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Quiz 05

Attempts	Score
1/1000	9/9

Question 01

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?

Answer

5

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 02

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.

Answer

Find two thresholds k1 and k2.

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. Many great answers were given in the forums.

Question 03

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

Answer

A function of the grey (or color) difference between the pixels.

Explanation

A function of the grey (or color) difference between the pixels. 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 04

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

Answer

The total segments' boundary length.

Explanation

This is exactly as 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 05

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

Answer

Add a length term to Otsu's algorithm penalty function and perform brute-force search for the optimal threshold that minimizes the new penalty.

Explanation

Add a length term to Otsu’s algorithm penalty function and perform brute-force search for the optimal threshold that minimizes the new penalty. 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 06

The threshold computed by Otsu's method is unique.

Answer

No.

Explanation

Consider an image with 1/2 pixels with value 0 and 1/2 pixels with value 255. Any threshold in between these two values will give the same result.

Question 07

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 != 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?

Answer

- Hough Transform
- Otsu's Algorithm

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 08

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

Answer

Otsu's algorithm automatically computes the threshold.

Explanation

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

Question 09

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

Answer

False.

Explanation

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