Question Paper

Exam Date & Time: 08-Jan-2024 (02:30 PM - 05:30 PM)



MANIPAL ACADEMY OF HIGHER EDUCATION

SEVENTH SEMESTER B.TECH END SEMESTER MAKE-UP EXAMINATIONS, JAN 2024

Computer Vision [ICT 4031]

Marks: 50

Duration: 180 mins.

(3)

Answer all the questions.

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

- A point in an object is given by the coordinates (2,2,2). Compute the final coordinates of that point (5) after carrying out the following transformations sequentially. The object is translated by an amount (3,2,1). This is followed by scaling by an amount (1,2,3) which is followed by rotation by an angle 90 degrees along X axis in clockwise direction. Show the intermittent result with each transformation.
 - B) An image is as shown in Fig Q. 1B. Obtain the resultant image on applying
 - a) A 5x5 box filter.

b) Median filter with filter size 5x5.

51	23	43	21	28	11
44	71	26	32	11	14
71	39	9	22	51	12
67	25	41	64	26	10
62	20	15	12	77	12
13	24	56	21	45	13

Fig. Q.1B

C) In the perspective projection, find the vanishing point coordinates of the parallel lines. (2)

2)

Given the image as shown in Fig. Q.2A, identify which of the points form the edge pixel using the (5) sobel edge detector. Let the threshold value be 12.

A)

10	25	50	25
25	40	20	27
10	20	25	12
15	57	40	30

Fig. Q.2A

- B) Consider a scenario with a world coordinate point P and two cameras all of which are in the same (3) plane. The two cameras are separated by a distance T. Obtain the expression for the Essential matrix.
- C) In the perspective projection obtain the relation between the world coordinate (X,Y,Z) and image (2) coordinates (x,y) for the following cases.

a)Origin at the lens centre and image plane and world coordinates on either side of lens.

b)Origin on image centre, lens placed between image plane and world coordinate system. (Focal length is f)

Given a set of data points (15, 20), (5, 3), (10, 30), (20, 40), (25, 55), (35, 60), (50, 10), using the (5) Random Sample Consensus method find the best fit line. The line should fit at least 3 points. The threshold value given is 2. The relation between N, the number of computations required, p the probability that at least one random sample is free from outlier is given by log(1 - p)

$$N = \frac{\log(1-p)}{\log(1-(1-e)^{s})}$$

- B) Specify the steps to identify the edges using Marr Hildreth edge detector. (3)
- C) Two world coordinates (X1,Y1,Z1) and (X2,Y2,Z2) and its corresponding image coordinates are (2) (x1,y1) and (x2,y2). World coordinate with Z component assigned to zero are (X11,Y11) and (X22,Y22) respectively for the two point. Identify the location of the camera.
- Given the gradient magnitude and gradient direction (which is perpendicular to the edge) in Fig. (5)
 Q.4A.1 and Fig. Q.4A.2 respectively, find the magnitude of the edge pixel using Canny edge
 A) detector. Specify the steps for each of the pixels. The gradient direction is measured clockwise.
 Fig. Q4A.1 and Fig. Q4A2

20	15	10	10	10
10	15	5	20	10
30	5	50	5	10
20	20	5	15	10
10	10	10	10	10

10	20	30	40	50
130	100	55	120	60
210	200	220	250	70
300	310	20	350	80
270	280	290	260	90

B)

5)

A)

4)

Harr Covariance Matrix for a pixel is as shown in Fig. Q.4B. Check if this point represents a corner (3) point or not. The value of constant K used in the computation is given as 0.04. Large value of R implies more than 10. Fig Q.4B



- C) Given a color intensity of a pixel in green band as R, using probabilistic approach, check if the given (2) pixel is a skin pixel or not.
 - Create a histogram for the given HoG descriptor. The magnitude and direction at a specific location (5) are as shown in Q.5A.1 and Q.5A.2 respectively. 0 is the centre of first bin and distance between bins are 20.

Fig. Q5A.1 and Fig Q5A.2





B)	Substantiate with diagram on builing of scale space in SIFT algorithm.	(3)
C)	Provide the pseudo code using polar form of Hough transform to fit a straight line.	(2)

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