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Image Segmentation Using Dynamic Region Merging

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Abstract:-In region merging the there are two essential issues first is order of merging and second one is stopping criterion. This work addresses two issues which are solved by Dynamic region merging algorithm which is defined by SPRT and the minimal cost criterion. The process is start from an oversegmented image, then neighboring regions are progressively merged if there is an evidence for merging. The final result is based on the observed image. This algorithm also satisfies the certain global properties of segmentation. In this algorithm region merging process become faster due to nearest neighbor graph in each iteration. The performance of dynamic region merging algorithm is shown on natural images.

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INTRODUCTION

The image segmentation is a vital process of the image analysis and the image comprehension. It is a process of partitioning a digital image into multiple regions, which are different objects in image which have the same features like texture or color. The segmentation result is a set of regions that collectively cover the entire image, or a set of contours extracted from the image. All of the pixels in a Region is similar with respect to some characteristic or computed property, such as color, intensity, or texture. Adjacent regions are significantly different with respect to the same characteristics. Image is the powerful medium which represents the information and process that in a compact and efficient way.

Image segmentation algorithms are normally based on one of two basic properties of intensity values of the image pixels: discontinuity andsimilarity.When intensity value changes then partition an image based on that sudden changes. The idea is to partition the image into different regions such that pixels belonging to a given region are similar with respect to a set of predefined criteria's.

1. SYSTEM OVERVIEW OF PROPOSED METHOD

This proposed work is based on DRM algorithm for an Image Segmentation as dynamic region merging process, which is proposed to minimize an objective function with the merging predicate *P*.For simplicity and in order to validate the effectiveness of the proposed DRM algorithm, we use the watershed algorithm to obtain the initially over-segmented, yet using a more sophisticated initial segmentation algorithm lead better final segmentation results.

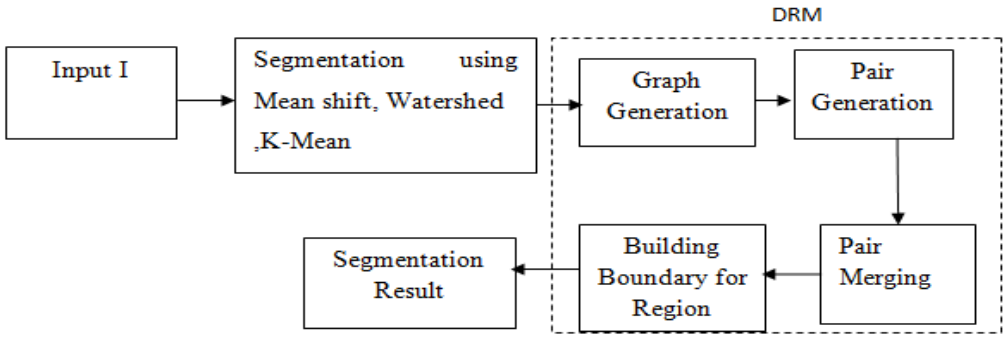


Figure 1.1 System Architecture Of Proposed Method

Figure 1.1 shows the system architecture of dynamic region merging process. The input image is taken from Berkeley Segmentation Dataset[10]. Segmentation is applied on the image by using DRM algorithm. Later on segmentation graph is generated, which in turns generate pairlist P1 and pair listP2 ,from these pair lists pairs get merge. Furthermore the boundary is build for regions and then it gives the segmented result.

This work is carried out using various algorithms for segmentation then the segmented output is given as inputto DRM algorithm and then we get the resulted output.

1.1 Mean shift Algorithm

The mean shift algorithm is a clustering technique which is nonparametric and neither require prior knowledge of the number of clusters nor constrain the shape of the clusters.

This algorithm is use for the initial segmentation. The algorithm is:
step 1:Fix a window around each data point.
step 2: Compute the mean of data within the window.
step 3: Shift the window to the mean and repeat till convergence.

1.2 Watershed Algorithm

The Watershed algorithm is used to separate plane image into regions. The watershed transform can beclassified as a region-based segmentation approach. This method comes from geographythat of a landscape or topographic relief which is flooded by water, watersheds being the divide lines of the domains of attraction of rain falling over the region. The boundaries are continuous and there are no gaps. The watershed algorithm is as follows:
Step 1: Read in an Image and covert it in grayscale.
Step 2: Use the gradient magnitude as the segmentation function.
Step 3: Mark the foreground objects and compute the background markers.
Step 4: Compute the watershed transform of the segmentation function.
Step 5: Visualize the result.

1.3 K-Mean Algorithm

This algorithm clusters the point nearest to the centroid. The centroid is basically the average of all the points in that cluster and has coordinate as the arithmetic mean over all points in the cluster, separately for each dimension. This algorithm minimizes the total distance of data points to the cluster center, of the cluster they are assigned to. Also it does not require the actual computation of distances.
The K-Mean algorithm
Step 1**:** Randomly select cluster centers and calculate the distance between each data point and cluster centers.
Step 2: Assign the data point to the cluster center whose distance from the another cluster center is minimum and recalculate the new cluster center.
Step 3: Recalculate the distance between each data point and new obtained cluster centers, no data point was reassigned then stop, otherwise repeat from step 3.

1.4 Dynamic Region Merging algorithm

The DRM algorithm is used for an Image Segmentation as dynamic region merging process, which is proposed to minimize an objective function with the merging predicate *P*. the proposed work is started from a set of over-segmented regions, because a small region can provide more stable statistical information than a single pixel, and using regions for merging can improve a lot the computational efficiency.
There are many regions to be merged for a meaningful segmentation. By taking the region merging as a labeling problem, the goal is to assign each region a label such that regions belong to the same object will have the same label, some global properties of thesegmentation can be obtained. It can be noted that the proposed DRM algorithm produces a segmentation which is neither over-merged nor under-merged according to the proposed predicate *P*.

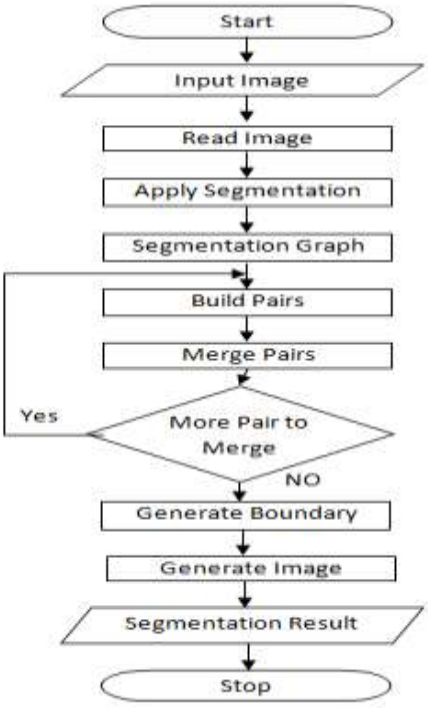


Figure 1.2.Flowchart of proposed system

Figure 1.2 shows the flow Chart of proposed system The algorithm is summarize in the steps:
Step 1: Take input image file.
Step 2: Read image file.
Step 3: Extract width and height of image file.
Step 4: Apply segmentation.
Step 5: Extract the regions from segmented output.
Step 6: Build pairing of segmented region.
Step 7: Generated pair get merged.
Step 8: Generate boundary around the region obtained after merging.
Step 9: Generate image.
Step 1**0** :Show result.

2. RESULT AND DISCUSSIONS

This proposed work is tested on various images of Berkeley Segmentation Dataset which consist of 100 test images.

Performance Parameter Evaluation

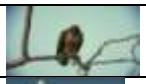
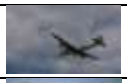
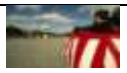
Formula For performance parameter

1) Number of Regions
2) Accuracy(in percentage)
   Accuracy= 1-(ground truth image value-output image value)
3) Time(in seconds)
   Execution time = (end time –start time).

2.1 Results using Mean-shift with DRM algorithm.

Input image of size 481 x 321 is given as input.Segmentation using mean shift algorithm is carried out. In this the mean of all data points is calculated, later on window is fix around data points and the procedure is repeated till the segmented result. This segmented result is given as input to DRM. Further the graph is generated from the gradient value of each node and accordingly pair list P1 and P2 is build and pairs from P1 and P2 is merge,this procedure is repeated till no pairs are found for merge and get final result. In the similar way other image on dataset are tested and result of 10 such images are enlisted. The accuracy is calculated from ground truth image and output image. The average accuracy for MDRM is 96.23% given in table 2.1.

Table No 2.1 Results using MDRM

Sr No	Image	Ground Truth	No Of Regions	Time	Accuracy
1			19	4.84	90.25
2			26	4.87	87.73
3			49	5.04	91.73
4			9	4.77	95.3
5			22	4.82	91.67
6			18	4.87	93.67
7			37	4.95	90.79
8			21	4.86	95.18
9			43	4.88	92.2
10			18	4.94	93.4
Average accurcy					96.26

2.2 Results using Watershed with DRM algorithm.

Input image of size 481 x 321 is given as input. Segmentation using watershed algorithmis carried out. In this image is converted into gray scale, then gradient magnitude is calculated. Further foreground object is mark and then watershed transform computed and get the output. This output is given as input to DRM and then the same procedure carried out which is mentionin2.1. The average accuracy for WDRM is 96.13% given in table 2.2.

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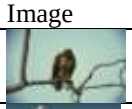
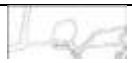
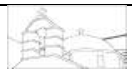
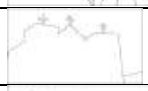
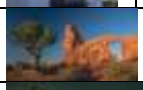
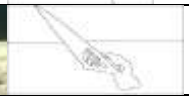
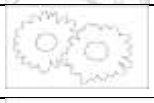
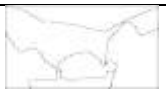
Table No 2.2 Results Using WDRM

Sr No	Image	Ground Truth	No Of Regions	Time	Accuracy
1			2	3.08	91.61
2			7	2.84	92.71
3			9	2.82	99.26
4			2	2.81	96.84
5			7	2.83	95.68
6			7	2.83	95.91
7			11	2.86	95.87
8			5	2.86	98.23
9			10	2.85	96.47
10			4	2.90	98.75
Average accuracy					96.13

2.3 Results using K-Mean with DRM algorithm.

Input image of size 481 x 321 is given as input. Segmentation using K-Mean algorithm is carried out. In this cluster center is selected then the distance between data point and center is calculated .Later on assign a cluster center which is near to data point and then recalculate the center ,this procedure is repeated till no data point is remains to assign and get the output. This output is given as input to DRM and the same procedure is carried out which is mention in 2.1. The average accuracy for KDRM is 97.70% given in table 2.3.

Table No 1.3 Results Using KDRM

Sr No	Image	Ground Truth	No Of Regions	Time	Accuracy
1			18	1.83	97.07
2			17	1.79	96.46
3			30	1.84	97.75
4			11	1.78	98.72
5			15	1.82	97.70
6			13	1.82	98.19

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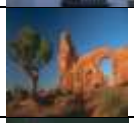
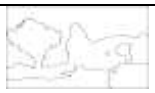
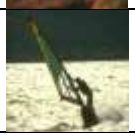
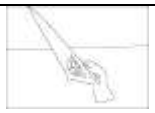
7			16	1.83	96.77
8			14	1.78	98.50
9			24	1.83	97.30
10			11	1.79	98.63
Average Accuracy					97.70

2.4 Comparison of accuracy and time

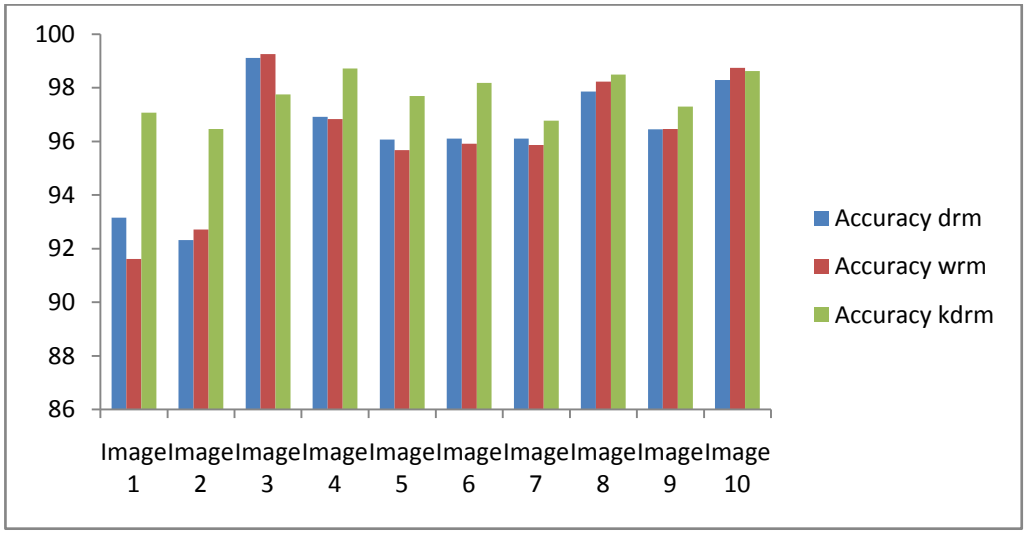


Figure 2.1 Plot of accuracy

Figure 2.1 shows the comparison of accuracy by using three algorithms MDRM,WDRM and KDRM. It shows that KDRM gives the better accuracy than the other two algorithms.

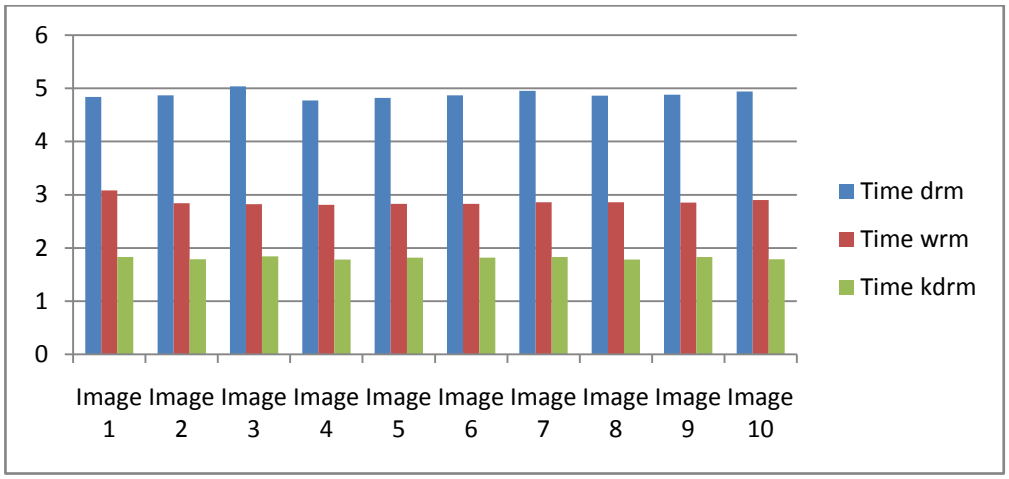


Figure 2.2 Plot of time

Figure 2.2 shows the comparison of time using three algorithms MDRM, WDRM and KDRM. It shows that the time required to execute the complete algorithm is less for KDRM algorithm than the other two algorithms.
By using K-Mean algorithm we can change the value of Kand then calculate the accuracy and time.

Table 2.4 Accuracy for different K

Accuracy			
SR No	Image	K=3	K=5
1	Image 1	97.07	95.53
2	Image 2	96.46	94.33
3	Image 3	97.75	97.88
4	Image 4	98.72	97.67
5	Image 5	97.7	96.82
6	Image 6	98.36	97.47
7	Image 7	96.77	97.47
8	Image 8	98.61	98
9	Image 9	97.3	97.69
10	Image 10	99.07	97.76

Table 2.5 Time for different K

Time			
SR No	Image	K=3	K=5
1	Image 1	1.83	1.99
2	Image 2	1.79	1.96
3	Image 3	1.84	2.05
4	Image 4	1.78	2
5	Image 5	1.82	2.05
6	Image 6	1.82	2
7	Image 7	1.83	2.02
8	Image 8	1.78	1.97
9	Image 9	1.83	2.04
10	Image 10	1.79	2.01

Comparison of Output

(a) Original image

(b) Segmentation results by MDRM

(C) Segmentation results by WDRM

(D) Segmentation results by KDRM

CONCLUSIONS

Dynamic Region Merging algorithm is an efficient algorithm for Imge Segmentation. A new comparative method is developed by using K-Mean along with DRM.The proposed method gives the modified segmentation algorithm.. Experimental result shows that segmentation using K-Mean algorithm with DRM givesbetter accuracy hence the segmentation efficiency is large. Result also shows that the execution time required to KDRM is very much less than the existing methods.This means we can say that we obtained improvement in results by modifying the segmentation algorithm.

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