Assignment Questions – Unit 1

| Unit-1- topic wise | | | |
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|  | **Introduction:**   1. Explain the term "digital image." How is it represented in a computer? 2. Define image processing and explain its primary objectives. 3. List the key steps involved in the digital image processing pipeline. 4. What are the challenges commonly faced in image processing? | |
|  | **Applications of Image Processing:**   1. Name and briefly describe at least three application areas of image processing. 2. How is image processing applied in medical imaging? Provide examples. 3. Discuss the role of image processing in satellite and remote sensing applications. 4. What are the applications of image processing in the field of biometrics? 5. Explain how image processing is used in autonomous vehicles. | |
|  | **Sampling and Quantization:**   1. Define sampling and quantization in the context of image processing. 2. What is bit depth, and how does it influence the quality of an image? | |
|  | **Relationship Between Pixels**  1. Define the concept of pixel connectivity. What are 4-adjacency and 8-adjacency ? 2. What is adjacency in terms of pixel relationships? Provide examples. 3. Explain the term "neighborhood" of a pixel. How is it useful in image processing? 4. Discuss the importance of connectivity in image segmentation and object recognition. 5. What are the potential ambiguities in 8-connectivity? How can they be resolved? | |
|  | Explain the following terms-   1. Decimation 2. Interpolation | |
|  | **Distance Measures**  1. What is Euclidean distance, and how is it used in image processing? 2. Compare and contrast city-block distance and chessboard distance. 3. Explain the importance of distance measures in image segmentation. 4. Provide a practical example where distance measures are used in image processing. | |
|  | **Convolution and Correlation**  1. Define convolution in image processing. How is it different from correlation? | |
| 14 | Explain the concept of Spatial correlation and spatial Convolution using 1-D function.  1-D function – 00010000  W - 12328 |  |
| 15 | Find the 2D convolution of the given matrices. (Discard padded position so that final answer will be 3X3 matrix)   | Input Image   | 5 | 8 | 3 | | --- | --- | --- | | 3 | 2 | 1 | | 0 | 9 | 5 | | Kernel   | -1 | -2 | -1 | | --- | --- | --- | | 0 | 0 | 0 | | 1 | 2 | 1 | | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |
| 16 | Explain the concept of Spatial correlation and spatial Convolution using 2-D function.   | 2-D function   | 0 | 0 | 0 | 0 | 0 | | --- | --- | --- | --- | --- | | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 1 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | | w-window   | 1 | 2 | 3 | | --- | --- | --- | | 4 | 5 | 6 | | 7 | 8 | 9 | | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |
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MCQ:

1. What does the term "digital image" refer to?

a) A continuous-tone image

b) A collection of pixels arranged in a matrix form

c) A 3D representation of an object

d) A physical photograph

### Which of the following is a typical step in digital image processing?

a) Image acquisition  
b) Image enhancement  
c) Image segmentation  
d) All of the above

### What is a pixel?

a) The smallest unit of a digital image  
b) A group of colors in an image  
c) A type of filter used in image processing  
d) The brightness of an image

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### What is the role of a histogram in image processing?

a) To count the number of objects in an image  
b) To represent the distribution of intensity levels in an image  
c) To detect edges in an image  
d) To enhance the image clarity

Answer: b) To represent the distribution of intensity levels in an image

### What is the purpose of image segmentation?

a) To reduce image size  
**b) To divide an image into meaningful regions**c) To enhance the brightness of an image  
d) To calculate the histogram

Answer: b) To divide an image into meaningful regions

### In which application is image processing NOT commonly used?

a) Medical imaging  
b) Satellite imaging  
**c) Word processing**d) Facial recognition

### What is the primary difference between image enhancement and image restoration?

a) Enhancement focuses on visual appeal, while restoration corrects degradation  
b) Enhancement is automatic, while restoration is manual  
c) Enhancement is for 2D images, while restoration is for 3D images  
d) Enhancement involves filters, while restoration involves segmentation

Answer: a) Enhancement focuses on visual appeal, while restoration corrects degradation

### In a 4-connected neighborhood, how many neighboring pixels are considered for a given pixel?

a) 4  
b) 8  
c) 6  
d) 3

1. What is the minimum distance between two pixels called?

a) Euclidean distance  
b) City-block distance  
c) Chessboard distance  
d) Pixel intensity

Answer: a) Euclidean distance

### When both 4-connectivity and diagonal connectivity are combined, it forms:

a) 2-connectivity  
b) 6-connectivity  
c) 8-connectivity  
d) Hybrid connectivity

Answer: c) 8-connectivity

### What is the main issue with 8-connectivity in image segmentation?

a) It increases processing time  
**b) It may lead to diagonal pixel ambiguity**  
c) It reduces image resolution  
d) It cannot handle grayscale images

### How does correlation differ from convolution in terms of kernel orientation?

a) The kernel is flipped in correlation, but not in convolution  
b) The kernel is flipped in convolution, but not in correlation  
c) Both operations flip the kernel  
d) Neither operation flips the kernel

Answer: b) The kernel is flipped in convolution, but not in correlation

### Which term refers to adding extra rows and columns of zeros around an image before convolution?

a) Normalization  
b) Padding  
c) Correlation  
d) Striding

Answer: b) Padding

### In image processing, what does the kernel (or filter) represent?

a) The input image  
b) The output image  
c) A small matrix used to perform transformations  
d) The pixel intensity histogram

Answer: c) A small matrix used to perform transformations

### What is interpolation in image processing?

a) Reducing the size of an image  
b) Increasing the resolution of an image  
c) Compressing an image  
d) Applying a filter to an image

Answer: b) Increasing the resolution of an image

### What is decimation in image processing?

a) Reducing the size of an image by downsampling  
b) Upscaling the image resolution  
c) Converting a color image to grayscale  
d) Enhancing the sharpness of an image

Answer: a) Reducing the size of an image by downsampling

### What is the key purpose of decimation in image processing?

a) To smoothen an image  
b) To reduce the amount of data for storage or transmission  
c) To increase the dynamic range of an image  
d) To enhance the contrast of an image

Answer: b) To reduce the amount of data for storage or transmission

### What is sampling in the context of image processing?

a) Converting an analog signal into a digital signal  
b) Selecting specific points or pixels from a continuous image  
c) Reducing the number of colors in an image  
d) Enhancing the image resolution

Answer: b) Selecting specific points or pixels from a continuous image

### What does quantization in image processing refer to?

a) Mapping continuous intensity values to discrete levels  
b) Subsampling the image resolution  
c) Increasing the number of samples in an image  
d) Interpolating pixel values

Answer: a) Mapping continuous intensity values to discrete levels

### How many intensity levels are possible for a pixel in an image with an 8-bit quantization?

a) 128  
b) 255  
c) 256  
d) 1024

Answer: c) 256

### What does the term "bit depth" refer to in quantization?

a) The number of pixels in an image  
b) The number of intensity levels assigned to each pixel  
c) The size of the image in bytes  
d) The spatial frequency of an image

Answer: b) The number of intensity levels assigned to each pixel