VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)

IBRAHIMBAGH, HYDERABAD-31

Department of Computer Science and Engineering

#### Name of the Course: Image Processing

Assignment – 1

Name of the Faculty: C. Gireesh Date of submission: 27-02-2024, 4.20PM

Class: VIth sem B.E CSE-A Academic Year: 2023-24

**Set-1(** Top 10 Students: **1602-21-733-005, 012, 13, 20, 26, 29, 32, 36, 37, 63 )**

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| Q. No | Questions | Marks | BTL | CO |
| 1. | You are preparing a report and have to insert in it an image of size 2048 \* 2048 pixels.  **(a)** Assuming no limitations on the printer, what would the resolution in line pairs per mm have to be for the image to fit in a space of size 5 × 5 cm?  **(b)** What would the resolution have to be in dpi for the image to fit in 2 × 2 inches? | 1 | 3 | 1 |
| 2. | A common measure of transmission for digital data is the *baud rate*, defined as symbols (bits in our case) per second. As a minimum, transmission is accomplished in packets consisting of a start bit, a byte (8 bits) of information, and a stop bit. Using these facts, answer the following:  **(a)** How many seconds would it take to transmit a sequence of 500 images of size 1024 \*1024 pixels with 256 intensity levels using a 3 M-baud (106 bits/sec) baud modem? (This is a representative medium speed for a DSL  (Digital Subscriber Line) residential line.  **(b)** What would the time be using a 30 G-baud (109 bits/sec) modem? (This is a representative medium speed for a commercial line.) | 2 | 3 | 1 |
| 3. | The two images shown in the following figure are quite different, but their histograms are the same.  Suppose that each image is blurred using a 3\*3 box kernel.  **(a)** Would the histograms of the blurred images still be equal? Explain.    **(b)** If your answer is no, either sketch the two histograms or give two tables detailing the histogram components. | 2 | 3 | 2 |

**Set-2 (1602-21-733-001,02,03,04,06,07,08)**

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| Q. No | Questions | Marks | BTL | CO |
| 1. | Given height of the tree is 20m at a distance of 1000m and approximate focal length is 17mm. Obtain the dimension of the image formed on retina of the eye. | 1 | 3 | 1 |
| 2. | A camera with focal length 0.04 m is placed at a height of 1.0 m and is looking vertically downwards to take images of the XY plane. If the size of the image sensor plate is 4mm x 3mm, find the area on the XY plane that can be imaged. | 2 | 3 | 1 |
| 3. | An image with intensities in the range [0,1] has the PDF, *pr(r)*, shown in the following figure. It is desired to transform the intensity levels of this image so that they will have the specified *pz*(*z*) shown in the figure. Assume continuous quantities, and find the transformation (expressed in terms of *r* and *z*) that will accomplish this. | 2 | 3 | 2 |

**Set-3 (09, 10,11,14,15,16,17)**

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| Q. No | Questions | Marks | BTL | CO |
| 1. | How much memory is required to store 1024x1024 image of 8 intensity levels. | 1 | 3 | 1 |
| 2. | Determine whether these two subsets are 4-adjacent for V = {1 }  S1 S2   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | | 2 | 3 | 1 |
| 3. | The intensity distribution of a 3-bit 64x64 digital image is given below along with the desired probability distribution in an enhanced image. Plot the histogram of the image obtained from histogram matching of this image with the specified distribution. | 2 | 3 | 2 |

**Set-4(18,19,21,22,23,24,25)**

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| Q. No | Questions | Marks | BTL | CO |
| 1 | Generally image transmission is accomplished in packets consisting of start bit, a byte of information and a stop bit. How many minutes would it take to transmit a 1024x1024 Image with 256 intensity levels using 56 K baud modem? | 1 | 3 | 1 |
| 2 | A CCD camera chip of dimensions 7 × 7 mm and 1024 × 1024 sensing elements, is focused on a square, flat area, located 0.5 m away. The camera is equipped with a 35-mm lens. How many line pairs per mm will this camera be able to resolve? (*Hint:* Model the imaging process as in Fig. 2.3, with the focal length of the camera lens substituting for the focal length of the eye.) | 2 | 3 | 1 |
| 3 | You are given the following kernel and image:    Give a sketch of the area encircled by the large ellipse in Fig. 3.28 when the kernel is  centered at point (2,3) (2nd row, 3rd col) of the image shown above. Show specific values of w and *f*. | 2 | 3 | 2 |

**Set-5(27,28,30,31,33,34,35)**

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| Q. No | Questions | Marks | BTL | CO |
| 1 | Determine whether these two subsets are 8-adjacent for V = {1 }  S1 S2   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | | 1 | 3 | 1 |
| 2 | You are given the following kernel and image:    Compute the convolution between w and *f* using the *minimum* zero padding needed. Show the details of your computations when the kernel is centered on point (2,3) of *f*; and then show the final full convolution result. | 2 | 3 | 2 |
| 3 | Find the output image with the equalized histogram for the given hypothetical input image   |  |  |  |  |  | | --- | --- | --- | --- | --- | | 2 | 2 | 2 | 3 | 3 | | 3 | 3 | 3 | 3 | 3 | | 3 | 3 | 4 | 4 | 4 | | 5 | 5 | 4 | 4 | 4 | | 6 | 6 | 7 | 7 | 7 | | 1 | 3 | 2 |

**Set-6(38,39,40,41,42,43,44)**

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| Q. No | Questions | Marks | BTL | CO |
| 1 | Generally image transmission is accomplished in packets consisting of start bit, a byte of information and a stop bit. What would be the time be at 1000K baud, a representative medium speed of a phone DSL(Digital subscriber Line) connection? | 1 | 3 | 1 |
| 2 | Perform the histogram matching, and draw the transformed histogram using the following data.   |  |  | | --- | --- | | rk | nk | | r0 | 790 | | r1 | 1023 | | r2 | 850 | | r3 | 656 | | r4 | 329 | | r5 | 245 | | r6 | 122 | | r7 | 81 |  |  |  | | --- | --- | | zq | Specified Pz(zq) | | Z0=0 | 0.15 | | Z1=1 | 0.20 | | Z2=2 | 0.30 | | Z3=3 | 0.20 | | Z4=4 | 0.15 | | Z5=5 | 0.00 | | Z6=6 | 0.00 | | Z7=7 | 0.00 | | 2 | 3 | 2 |
| 3 | Find the effect of correlation and convolution on the given 1-D function f and a filter w. where f = 0 0 0 1 0 0 0 0 and w = 1 5 3 2 5 | 2 | 3 | 2 |

**Set-7(46,47,48,49,51,52,53)**

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| Q. No | Questions | Marks | BTL | CO |
| 1 | A camera with focal length 0.04 m is placed at a height of 1.0 m and is looking vertically downwards to take images of the XY plane. If the size of the image sensor plate is 4mm x 3mm, find the area on the XY plane that can be imaged. | 1 | 3 | 1 |
| 2 | Design a 3x3 Gaussian mask and apply to the following input image   |  |  |  | | --- | --- | --- | | 1 | 0 | 1 | | 0 | 1 | 0 | | 1 | 0 | 1 | | 2 | 3 | 2 |
| 3 | Perform the histogram equalization for the given input image details and draw the histogram for the output image   |  |  | | --- | --- | | Gray Levels | No. Of Pixels | | 0 | 256 | | 1 | 200 | | 2 | 50 | | 3 | 45 | | 4 | 288 | | 5 | 144 | | 6 | 220 | | 7 | 93 | | 2 | 3 | 2 |

**Set-8(54,55,56,57,58,59,60)**

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| Q. No | Questions | Marks | BTL | CO |
| 1 | Determine whether these two subsets are m-adjacent for V = {1 }  S1 S2   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | | 1 | 3 | 1 |
| 2 | Find the output image after applying the median filter of size 3x3 on the following input image   |  |  |  | | --- | --- | --- | | 5 | 5 | 5 | | 5 | 5 | 0 | | 5 | 0 | 0 | | 2 | 3 | 2 |
| 3 | Find the sharpened output image after applying the Laplacian mask on the following input image   |  |  |  | | --- | --- | --- | | 0 | 0 | 3 | | 0 | 3 | 3 | | 3 | 3 | 3 | | 2 | 3 | 2 |

**Set-9(61, 62,64,65,66,67,135)**

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| Q. No | Questions | Marks | BTL | CO |
| 1 | Obtain the nearest neighbour interpolated image for the given image   |  |  |  |  | | --- | --- | --- | --- | | 5 | 5 | 5 | 3 | | 5 | 5 | 5 | 3 | | 3 | 3 | 4 | 4 | | 5 | 5 | 4 | 4 | | 1 | 3 | 1 |
| 2 | Find the effect of correlation and convolution on the given 1-D function ‘f’ and a filter ‘w’. where f = 0 0 0 1 0 0 1 0 and w = 1 5 4 4 1 | 2 | 3 | 2 |
| 3 | Find the output image after applying the average filter of size 3x3 on the following input image   |  |  |  |  | | --- | --- | --- | --- | | 5 | 5 | 5 | 3 | | 5 | 5 | 5 | 3 | | 3 | 3 | 4 | 4 | | 5 | 5 | 4 | 4 | | 2 | 3 | 2 |

**Set-10(136,301,302,303,304,305,306,307)**

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| Q. No | Questions | Marks | BTL | CO |
| 1 | Obtain the bilinear interpolated image for the given image   |  |  |  |  | | --- | --- | --- | --- | | 1 | 5 | 5 | 3 | | 3 | 3 | 4 | 4 | | 5 | 5 | 4 | 4 | | 6 | 6 | 7 | 7 | | 1 | 3 | 1 |
| 2 | Find the output image after applying the a max and min filter of size 3x3 on the following input image   |  |  |  |  | | --- | --- | --- | --- | | 5 | 5 | 5 | 3 | | 5 | 5 | 5 | 3 | | 3 | 3 | 4 | 4 | | 5 | 5 | 4 | 4 | | 2 | 3 | 2 |
| 3 | Suppose that an image has the intensity PDF Pr (r) = 2r/(L-1)2  for 0≤ r ≤ L-1 and Pr (r)=0 for other values of r. Find the transformation function that will produce Histogram equalized image | 2 | 3 | 2 |