# **Question Paper**

Exam Date & Time: 28-Nov-2022 (09:00 AM - 12:00 PM)



# MANIPAL ACADEMY OF HIGHER EDUCATION

## VII SEMESTER B.TECH END SEMESTER EXAMINATIONS, NOV 2022

Computer Vision [ICT 4031]

Α

Marks: 50

### Duration: 180 mins.

Section Duration: 180 mins

### Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1) Using Laplacian of Gaussian method identify the edge pixels in the image block. The image block (5) and LoG kernel is given as in the Table 1A.1 and 1A.2 respectively. Take threshold as 5.

A)

Table 1A.1: Image Block

10	10	10	10	10
10	150	5	200	10
10	5	500	5	10
10	200	5	150	10
10	10	10	10	10

Table 1A.2: LoG Kernal

0	2	0	
2	4	2	
0	2	0	

- B) Show that Orthogonal transformation preserves isometry. Give one example for non-isometric (3) transformation.
- C) Apply 3 x 3 median filter to remove the noise from the following image block:

10	10	10	10
10	45	52	20
10	25	35	5
10	20	5	15

2)

A)

Check whether the pixel X given in the following table is an interest point. Make use of uniform (5)windows.

100	500	100
500	X=5	500
100	500	100

B) Find the image coordinates (x, y) corresponding to the world point (X, Y, Z) in Perspective (3)Projection. Assume that origin at image center (not at the lens center).

(2)

C) Differentiate between convolution and correlations. Whether all linear filters are convolutions?

(2)

Let A and A<sup>-1</sup> denote camera calibration matrix and its inverse [as given in Table 3A.1 and Table (5) 3A.2 respectively].

A)

3)

Та	ble	3A.:	1
1	2	1	2
1	1	2	1
2	0	1	1
1	1	1	1

Table 3A.2					
-1	-1	0	3		
-1	-1	-1	4		
0	1	0	-1		
2	1	1	-5		

Consider two 3D points say P1 and P2. The homogenous coordinates of points P1 and P2 are given as P1 = [5, 5, 5, 5] and P2 = [10, 10, 10, 5] respectively. Find the camera location.

B)

Find gradient magnitude and gradient orientation for the image block given below. Make use of (3) forward difference.

10	10	10	10
10	15	5	20
10	5	50	5
10	20	5	15

	C)	Let A and B denotes left and right camera calibration matrix. Find the relationship between fundamental matrix and essential matrix. Also, mention two applications of fundamental matrix.	(2)
4)		Using RANSAC method, fit the line for the following data points:	(5)
	A)	(10, 55), (5, 45), (100, 505), (5, 30), (6, 35), (8, 45), (15, 80), (20, 105), (1, 10), (2, 150)	
		Take the number of outliers as 2. Also find expected number of iterations to get good fit for the given data points. In worst case scenario, what is the maximum number of iterations need to be considered? Justify.	
	B)	Write an algorithm to track a rigid body in a video. Give displacement model Jacobian $\delta W/\delta \textbf{P}$ for the same.	(3)
	C)	How mean shift method can be used to find clusters in the given data points?	(2)
5)		Using probabilistic approach, write a step-by-step procedure for recognizing the skin pixel in an image. Is it possible to use any other machine learning technique for the same? Justify.	(5)
	A)		
	B)	Write an algorithm for finding motion vectors in a consecutive frame in the video.	(3)
	C)	What is the difference between detector and descriptor? Give one example for both. Also, mention difference between interest point and patch.	(2)

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