Register Number | 3 | 1 | 2 | 2 | 2 | 1 | 5 | 0 | 0 | 1 | 0 | 6 | 6 |

Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam – 603 110

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Computer Science and Engineering

Continuous Assessment Test – I

Regulations – R2021

Degree & Branch	B.E. CSE				**Semester**	VI
Subject Code & Name	UCS 2H26 COMPUTER VISION					
Academic Year	2023-2024 ~~ODD~~/EVEN	**Batch**	2021-2025	**Date**	**25/03/2024**	~~FN~~ / AN
Time: 03:45 – 05:15 p.m (90 Minutes)	**Answer All Questions**				**Maximum: 50 Marks**	

(K1: Remembering, K2: Understanding, K3: Applying, K4: Analyzing, K5: Evaluating)

CO1:	Apply various low-level feature detection methods (K3)
CO2:	Apply various feature analysis methods and transforms for intermediate-level vision (K3)
CO3:	Explain depth estimation and 3D reconstruction (K2)
CO4:	Analyse different object recognition methods (K4)
CO5:	Analyse deep learning models for a real-time computer vision application (K4)

Part – A (4 × 2 = 8 Marks)

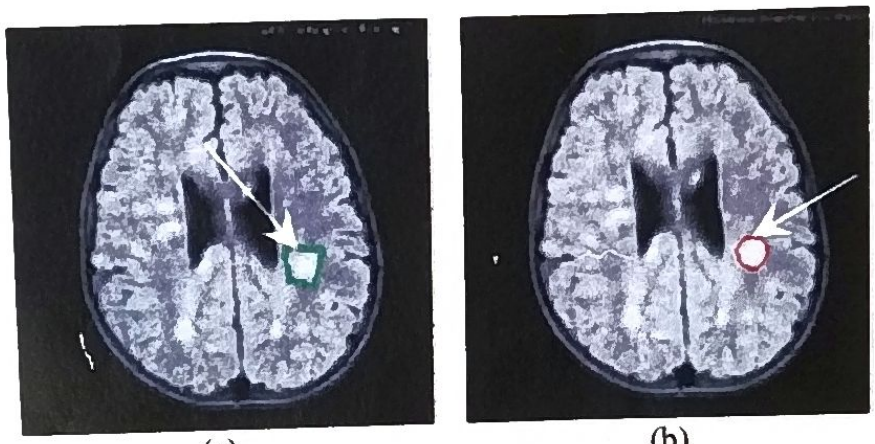
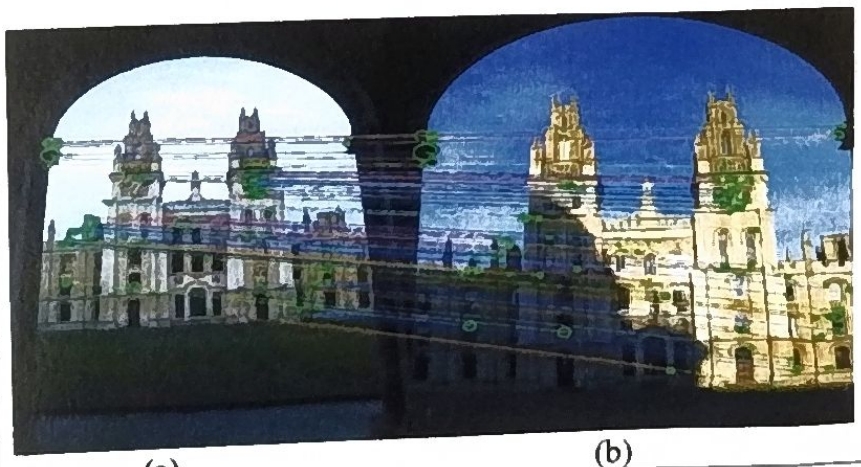
		KL	CO	PI
1.	Compare and contrast convex hull and convex deficiency.	K2	CO2	1.3.1
2.	Summarise the steps involved in Canny edge detector.	K2	CO1	1.3.1 2.1.3
3.	Explain the role of crossing number in skeletonization.	K2	CO2	2.1.3 2.2.3
4.	Define correspondence problem.	K2	CO3	1.4.1 2.1.3

Part – B (3×6 = 18 Marks)

		KL	CO	PI
5.	Compare and contrast 1st and 2nd derivative methods of local edge detection. What are the advantages and disadvantages of each?	K2	CO1	1.3.1 2.1.3
6.	Consider a scenario for designing wearable devices to monitor the gait patterns of elderly individuals or patients with mobility issues. The centroidal profile approach would enable	K3	CO2	2.1.3 2.2.3

	continuous monitoring of gait parameters and early detection of changes that may indicate health problems or increased fall risk. Identify the potential risks/ challenges/ problems in the centroidal profile approach for the above mentioned scenario.			
7.	Illustrate a scenario when two lenses are used to obtain a stereo pair of images.	K2	CO3	1.4.1 2.1.3

Part – C (2 × 12 = 24 Marks)
(Any subdivisions should be either 7+5 or 8+4)

		KL	CO	PI
8.	Consider the brain MR images given below. A suitable technique is applied and initially obtained the region (tumor) as marked in green color (as given in (a)). After several iterations, finally obtained the region as marked in red color (as given in (b)). Identify the technique applied and elaborate the steps involved.  (a) (b)	K3	CO1	2.1.3 13.3.1
	(Or)			
9.	Identify the technique the following pair of images ((a) and (b)) represent. Elaborate the problem that the technique solves and mention the steps involved.  (a) (b)	K3	CO1	2.1.3 13.3.1

B&W

10.	In autonomous vehicle navigation, consider a scenario where a self-driving car needs to detect circular road signs for effective traffic management. Identify and describe a suitable algorithm to detect road signs amidst varying lighting conditions, occlusions, and distortions caused by environmental factors such as rain or fog.	K3	CO2	2.2.3 13.3.1
	(Or)			
11.	In manufacturing industries such as automotive or consumer electronics, many components, such as gears, bearings, or connectors, have elliptical shapes. Identify and describe a suitable algorithm to detect elliptical shaped components amidst varying noise or defects.	K3	CO2	2.2.3 13.3.1

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Register Number	3	1	2	2	2	1	5	0	0	7	0	6	6

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Computer Science and Engineering

Continuous Assessment Test – II

Regulations – R2021

Degree & Branch	B.E. CSE				**Semester**	VI
Subject Code & Name	**UCS 2H26 COMPUTER VISION**					
Academic Year	2023-2024 ~~ODD~~/EVEN	**Batch**	2021-2025	**Date**	**06/05/2024**	~~FN~~ / AN
Time: 4:00 – 5:30 p.m (90 Minutes)	**Answer All Questions**				**Maximum: 50 Marks**	

(K1: Remembering, K2: Understanding, K3: Applying, K4: Analyzing, K5: Evaluating)

CO1:	Apply various low-level feature detection methods (K3)
CO2:	Apply various feature analysis methods and transforms for intermediate-level vision (K3)
CO3:	Explain depth estimation and 3D reconstruction (K2)
CO4:	Analyse different object recognition methods (K4)
CO5:	Analyse deep learning models for a real-time computer vision application (K4)

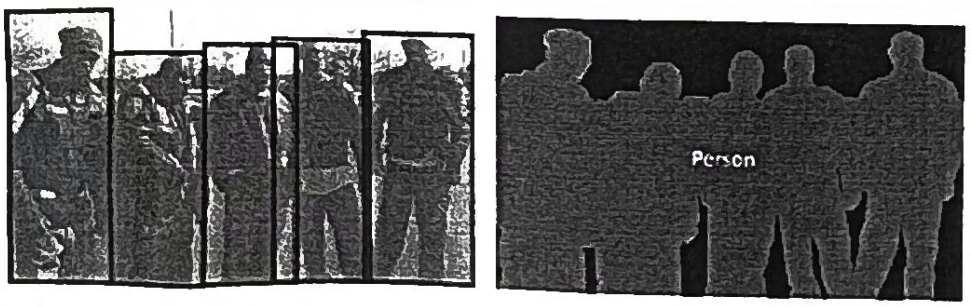
Part – A (4 × 2 = 8 Marks)

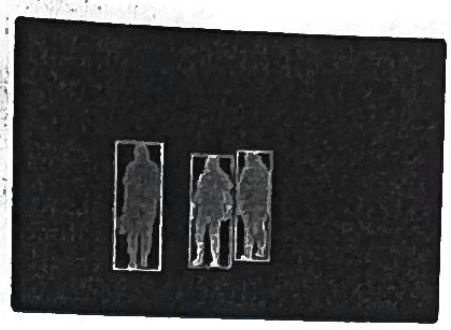
		KL	CO	PI
1.	Define bundle adjustment.	K1	CO3	1.3.1
2.	Compare and contrast the concepts of detection and recognition with suitable examples.	K2	CO4	1.3.1, 1.4.1
3.	Summarize context understanding and scene understanding.	K2	CO4	1.3.1, 2.1.3
4.	Describe visualization of kernels.	K2	CO5	1.4.1, 2.1.3

Part – B (3×6 = 18 Marks)

		KL	CO	PI
5.	Describe the process to reconstruct a 3D scene and simultaneously obtain the camera poses of a monocular camera with respect to a given scene.	K2	CO3	1.3.1, 2.1.3
6.	Design a suitable attendance tracking system by making use of a face detection algorithm. List down the various challenges involved during the design and identify the possible solutions.	K3	CO4	2.1.3, 4.1.2
7.	Explain the concept of "receptive field" used both in CNNs (Convolutional Neural Networks) and in visual neuroscience, and identify the role of trainable connections. Why is the concept of convolution relevant?	K2	CO5	1.4.1, 4.1.2

Part – C (2 × 12 = 24 Marks)
(Any subdivisions should be either 7+5 or 8+4)

		KL	CO	PI
8.	When visually inferring a 3D representation of a face, it is useful to extract separately both a shape model, and a texture model. Analyze the purposes of these steps, their use in morphable models for pose-invariant face recognition, and how the shape and texture models are extracted and later re-combined.	K4	CO4	4.1.2, 13.3.1
	(Or)			
9.	*"An image is worth a thousand words, each image has various components in it."* Analyze the purposes of identifying the various components (parts) in an image.	K4	CO4	4.1.2, 13.3.1
10.	Design a computationally efficient model for performing the following task. 	K4	CO5	2.2.3, 12.2.1, 13.3.1
	(Or)			

11.	Design a computationally efficient model for performing the following task.  	K4	CO5	2.2.3, 12.2.1, 13.3.1

Register No: | 3 | 1 | 2 | 2 | 2 | 1 | 5 | 0 | 0 | 1 | 0 | 6 | 6 |

Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam – 603 110.

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B.E. / B.Tech. End Semester Theory Examinations, April / May 2024.

Sixth Semester

Computer Science and Engineering

UCS2H26 COMPUTER VISION

(Regulations 2021)

(Common to Chemical Engineering, Electrical and Electronics Engineering, Electronics and Communication Engineering and Bio Medical Engineering)

Time: **Three Hours** Maximum:**100 Marks**

K1: Remembering K2: Understanding K3: Applying K4: Analyzing K5: Evaluating

CO1:	Apply various low level feature detection methods
CO2:	Apply various feature analysis methods and transforms for intermediate level vision
CO3:	Explain depth estimation and 3D reconstruction
CO4:	Analyse different object recognition methods
CO5:	Analyse deep learning models for a real time computer vision application

Part – A (5 × 2 = 10 Marks)

		KL	CO	PI
1.	Compare and contrast computer vision and human vision.	K2	CO1	1.3.1
2.	What is the difference between thinning and skeletonizing?	K1	CO2	1.4.1 2.2.3
3.	How does feature-based alignment contribute to the process of image registration and 3D reconstruction?	K1	CO3	1.4.1
4.	Define Eigen faces and state their necessity.	K1	CO4	1.3.1 1.4.1
5.	Outline the concept of spatio-temporal models in the context of vision applications.	K2	CO5	1.3.1 1.4.1

Part – B (5 × 6 = 30 Marks)

		KL	CO	PI
6.	Mention the common strategies for selecting seed points in region growing methods. How does the choice of seed point selection strategy impact the effectiveness and efficiency of the segmentation process?	K3	CO1	1.1.1 2.1.3
7.	State the challenges involved in shape recognition and the techniques used to address them. Discuss the contribution of shape recognition algorithms in computer vision applications.	K2	CO2	2.1.3 2.2.3

8.	Utilize the concept of triangulation in the context of structure-from-motion (SfM) techniques to estimate the 3D structure of a scene from multiple 2D images. Discuss the key principles of triangulation, including the use of corresponding image points and camera parameters.	K3	CO3	1.4.1 2.1.3
9.	Explain the roles of data preprocessing, augmentation techniques, and model evaluation metrics in optimizing face detection algorithms for real-world scenarios.	K3	CO4	2.1.3 2.2.3
10.	Compare and contrast R-CNN, Fast R-CNN, and Faster R-CNN with suitable justification.	K2	CO5	2.1.3 2.2.3

Part – C (5 × 12 = 60 Marks)

		KL	CO	PI
11.	Analyze the mechanism of thresholding in image processing, focusing on both global and adaptive thresholding methods. Explain how thresholding is used to segment images by separating objects or features of interest from the background. (6M+6M)	K3	CO1	2.1.3 13.3.1
	(Or)			
12.	Explain the Canny edge detection algorithm and its significance in vision applications in a detailed step-by-step process. Highlight the advantages of the Canny edge detection algorithm compared to other edge detection techniques. Provide the examples of real-world applications where Canny edge detection is commonly used and discuss the factors influencing its effectiveness in different scenarios	K3	CO1	2.1.3 13.3.1
13.	Discuss the principles behind centripetal profile generation for boundary tracking and explain how centripetal profiles are used to track boundaries or contours of objects in images with the factors influencing their performance in different types of images and environments.	K4	CO2	2.2.3 4.1.2 13.3.1
	(Or)			
14.	Elaborate how the Hough Transform is used for detecting geometric shapes, particularly lines and circles, in digital images.	K4	CO2	2.2.3 4.1.2

	Describe the key steps involved in the Hough Transform algorithm. List any two real-life examples where Hough transform is utilized.			13.3.1
15.	Assess the importance of the epipolar geometry concept in stereo vision techniques. Determine the key components of epipolar geometry and justify their significance in computer vision by listing the sample tasks.	K3	CO3	1.3.1 2.1.3 13.3.1
	(Or)			
16.	Discuss the different variations of Shape from X and elaborate each variation in detail with the necessity of each. Also, identify the domains in which Shape from X plays a vital role.	K3	CO3	1.3.1 2.1.3 13.3.1
17.	Compare and contrast bag-of-words and part-based models in terms of their effectiveness, robustness, and computational complexity. Describe the key components and workflow of each approach.	K4	CO4	4.1.2 13.3.1
	(Or)			
18.	Discuss how learning from large image collections contributes to improving context and scene understanding algorithms. Describe the key challenges involved in context and scene understanding and discuss the potential benefits and limitations of these techniques.	K4	CO4	4.1.2 13.3.1
19.	Design the architecture of a neural network designed for backpropagation training with the key components and layers involved for computer vision. Elaborate on the role of parameters such as learning rate, batch size, and optimization algorithms in the training process.	K3	CO5	4.1.2 12.2.1 13.3.1
	(Or)			
20.	Judge the significance of CNN's and RNN's in video understanding for vision applications. Justify how they will be used for activity recognition in a simplified manner.	K3	CO5	4.1.2 12.2.1 13.3.1