CV2015Spring—Assignment #3

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1. Overview

As the assignment required, I implemented segmentation through grab cut and meanshift, and then evaluate each method by adjusting parameters in segmentation. In the grab cut part, I choose three parameters to adjust: threshold, size of rectangle and times of iteration. Then, compute the mean value of evaluation result from all images and draw PRF bar graph to evaluate each parameter. the result is listed by the end of each part.

2. Grab cut

The whole framework of the implementation for evaluation of grab cut is shown in Figure 1.

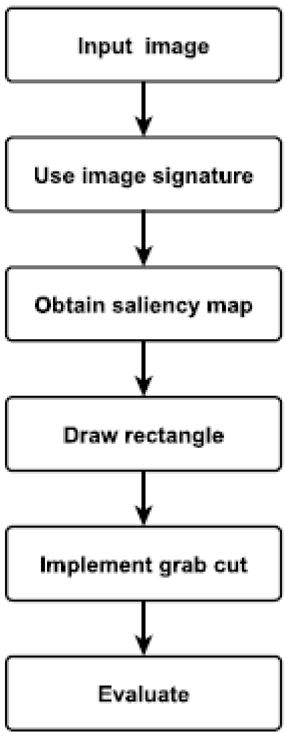

Figure1 Framework of the implementation for evaluation of grab cut

I followed the steps which were shown in the assignment #3.and here is the main steps.

1. Implement image signature, grab cut and evaluation
2. Adjust one parameter to obtain different segmentation results, then evaluate .
3. Adjust another parameter to obtain different segmentation results and evaluate.

2.1 Step 1: Input image

In this step I used the PASCAL dataset to download on the assignment web page 1 and get it uncompressed. The dataset contains raw images and their groundtruth. I use all images from the dataset for segmentation, and evaluate grab cut by adjusting some different parameters such as the thresthod parameter.

2.2 Step 2: Use image signature

Input The input color image (m×n×3 matrix).

Output The saliency map (m×n matrix).

In this step I got the saliency map by image signature and downloaded the matlab code of "signatureSal" from website2, where the files of SIG_single, signatureSal and default_signature_param are used. When I get the saliency map, I use two for loops and one if...else to get the binary images of seven thresholds as the input of the next step and save these images to a file.

Figure 2 binary images

2.3 Step 3 & step 4 : Draw the rectangle & implement grab cut

Input The input saliency map image (m×n matrix).

Output A rectangle that is used to initialize the grab cut and The image after segmentation (m×n×3 matrix).

In this step, I use opencv to deal with the images. Firstly, I processed the images of seven thresholds and store the path of origin images and saliency maps. Then I stored all of the images in these paths and store their information. Thirdly, I processed images of each threshold with the iterations of 3,4,5 and 6 in Grab Cut. I read in the origin image and saliency map and their length and height. At last I used the program which is already given to do the grab cut.

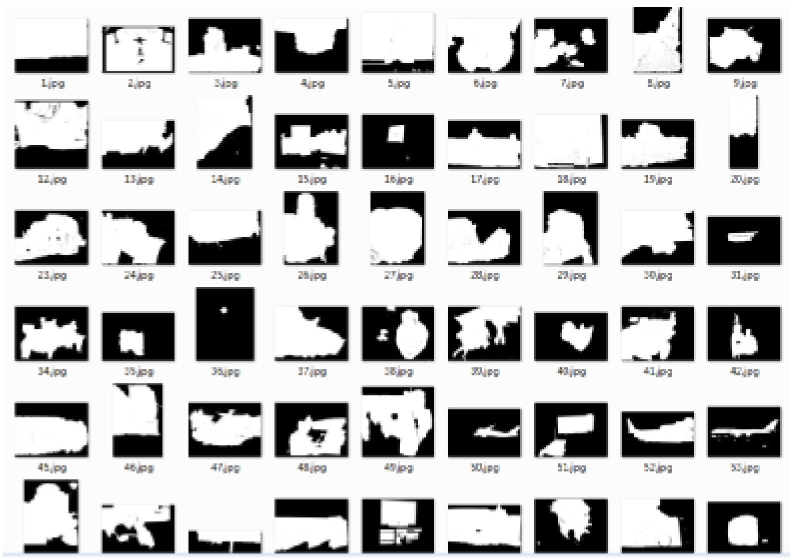

Figure 3 different threshold list

2.4 Step 5: Evaluate segmentation result

Input Segmentation result (m×n×3 matrix) and groundtruth (m×n matrix) from dataset.

Output A figure that indicates evaluation results (The horizontal axis represents the parameter, the vertical axis represents the evaluation results.).

In this step I draw some PRF (Precision Recall F-measure) bar graph to evaluate the out come of Grab cut. I alterate the iteration paramter to 3, 4, 5, 6 so that the result is different. And here is the result.

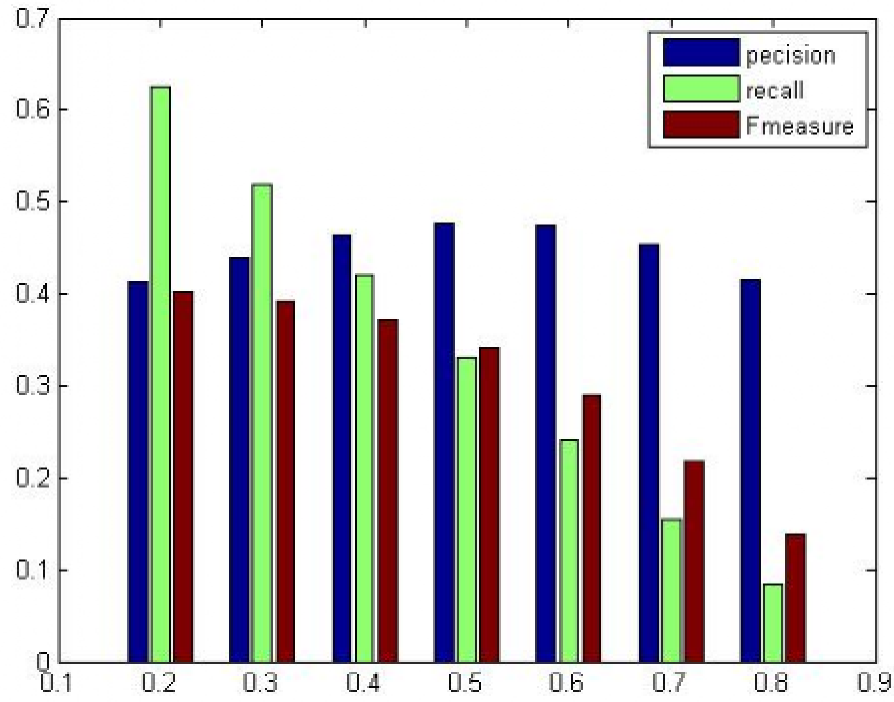

Figure 4 Evaluation chart when iteration=3

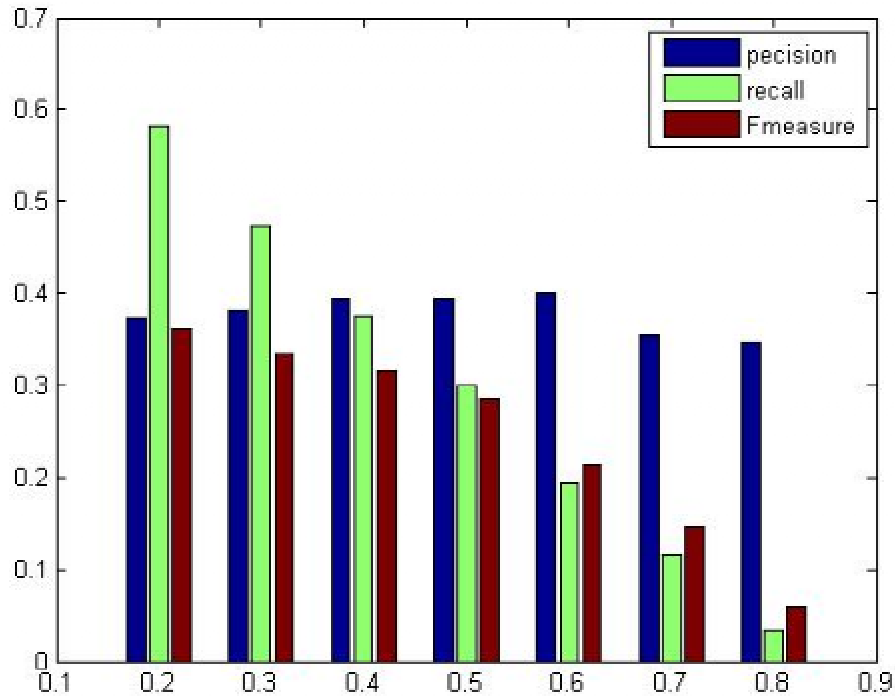

Figure 5 Evaluation chart when iteration=4

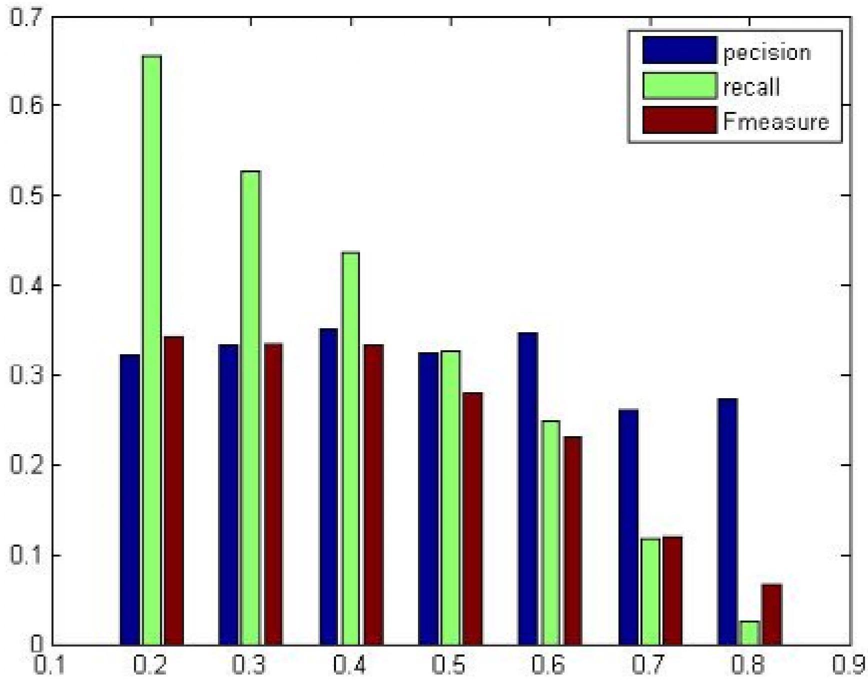

Figure 6 Evaluation chart when iteration=5

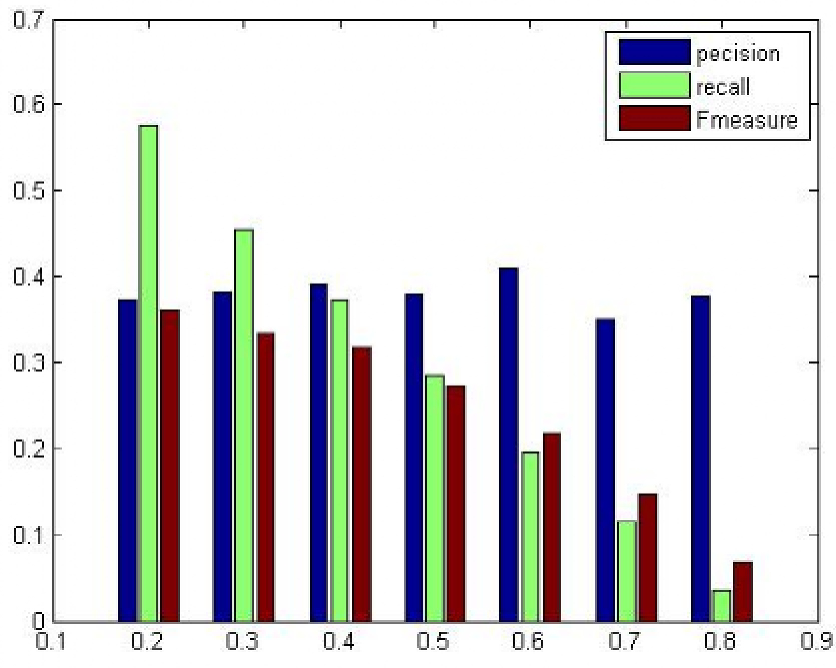

Figure 7 Evaluation chart when iteration=6

3. Mean shift

The whole framework of the mean shift method is shown in Figure 8.

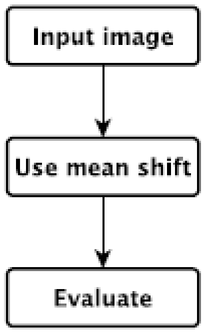

Figure 8: Framework of the implementation for evaluation of mean shift

3.1 Step1 & 2 Input image & Segment via mean shift

Input The color image (m×n×3 matrix).

Output The segmentation results (m×n×3 matrix) and label matrixes (m×n matrix) of different parameters.

In this step I use two matrix to store the parameters of means shift and use one for loop to get the outcome with different parameters. And in the first loop, I fix hr as 10 and changes hs from 10 to 100; in the second loop, I fix hs as 40 and changes hr from 10 to 100. Without that I use function dir get all the images and mat files under two paths and store their information in Files 1 and Files 2. And I use one for loop to get the outcome of each images with every parameters. Then I use function processSuperpixelImage() to get the label maps and save them.

3.2 Step3 Evaluate segmentation result with groundtruth

Input The label matrixes (m×n matrix) from step 2, the groundtruth matrixes (m×n matrix) from dataset.

Output Line chart of the evaluation results. (The horizontal axis represents parameters. The vertical axis represents the evaluation results.)

In this step I use four evaluation methods, including:

- Probabilistic Rand Index (PRI)
- Variation of Information (VOI)

- Global Consistency Error (GCE)
- Boundary Displacement Error (BDE)

The results were shown below.

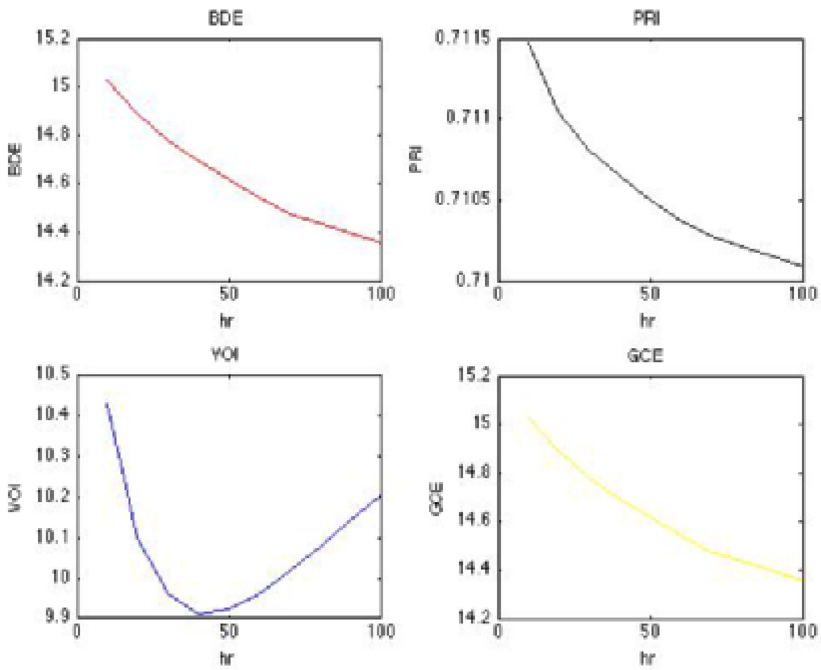

Figure 8 Line chart of BDE PRI VOI GCE by adjusting Spatial radius

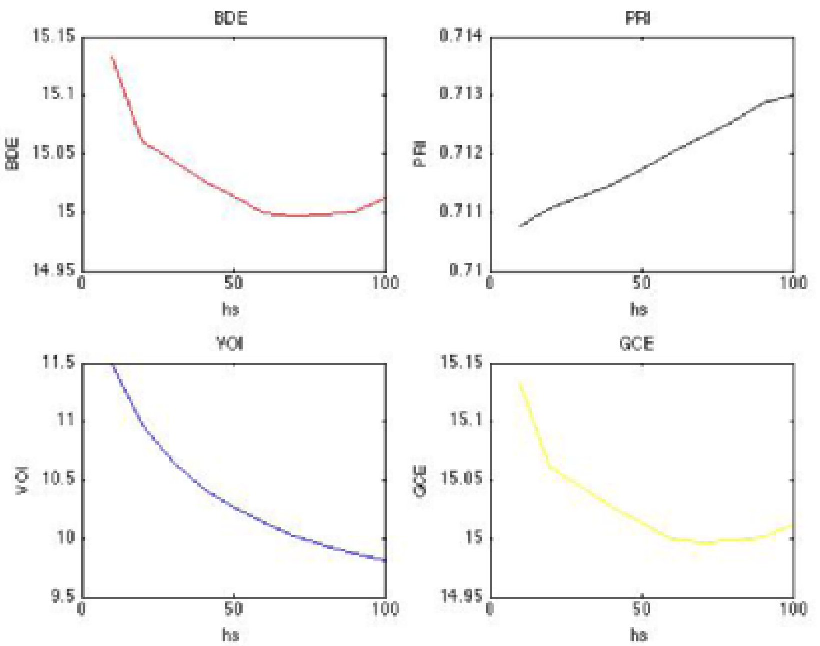

Figure 9 Line chart of BDE PRI VOI GCE by adjusting Color radius

From the Figure 8 and Figure 9 we can see that a segmentation is better if PRI is larger and the other three are smaller, when compared to the ground truths.