Computer Vision [CSE 344/544, ECE 344/544]

End Semester Examination, Winter Semester, 2021-22

Section A [15 marks]

Answer any **five (5)** of the following questions. Each question carries **three (3)** marks. [5x3=15 marks]

Q1: Given the projection matrix of a camera below, find the pixel location (row, col) of the 3D-point (50, 6, 7) in the image formed by the camera.

12	11	10	9
8	7	6	5
4	3	2	1

Q2: Apply transposed convolution on the input I using kernel k.

I=

3	5
6	7

k=

2	5	3
6	9	1
2	7	9

Stride= (1,1), Same Cropping.

Q3: Discuss any three ways of performing background subtraction in videos and the assumptions involved.

Q4: For which range of 'x' its LBP code will always be 171 in the below image?

82	57	90
78	x	53
99	56	92

Q5: Generate the HoG feature for an image patch whose gradient magnitude and gradient angle matrices are as follows. Consider 4 key angles: 0, 90, 180 and -90.

Magnitude=			Angle=		
84	54	90	-60	30	120
78	66	54	-150	60	150
96	54	90	-30	-120	90

Q6: Compute the similarity maps of the images I1 and I2 using the histogram-based matching method.

$$I1=\begin{matrix}0&1&2&3\\1&1&1&2\\3&0&0&0\\2&2&2&1\end{matrix} \qquad I2=\begin{matrix}1&1&1&3\\1&1&1&2\\2&2&1&1\\0&3&1&1\end{matrix}$$

Section B [15 Marks]

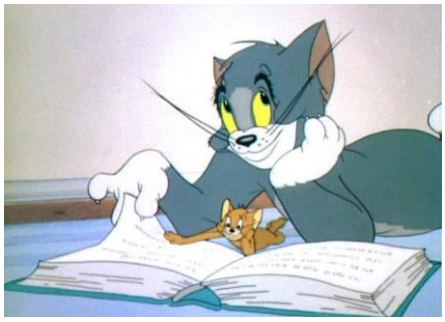
Answer any **three (3)** of the following questions. Each question carries **five (5)** marks. [3x5=15 marks]

Q7: Given the 5x5 image patch below, compute the R-scores of its central pixel using the Harris and Shi-Thomsi corner detection methods. Use a 3x3 window and Sobel filter wherever required.

Image patch=

209	210	22	25	21
208	211	25	29	21
206	207	223	27	19
206	207	223	27	19
206	207	223	27	19

Q8: Weighted sums (z's) in the last layer of an image classifier for the Tom & Jerry image given below are as follows: 56, 89, -45, -10.



Find the output layer activation values, the output (in terms of class labels), and the loss value if:

(i) the image classifier is a multi-class classifier.

(ii) the image classifier is a multi-label classifier.

The class labels are cat, dog, rabbit, and mouse. They are in the order required for annotation.

Q9: An image of size (81, 81) is scaled by the factor of two, translated by (50, 50), and rotated by 45 degrees clockwise. The origin of the image coordinate system is at the bottom-left of the original image. Where will the central pixel of the original image be located now in the image coordinate system?

Q10: Apply the Otsu algorithm on the image given below and compute the IoU score of the segmentation result by comparing it with the groundtruth given below.

What will be the IoU and CorLoc scores between the tight bounding boxes around the objects of the segmentation result and the groundtruth?

Image =

7	1	2	2	2
7	1	2	2	2
6	6	6	2	2
6	6	6	2	3
6	6	6	5	3

Groundtruth =

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

**********END OF THE QUESTION PAPER**********