Sample Questions

Please note that the questions provided are merely illustrative examples and should not be considered as indicative of the actual exam content.

The examination syllabus includes all topics covered in the three provided slide sets as well as those discussed during class sessions.

Image and Image processing:

1. What is an image? Describe the types of images with examples.
2. You are working for a secretive art restoration team that uses image processing to analyze old paintings. One painting seems to have been digitally altered in a way that colors have been subtly changed to hide a forgery. The original image is in RGB, and you must analyze it in HSV and CMYK color spaces to spot the forgery. You are given a pixel from the painting with the following RGB values: R = 102, G = 205, B = 170.
   a. Convert the RGB value to normalized form (R', G', B').
   b. Convert the pixel to HSV and CMYK.
   c. You discover that forged pixels tend to have Hue between 140° and 160°, Cyan > 0.2 and Black < 0.1. Based on your conversion, is this pixel likely to be part of the forgery? Justify using your computed values.

3. You're collaborating with marine biologists to analyze underwater images of coral reefs. The goal is to segment and quantify healthy vs. bleached corals from drone-captured images. However, underwater images suffer from: Uneven lighting and Similar textures across coral types. Your task is to design an image segmentation pipeline to solve this real-world problem.

   Mention the common image segmentation methods. Which one will you use for this purpose? Justify your choice based on the strengths/weaknesses of each method.

Morphological Operation:

1. What is morphology? What's the difference between conventional morphology and mathematical morphology?
2. Explain the properties and usage of – opening and closing.
3. A is a zoomed-in part of the binary image.
    a. Represent the image as a set A of black pixel co-ordinates. (e.g. A = {(1,1), (2,1), ..}).
    b. Define a structuring element B with a shape 3×3 where all the elements are 1. Now apply dilation operation on A with B. sketch the resulting image.
    c. Define the new pixel co-ordinates obtained in b in a separate set C. Now, apply union and subtraction operation between set A and set C.
    d. Describe the process of extracting the boundary of A.

0	0	0	0	0	0	0
0	0	1	0	0	0	0
0	0	1	1	1	1	0
0	0	1	1	1	1	0
0	0	1	1	1	1	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

A

Image Filtering:

1. What is image filtering?
2. What are Linear and non-linear image filter?
3. Explain some basic Linear and non-linear image filter. Explain some of the Linear and non-linear filter.
4. A satellite image analyst is trying to identify subtle features of an ancient city buried under a desert. The raw image contains varying levels of Gaussian noise due to atmospheric interference. The analyst applies a linear smoothing filter to clean the image, but complains that important edges and structures are fading away. Now, as the image processing expert on the team:

a. Explain why this happens when using linear smoothing filters like the box or Gaussian filter.
b. Design a filter strategy (or a hybrid approach) that can reduce noise while preserving edges. Justify your approach with concepts like filter size/frequency components/filter shape.
c. The analyst suggests applying multiple small filters repeatedly rather than one large filter. Is this a good idea? Explain the reason.