Indian Institute of Technology Hyderabad
EE6310: Image and Video Processing
Quiz 3, 06.04.2023, 10 points

1. An image contains circles and ellipses in it. Can the Hough transform be employed to find the instances of these circles and ellipses? If yes, how? If no, why not? (1)

2. $\mathbf{I}$ is a 4×4 2-bit image whose entropy E($\mathbf{I}$) = 1.75 bits (exactly). Find such an $\mathbf{I}$ while ensuring that all the possible intensities are present in it. (2)

3. The above image $\mathbf{I}$ is Huffman coded (where a 0 is assigned to the top branch and a 1 to the bottom branch). Decode the intensity sequence corresponding to the coded stream "111010110". Assume that the image intensities are denoted by a, b, c, d in the decreasing order of their frequency of occurrence. (2)

4. Using the intensity notation from Q3, arithmetic code the image intensity sequence *dabc* (coming from the image in Q2). (2)

5. The covariance matrix of a set of 2-dimensional data points is given by

$$\mathbf{C_x} = \begin{bmatrix} 5 & 2 \\ 2 & 3 \end{bmatrix}.$$

   Find the optimal decorrelating transform for these data points. (2)

6. Which of the following 4-bit images is easier to losslessly compress in the DCT domain? Clearly justify. (1)

$I_1 =$

15	15	15	15
15	15	15	15
15	15	15	15
15	15	15	14

$I_2 =$

15	15	15	15
0	0	0	0
0	0	0	0
15	15	15	15