Total number of printed pages: **UG/8th Sem/UECE813A**

2024

Computer Vision

Full Marks : 100

Time : Three hours

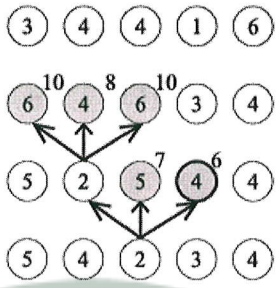
The figures in the margin indicate full marks for the questions.

Answer Q-1 and ***any four*** *questions from the rest.*

1. A	a)	Which of the following transformation is not linear i)Scaling ii)Translation iii) Rotation iv) Warping	1
	b)	Perspective projection of an object assumes I) All rays are parallel to the axis ii) Rays passes through a pin hole iii) Projection plane is always perpendicular to the rays iv) The intensity of a projected point is independent of the camera orientation.	1
	c)	Depth estimation can be done using I) Single camera and Tomasi-Kanade algorithm ii) A stereo camera and triangulation method iii) None of the above iv) Both i) and ii)	1
	d)	Which of the following corner detection algorithms requires Eigen value analysis of the covariance matrix I) Harris corner detection ii) Moravecc corner detection algorithm iii) Shi-Tomasi corner detection algorithm iv) Frostner corner detection algorithm	1
	e)	Which of the following is not a scale independent feature of an image. i) Shape feature, ii) Histogram iii) SIFT iv) corner	1
	f)	Which of the following method can be used for dimensionality reduction of	1

		feature i) Principal component analysis, ii) Vector quantization iii) Histogram equalization iv) Independent component Analysys	
	g)	Image segmentation is a..... a) Classification problem b) An optimization problem c) Image enhancement problem d) Intensity threshold estimation problem	1
	h)	Hough transformation a) Finds missing edge lines in an object b) Finds missing curves on the discontinuous boundaries c) Is a robust to noise algorithm of edge detection d) All of the above	1
	i)	d) Otsu's threshold optimizes i) Intraclass covariance ii) Interclass covariance iii) Optimizes sum of squared differences iv) Non of the above	1
	j)	A point in a Houugh domain is a ..... in spatial domain i) point ii)line ii) curve iv) Either a line or a curve	1
B		Answer the following questions	2x5
	a)	An object is at a distance of 5 Meter along X -direction and 4 Meter along Y-direction from a pin-hole camera. The height of the object is 1 meter and the focal length of the camera is 25 cm. Find the image coordinate in the camera if the image is captured at Y-Z plane. Assume that the point where the camera axis intersect the image plane as the reference point.	
	b)	b) Match the following	

i) Object coordinates(3D)	A) Intrinsic camera parameters
ii) Camera coordinates(3D)	B) Intrinsic camera parameters
Iii) Image plane coordinates (2D)	C) Extrinsic camera parameters
iv) Pixel Coordinates (2D)	D) Extrinsic camera parameters

	c)	c) Define Bidirectional reflectance distribution function (BRDF). It is the ratio of ..... and	
	d)	Draw the next step of the following graph using A-algorithm graph-search technique 	
	e)	Find Eigen values and the Eigen vectors of the following matrix, $\begin{bmatrix} 5 & 2 \\ -3 & -2 \end{bmatrix}$	
2.	a)	Describe Shi-Tomasi corner detection algorithm for corner detection.	10
	b)	Define the following terminologies I) Radiant intensity ii) Irradiance iii) Radiance	3x2
	c)	Discuss how radiance leaving a surface due to its irradiance can be computed.	4
3	a)	Name any four low level feature extraction scheme.	2
	b)	Discuss Sobel and Prewitt and Canny edge detection techniques.	12
	c)	Give some idea about feature matching between two images.	6
4.	a)	Discuss line and curve detection using Hough transform.	10
	b)	What is active contour image segmentation. Discuss how its evolution stops at the boundary of a region.	10
5)	a)	What do you mean by graph-based segmentation. How edge affinities are measured in a graph? Discuss min-cut algorithm for bisecting a segment into two parts.	10

6)	a)	What do you mean by optical flow in a video? Discuss optical flow constraint equation. Explain its significance	2+3+2
	b)	Explain how Lucas-Kanade algorithm find motion from a small patch. What are the necessary assumptions for obtaining that.	11+3
7)		Write short notes (any two)	10x2
	a)	Scale invariant feature extraction	
	b)	Otsu's thresholding	
	c)	Structure estimation from video using Tomasi-Kanade algorithm	
	d)	Triangulation method for depth estimation in a stereo camera.	