Assignment#3

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This assignment include two parts: segmentation through grab cut and meanshift. In the first part, I used MATLAB to obtain saliency map, then use C++ to draw rectangle and implement grab cut. In the second part, I use MATLAB to for the whole part, including implement mean shift and evaluate the result. Next I will show the detailed steps.

Part I Grab Cut

The whole framework of the implementation as follows.

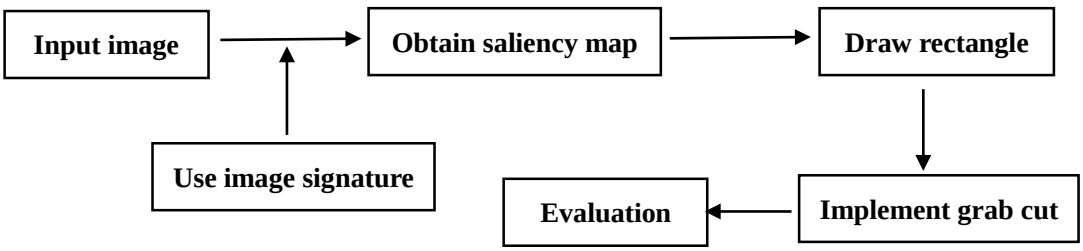


Figure 1: framework of grabcut

Step 1.1 : Input image

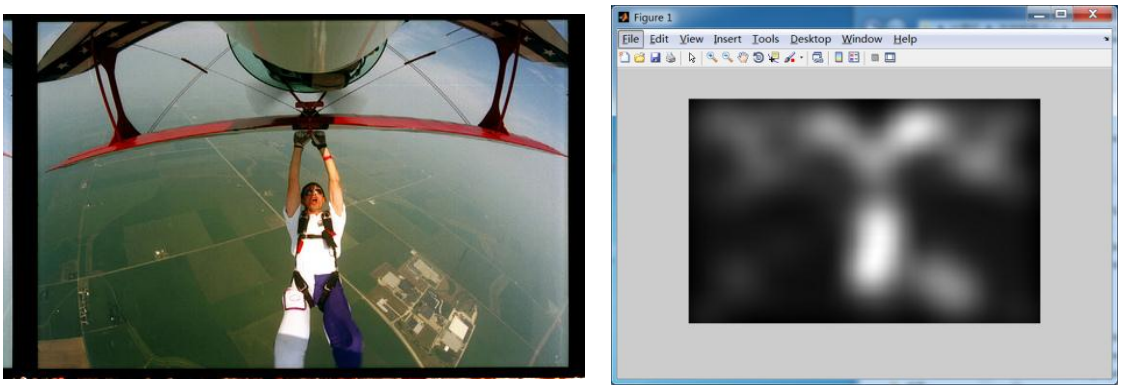
I downloaded the dataset from website given by *Assinment #3*, the dataset contains input images and groundtruth. Then I write a piece of MATLAB code to read in all the image name.

Step 1.2 : Use image signature obtain saliency map

Use the image obtained by setp 1.1 to calculate saliency map. I downloaded the MATLAB code "signatureSal" from the website given by the assignment. The result of this step is shown in Figure 2.

Step 1.3 : Draw the rectangle

Use a threshold to transform saliency maps to binary images and draw a rectangle according to the binary image. The binary images is used to determinate he significant area. Then draw a rectangle to surround it. The result can be seen in Figure 3.



(a) Input image (b) Saliency map

Figure 2: Saliency map

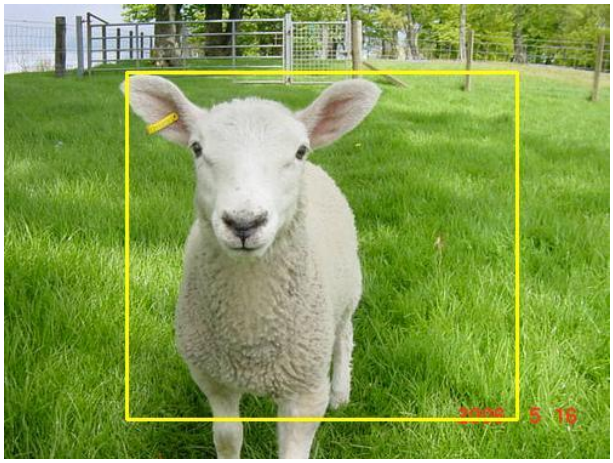


Figure 3: Rectangle in input image

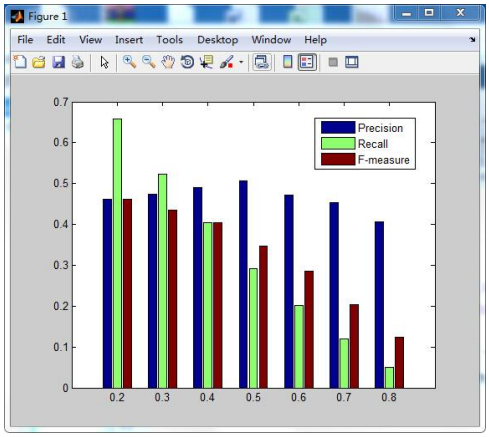
Step 1.4 : Implement grab cut

Use the images got from Step 1.1 and the rectangle computed from Step 1.3 to implement grab cut. This step is the key procedure of Part I. According to the assignment requirements, the grab cut need to iterate *k* times. In my assignment I set *k* as several values, and the final result of one picture is shown in Figure 4,

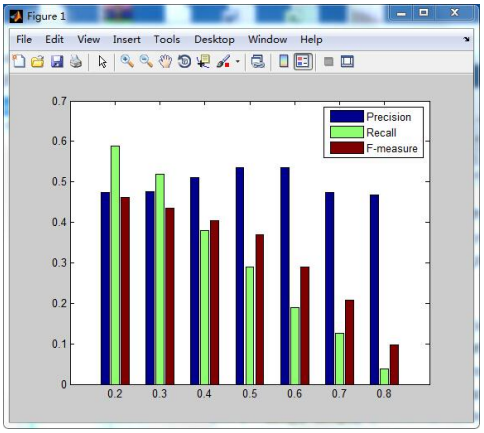
Figure 5: Segmentation result

Step 1.5 : Evaluate segmentation result

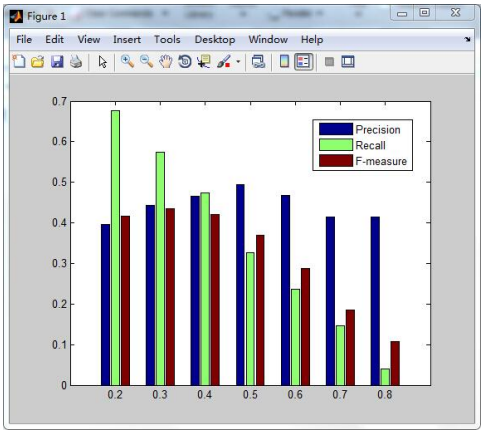
Use the segmentation result got from Step 1.4 and the groundtruth from dataset to evaluate segmentation result. According to the assignment requirements, I adjust threshold to obtain different segmentation results and then draw a bar graph to show the evaluation. The evaluation result is shown in Figure 6.



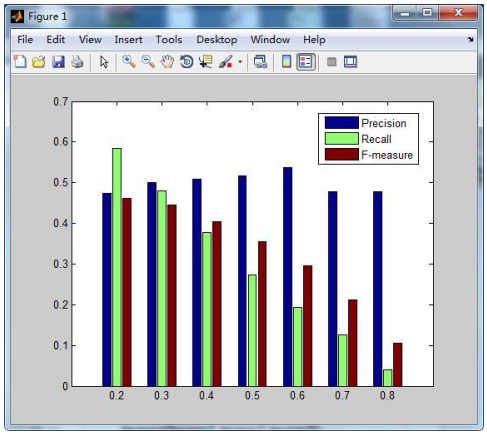
(a) iterate 3 times



(b) iterate 4 times



(c) iterate 5 times



(d) iterate 6 times

Figure 6: The evaluation result

Part II Mean shift

The whole framework of my assignment for this part is shown in Figure 7.

Step 2.1 : Input image

Download a simple dataset from the website given by the assignment. The dataset contains input images and groundtruth. I choose some of the images from the dataset for segmentation. In this step, I write a batch process program, which can input all the image automatically.

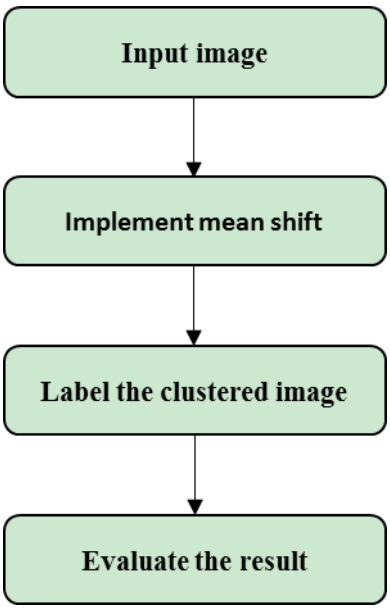


Figure7: Framework of Part II

Step 2.2 : Segment via mean shift

In this step I used a MATLAB function downloaded from website. The function can implement mean shift to cluster the pixels. There are four parameters in the function, the bandwidth of spatial kernel, the bandwidth of feature kernel, the threshold of the convergence criterion and the number of iterations. I adjusted the first two parameters to study their influence on the final result. One of the result is shown in Figure 8.

(a) Original image (b) Image after clustered

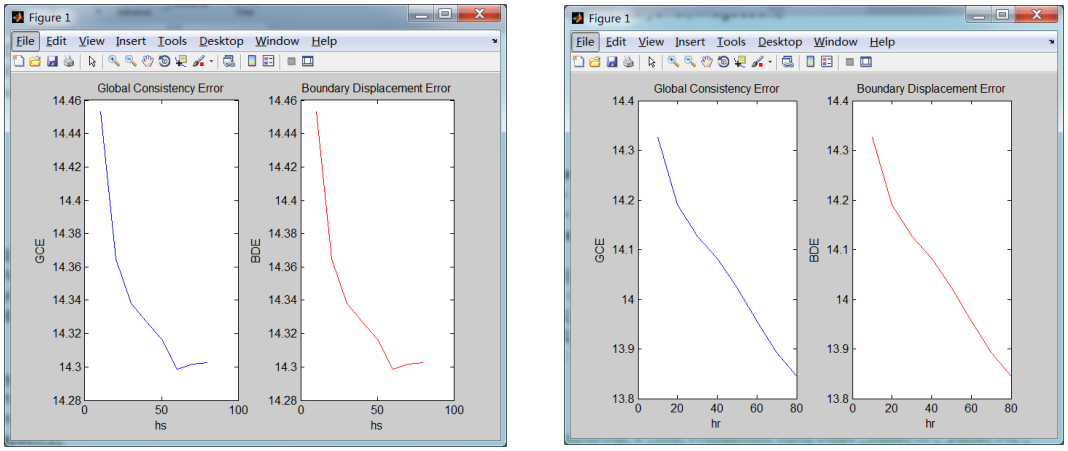
Figure 8: Images before and after mean shift

Step 2.3 : Label the clustered image

In order to evaluate the result, you need to compare your result with the groundTruth given by the dataset. The groundTruth is a dataset of label map, each clustered image corresponding to a label map. So I labeled my clustered images using a MATLAB function provided by Wang Ruchen.

Step 2.4 : Evaluate the segmentation

In this step I use an evaluation function provided by Wang Ruchen. The function can use four methods, Probabilistic Rand Index (PRI), Variation of Information (VOI), Global Consistency Error (GCE) and Boundary Displacement Error (BDE), to compare my segmentation result with the groundtruth. Then draw a line chart of the evaluation result, shown in Figure 9.



(a) (b)

Figure 9: (a) hr=20, iterations=6, image number= 100. (b) hs=30, iterations=6, image number= 100.