency graph, nearest neighbour graph and dynamic region merging. This total system gives efficient output which is segmented image; this result image is useful from engineering field to medical field.

2. LITERATURE SURVEY

Literature review suggests various methods for image segmentation, this paper suggest combination of various methods which is beneficial from efficiency point of view. Following are some methods of image segmentation:

1. Thresholding: This is one of the useful and easy to use methods. This method separates given input data into different subparts according to its features. One subpart is with positive characteristics and another is with negative characteristics. Here as shown in the following diagram consider color as a feature, then this method divideinput image into black color and white color partition. [6] This operation is shown diagrammatically as follows:

Fig2.Input image Threshold effect on input image

2. Clustering:

Clustering is grouping of similar type of data. The clusters of the colors are formed with the help of various clustering technique such as Log based clustering, Fuzzy clustering; k-means (KM) [7] clustering. Out of these the paper suggests K means clustering. Input to clustering algorithm is K, whichare number of clusters and the all the data points are randomly assigned to the clusters. The procedure is repeated as we continuously computing the distance between the centroids and data points. K means clustering is the very well-known method to group the similar elements of the given image.

Fig3 conversion of original image into K Means segmentation

3. Automatic image segmentation

This is most advance method in the image segmentation. Dynamic region merging algorithm [9] and watershed algorithm [8] are the famous examples of Automatic image segmentation. In this process the closest regions are merged together to form output segmented image. The regions are represented bylabels, and these labels are transfers from initial to final label. And gets merged if we find large homogenous characteristics, this procedure continue up to stopping criteria.

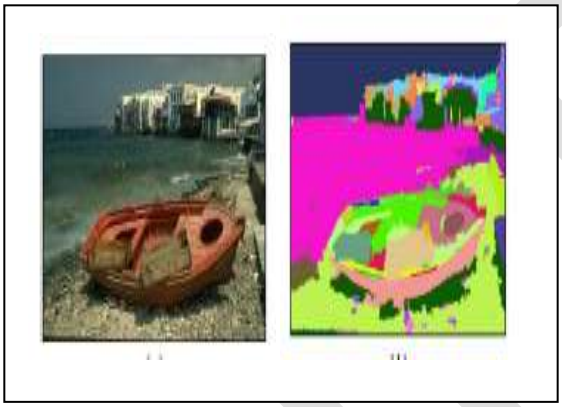
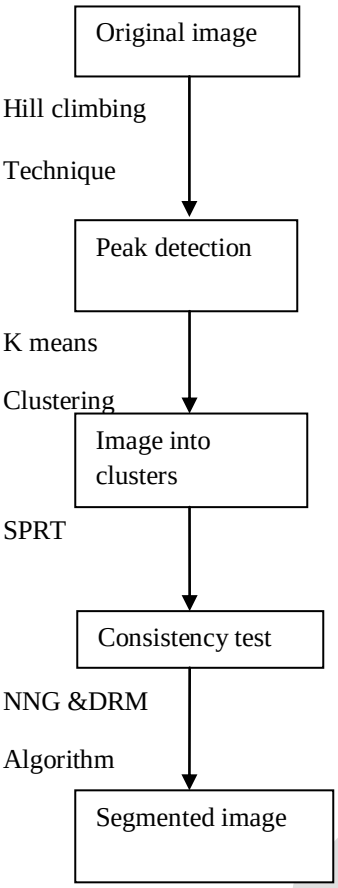


Fig 4 segmentation of original image in region merging style.

3. OVERVIEW OF SYSTEM



1. Hill climbing Technique

This algorithm is used at the initial stage in our system. This algorithm has unique property to detect the peaks from given histogram diagram. The algorithm [3][4] is mention as follows:

- Obtain histogram of the given color image.
- Start from initial points of color histogram graph, it then move upwardsup to peak.
- If number of pixels of the closest regions is not same then the algorithm goes upwards.
- If the closest regions have same numbers of pixels, then algorithm follows neighboring regions, and the process is continue.
- At last stage histogram gives number of peaks which gives number of clusters as input for the cluster formation. The hill climbing process is as shown diagrammatically below:

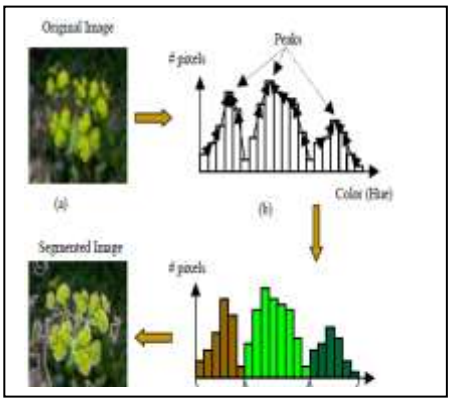


Fig.4 Hill climbing process

(a) Input image. (b) Hill-climbing process

(c) Histogram shows 3 peaks.

(d) Output as segmented image.

2. K means clustering: k-means clustering is an algorithm to divide and merge the objects based on some featuresinto K number of group. The groups are based on the squares of distances between random points of the images andits nearest cluster centroid. Iterate the process up to the final iteration. [7]

The algorithm for the K means is as follows:

- Consider number of clusters as input.
- Compute the centroid.
- Calculate the distance objects to centroid.
- If two regions find minimum distance the gather them.
- Continue up to stopping criteria. The color clusters are formed at the output stage.

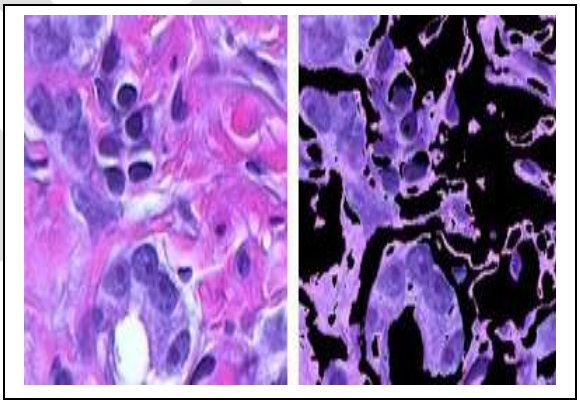


Fig5.Kmeans Clustering

3. Sequential probability ratio test: The neighbouring regions check the consistency of the regions using SPRT test [5].This test identifies the similar characteristics according to various attributes like intensity, edge etc. At the initial stage Consider two assumptions to check if the regions are similar or not.

- Result=valid, if neighboring regions are same in desired features, then called as valid hypothesis.

- Result=not valid, if neighboring regions are different, or very contradictory features then called as invalid hypothesis.

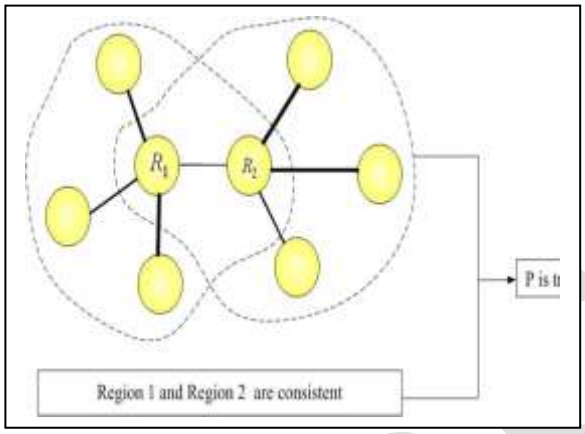


Fig.6 Consistency Test

SPRT Algorithm works as follows:

- Consider S number of regions which are in sequence.
- Form (A, B) as merging boundaries.
- Sequence of successive likelihood ratio (δ) is calculated.
- If this ratio is out of range the test stops.
- Otherwise the test is carried on.
- The algorithm for consistency test is as below
- Inputs: $A = \log(1-\beta/\alpha)$, $B = \log \beta(1-\alpha)$
  Where α, β are probabilities of decision error.

- The distribution of visual cues is given by $P0(x/\theta_0)$, $P1(x/\theta_1)$

- This values of predicate is calculated as
  $P_0 (x|\theta_0) = \lambda_1 \exp (-(I_b - I_{a+b})^T S_I^{-1}(I_b - I_{a+b}))$

  $P_1 (x|\theta_1) = 1 - \lambda_2 \exp (-(I_b - I_a)^T S_I^{-1}(I_b - I_a))$

- Choose the k pixels of neighboring regions.
- Calculate likelihood ratio $\delta = \log (P_0(x|\theta_0)/(P_1(x|\theta_1)$
- Update $\delta = \delta + \log (P_0(x|\theta_0)/(P_1(x|\theta_1)$
  If δ>=A, then regions are consistent

If δ>=B, then regions are not consistent.

4. Nearest neighbor graph

This algorithm is used to speed up the actual merging. Nearest neighbor graph structure is as shown below:

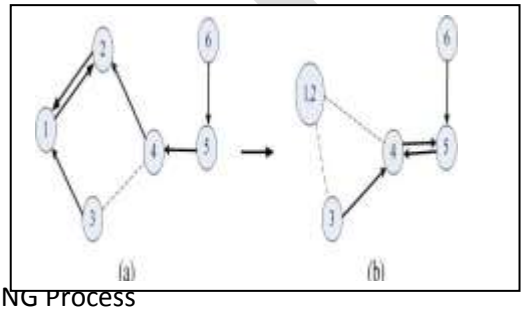


Fig 7.NNG Process

As shown in the above diagraph we can merge two regions directly if they find similar in the consistency test.there is no need to scan whole image. Thus the speed of the process is greatly increased.

5. Dynamic region merging algorithm

Dynamic region merging algorithm [1][9] is optimum algorithm as it is not over merged not under merge. It gives optimum solution as it follows the principle of dynamic programming. This algorithm divides the regions into problem, and each problem is assigned with label. Algorithm flows through initial label to final label to find the minimum edge weight.

If the algorithm finds minimum weight then we can merge the regions up to stopping criteria. Dynamic region merging algorithm gives automatic image segmentation

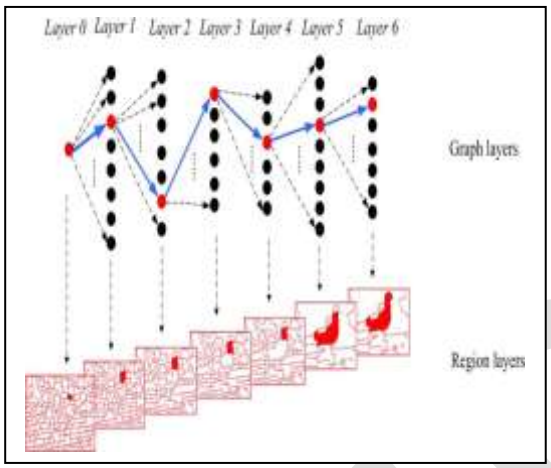


Fig.8 Dynamic region merging process as a shortest path in a layered graph (Upper row) the label transitions of a graph node. (Lower row) The corresponding image regions of each label layer. Starting from layer 0, (in red) the highlighted region obtains a new label from (in red) its closest neighbor. If the region is merged with its neighbor, they will be assigned to the same name of label. The shortest path is shown as the group of (in blue) the directed edges

4. SOFTWARE DEVOLOPEMENT

Interactive software is developed to do the reliable monitoring and management of segmentation process. The system software is made using MATLAB 10 .We are implementing hill climbing technique and k Means clustering first on the plane color image, and then applying consistency test using SPRT. Dynamic region merging algorithm and nearest neighbor graph on color image. This operation is totally software part. In the proposed DRM method, there are five parameters that control the consistency condition. While implementing the system there are four fix parameters, they are α, β, λ1, λ2.Here (α, β) represent the probability of accepting an "inconsistent" model as "consistent" and rejecting a "consistent" model as "inconsistent" .m is used to decide the amount of data selected for the random test. If we set λ2=1, then only λ1 is the user input which can be vary.

RESULT

Following images will show the output results:

Input image

Result image:

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CONCLUSION

Thusin this paper we studied the different image segmentation technique at different stages. The use of algorithms like hill climbing algorithm and K means algorithm are used for auto clustering. The region consistency is check by sequential probability ratio test.The

nearest neighbor graph and dynamic region merging algorithm combination gives efficient and enhanced output image. Thus total system makes use of variety of algorithms to get segmented image.

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