Feedback — Quiz #5

Help Center

You submitted this quiz on **Mon 16 Feb 2015 9:41 PM IST**. You got a score of **9.00** out of **9.00**.

Question 1

Consider you want to use the Hough transform to detect an ellipse in an image. What are the dimensions of the accumulator space? In other words, how many parameters you need to estimate?

Your Answer		Score	Explanation
○ 4			
◉ 5	✔	1.00	
○ 2			
○ 1			
Total		1.00 / 1.00	

Question Explanation

You can check Wikipedia. In general, you need 2 for detecting the center, 2 for the major and minor radii, and 1 for the rotation of the axes.

Question 2

Assume you have an image with a trimodal distribution, meaning you have 3 core pixel values (consider an histogram composed of 3 Gaussians). How would you use Otsu's method, designed only for bimodal distributions, to segment the image? Simply write your suggestion in the box below.

You entered:

designing 3 models- one vs other two

Your Answer		Score	Explanation
designing 3 models- one vs other two	✔	1.00	
Total		1.00 / 1.00	

Question Explanation

This goes into the area of hierarchical clustering. You could apply Otsu's method twice, and hope (depending on the separation between the Gaussians and their variance) that the first application separates one of the regions, and then a second application sub-divides the mixed objects into two objects. The success of this depends on the separation of the Gaussians and their mass (how many pixels are in each distribution). A suggested programming exercise investigates this.

Question 3

Considering foreground/background segmentation via graph cuts, which one of the following is an appropriate function for the weights between nodes representing image pixels?

Your Answer		Score	Explanation
◉ A function of the grey (or color) difference between the pixels.	✔	1.00	
○ A function of the area of the foreground object.			
○ A function of the grey (or color) average of the connected pixels.			
○ A function of the pixel's class.			
Total		1.00 / 1.00	

Question Explanation

We need to encourage pixels with similar values to stay together, and the gradient is an inverse measure of that. Note that the average doesn't provide that information and the other suggested

answers are based on the actual segmentation, which we don't have and is what we are looking for.

Question 4

In the Mumford-Shah segmentation model, what would be a good measure to penalize for creating too many segments?

Your Answer		Score	Explanation
◉ The total segments' boundary length.	✔	1.00	
○ The area under the histogram curve.			
○ To maximal pixel value in the image.			
○ The difference between that maximal and the minimal pixel value in each segment.			
Total		1.00 / 1.00	

Question Explanation

This is exactly what discussed in the video, and in a discrete image, measuring the total length of the boundaries is a form of measuring how many segments were found (in fractals this will not apply).

Question 5

How would you combine Otsu's algorithm with Mumford-Shah concepts to design a segmentation algorithm that considers both ideas simultaneously?

Your Answer	Score	Explanation
○ They are two incompatible algorithms and can't be combined.		
○ First find the optimal threshold via Otsu's algorithm and then		

return both the threshold and the length of the detected segments.		
Bound the possible threshold solutions.		
Add a length term to Otsu's algorithm penalty function and perform brute-force search for the optimal threshold that minimizes the new penalty.	✔	1.00
Total		1.00 / 1.00

Question Explanation

In Otsu's method we are minimizing the within variance, and that penalty function can be augmented with additional terms such as the length of the obtained segments. The recursive solution is lost and therefore all possible thresholds need to be tested for the one that minimizes the new augmented penalty.

Question 6

The threshold computed by Otsu's method is unique.

Your Answer		Score	Explanation
Yes.			
No.	✔	1.00	
Total		1.00 / 1.00	

Question Explanation

Consider an image with ½ pixels with value 0 and ½ pixels with value 255. Any threshold in between these two values will give the same result.

Question 7

Consider an image that is constant, with gray value A, except for a few straight lines of random

orientation and length, but constant gray value B ($A \neq B$). Which technique/s can you use to segment all the pixels in the image into 2 groups, one for the background and one for the lines?

Your Answer		Score	Explanation
☑ Hough transform	✔	0.33	
☐ Wiener filtering	✔	0.33	
☑ Otsu's algorithm	✔	0.33	
Total		1.00 / 1.00	

Question Explanation

The Hough transform is ideal for detecting such straight lines, but since they are only 2 values in the image, Otsu's technique will do the job as well.

Question 8

What is the fundamental difference between simple thresholding and Otsu's algorithm?

Your Answer		Score	Explanation
○ They are actually the same			
◉ Otsu's algorithm automatically computes the threshold	✔	1.00	
○ Simple thresholding works only for multiple Gaussian distributions			
○ Otsu's algorithm is faster			
Total		1.00 / 1.00	

Question Explanation

In simple thresholding techniques we have to decide the threshold to operate, while Otsu's algorithm automatically computes it.

Question 9

The Hough transform can be used only for detecting straight lines, circles, and ellipses.

Your Answer		Score	Explanation
(•) False	✔	1.00	
( ) True			
Total		1.00 / 1.00	

Question Explanation

It can be used for any parametric model, though not always will be computationally efficient.

Question 10

(Optional programming exercises)

- Implement the Hough transform to detect circles.
- Implement the Hough transform to detect ellipses.
- Implement the Hough transform to detect straight lines and circles in the same image.
- Consider an image with 2 objects and a total of 3 pixel values (1 for each object and one for the background). Add Gaussian noise to the image. Implement and test Otsu's algorithm with this image.
- Implement a region growing technique for image segmentation. The basic idea is to start from a set of points inside the object of interest (foreground), denoted as seeds, and recursively add neighboring pixels as long as they are in a pre-defined range of the pixel values of the seeds.
- Implement region growing from multiple seeds and with a functional like Mumford-Shah. In other words, start from multiple points (e.g., 5) randomly located in the image. Grow the regions, considering a penalty that takes into account average gray value of the region as it grows (and error it produces) as well as the new length of the region as it grows. Consider growing always from the region that is most convenient.

Your Answer	Score	Explanation
Total	0.00 / 0.00	