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

Assignment Questions – Unit 2.

| Unit 2 | | |
| --- | --- | --- |
|  | Explain the following intensity transformations using suitable diagrams.   * 1. Gamma Transformations   2. Contrast Stretching | |
| 2. | Explain the following intensity transformations using suitable diagrams.   * + - * 1. Contrast Stretching         2. Thresholding function | |
| 3. | What is histogram? Explain the process of histogram equalization using an example. | |
| 4. | Explain the following intensity transformations using suitable diagrams.  Log and Inverse Log Transformation  Power Law transformation | |
| 5. | Give an example with explanation where each of the following changes to gamma would be desirable.   * 1. Set Gamma > 1   2. Set Gamma < 1 | |
| 6. | Explain the two variation of Intensity level slicing using a suitable diagram. | |
| 7. | What is Bit- Plane Slicing? What is the advantage of applying Bit- Plane Slicing on an image? | |
| 8. | Find all the bit planes of the following 4 bit image  0 3 7 8  1 1 2 2  3 14 15 13  4 6 9 11 | |
| 9. | Perform Histogram equalization for the following image. Plot original and equalized histogram.   | 4 | 4 | 4 | 4 | 4 | | --- | --- | --- | --- | --- | | 3 | 4 | 5 | 4 | 3 | | 3 | 5 | 5 | 5 | 3 | | 3 | 4 | 5 | 4 | 3 | | 4 | 4 | 4 | 4 | 4 |   Sol:   | no-n | 3 | 4 | 5 | | --- | --- | --- | --- | | N | 6 | 14 | 5 | | Pr(n) | 6/25=.24 | 14/25=.56 | 5/25 =.20 | | S(n) | 3\*.24=.72 -> 1 | 3\*.56=1.68 -> 2 | 3\*.20=.6 ->1 | |
| 10. | Perform histogram equalization and draw new equalized histogram for the following image data. |
| 11. | Perform histogram equalization and draw new equalized histogram for the following image data.   | Grey level | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | No of Pixels | 400 | | 700 | 1350 | 2400 | 3000 | 1500 | 650 | 0 | |
| 12. | Histogram of an image with 8 quantization levels is given below. Perform histogram equalization. Draw original and equalized histogram. |
| 13. | What is low pass filtering? Discuss the image smoothing filters in spatial domain.   * Average * Weighted Average |
|  | What is salt and pepper noise and how does a median filter remove it? |
| 14. | How does Weighted average filter reduce the effect of blurring as compare to average filter.  Apply the below filter to the given image-   | Input Image   | 40 | 40 | 200 | 40 | 40 | | --- | --- | --- | --- | --- | | 40 | 40 | 40 | 40 | 40 | | 40 | 40 | 100 | 40 | 40 | | 40 | 0 | 40 | 40 | 40 | | 40 | 40 | 0 | 40 | 40 | | 40 | 40 | 40 | 40 | 40 | | Kernel   |  | 1 | 2 | 1 | | --- | --- | --- | --- | | 1/16 | 2 | 4 | 2 | |  | 1 | 2 | 1 | | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |
| 15. | Discuss and show the effect of order-statistics filters median, mean on the following-   1. Isolated pixels 2. Thin line 3. A step edge 4. A corner |

MCQ:

### **What is the primary purpose of intensity transformation in image processing?**

a) To improve the image resolution  
b) To enhance image details by modifying pixel intensities  
c) To reduce the size of the image  
d) To convert an image into grayscale

**Answer**: b) To enhance image details by modifying pixel intensities

### **Which of the following intensity transformations enhances the contrast of an image by stretching the range of pixel values?**

a) Logarithmic transformation  
b) Power-law transformation  
c) Contrast stretching  
d) Histogram equalization

**Answer**: c) Contrast stretching

1. **What is the result of applying a logarithmic intensity transformation to an image?**

a) Enhances bright areas of the image  
b) Increases the overall contrast  
c) Brightens dark regions while compressing bright regions  
d) Makes the image grayscale

**Answer**: c) Brightens dark regions while compressing bright regions

### **Which transformation is often used to improve the brightness of an image, especially in low-intensity regions?**

a) Exponential transformation  
b) Logarithmic transformation  
c) Linear transformation  
d) Gamma correction

**Answer**: b) Logarithmic transformation

### **What is the main advantage of applying contrast stretching to an image?**

a) It can remove noise from the image  
b) It enhances the visibility of features by expanding the range of pixel values  
c) It increases the image resolution  
d) It converts the image into grayscale

**Answer**: b) It enhances the visibility of features by expanding the range of pixel values

### **What is the main objective of histogram equalization in image processing?**

a) To reduce the image resolution  
b) To improve the contrast of an image by redistributing pixel intensities  
c) To convert the image to grayscale  
d) To smooth out the image noise

**Answer**: b) To improve the contrast of an image by redistributing pixel intensities

### **Histogram equalization is most effective when applied to images with:**

a) Low contrast  
b) High contrast  
c) Already equalized histograms  
d) Noisy backgrounds

**Answer**: a) Low contrast

### **Which of the following is the result of applying histogram equalization to an image?**

a) The image is turned into black and white  
b) The pixel intensities are uniformly distributed  
c) The image size is reduced  
d) The image is blurred

**Answer**: b) The pixel intensities are uniformly distributed

### **After applying histogram equalization, the histogram of the output image is:**

a) Concentrated around a small range of intensities  
b) Uniformly spread across all possible intensity values  
c) The same as the input histogram  
d) A smooth bell curve

**Answer**: b) Uniformly spread across all possible intensity values

### **What is the significance of the least significant bit (LSB) in bit-plane slicing?**

a) It carries the most important information of the image  
b) It carries the least important details and is often used for hiding data  
c) It represents the highest contrast features of an image  
d) It stores the grayscale values of an image

**Answer**: b) It carries the least important details and is often used for hiding data

### **When performing bit-plane slicing on an 8-bit grayscale image, how many bit planes will be generated?**

a) 1  
b) 4  
c) 8  
d) 16

**Answer**: c) 8