SRM VALLIAMMAI ENGINEERING COLLEGE
(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

&

DEPARTMENT OF ARTIFICIAL INTELLIGENCE-DATA SCIENCE

QUESTION BANK

V SEMESTER

PAD103– IMAGE AND VIDEO ANALYTICS

Regulation – 2023

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Ms.R.Anitha, Assistant Professor(Sr.G)/CSE
Ms.Mohana Priya, Assistant Professor(O.G)/CSE
Dr.B.MuthuSenthil, Professor/AI-DS

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SUBJECT : PAD103 – IMAGE AND VIDEO ANALYTICS

SEM / YEAR: VI SEM / III Year

UNIT I INTRODUCTION			
Computer Vision – Image representation and image analysis tasks - Image representations – digitization – properties – color images – Data structures for Image Analysis - Levels of image data representation - Traditional and Hierarchical image data structures.			
PART – A			
Q.No	**Questions**	**BT Level**	**Competence**
1.	Define computer vision.	BTL1	Remembering
2.	Define why computer vision is difficult?	BTL1	Remembering
3.	List the digital image properties..	BTL1	Remembering
4.	Give the names of hierarchical data structure.	BTL2	Understanding
5.	Define sampling.	BTL1	Remembering
6.	Elaborate quantization.	BTL6	Creating
7.	List the 4-neighborhood and 8-neighborhood pixel representation.	BTL1	Remembering
8.	Define pixel and voxel.	BTL1	Remembering
9.	Classify visual perception of the image.	BTL2	Understanding
10.	Identify the histogram of digital image.	BTL2	Understanding
11.	Illustrate the physics of color.	BTL2	Understanding
12.	Write about color images.	BTL2	Understanding
13.	Define palette images	BTL3	Applying
14.	What are the types of noise in image?	BTL2	Understanding
15.	List the traditional image data structures.	BTL1	Remembering
16.	Identify the color perceived by human.	BTL3	Applying
17	Outline the term pseudo color.	BTL4	Analyzing

18	Differentiate low-level image processing and high-level image processing.	BTL4	Analyzing
19	What is image digitization?	BTL4	Analyzing
20	Differentiate between M-Pyramids(matrix-pyramids) and T-Pyramids(tree-pyramids).	BTL4	Analyzing
21	Explain about HSV.	BTL5	Evaluating
22	Assess run-length encoding.	BTL5	Evaluating
23	Justify Chain code.	BTL5	Evaluating
24	Express about topological data structure.	BTL6	Creating
	PART - B		
1.	Describe in detail about traditional image data structures. (16)	BTL1	Remembering
2.	Describe in detail about pyramids.(16)	BTL1	Remembering
3.	List the visual perception of the image.(16)	BTL1	Remembering
4.	What is digital image property and explain in detail. (16)	BTL2	Understanding
5.	Summarize the following: i)Image quality ii)noise in images	BTL2	Understanding
6.	Illustrate image representation and image analysis tasks with neat diagram.(16)	BTL2	Understanding
7.	Discuss the following: i)Infer the term 'entropy'.(8) ii)Express the term 'contrast' and 'acuity'(8)	BTL2	Understanding
8.	Discuss in detail about why is computer vision is difficult. (16)	BTL2	Understanding
9.	Explain in detail about color spaces. (16)	BTL2	Understanding
10.	i) Explain in detail about metric and topological properties of digital images. (8) ii) Examine the term histogram. (8)	BTL3	Applying
11.	Illustrate on the concept of palette images. (16)	BTL3	Applying
12.	Write a concept on quadtrees. (16)	BTL3	Applying
13.	Explain in detail about color images. (16)	BTL4	Analyzing
14.	Explain in detail about hierarchical data structure. (16)	BTL4	Analyzing
15.	i)Analyze the levels of image data representation. (8) ii)Categorize image digitization process. (8)	BTL4	Analyzing
16.	Discuss the following: i) Summarize on matrices in image data structure. (8) ii) Justify on relational structures. (8)	BTL5	Evaluating
17.	Write in detail about color constancy. (16)	BTL3	Applying

UNIT II IMAGE PRE-PROCESSING

Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Scale in image processing - Canny edge detection - Parametric edge models - Edges in multi-speralct images - Local pre-processing in the frequency domain - Line detection by local pre-processing operators - Image restoration.

PART - A

Q.No	Questions	BT Level	Competence
1.	Define image smoothing.	BTL1	Remembering
2.	What are two groups in local-preprocessing?	BTL1	Remembering
3.	List down the examples of spatial filtering.	BTL1	Remembering
4.	Tell the types of edge profile.	BTL1	Remembering
5.	Define central limit theorem.	BTL1	Remembering
6.	What is meant by convulsion mask?	BTL1	Remembering
7.	How can you define low-pass filter?	BTL2	Understanding
8.	Do you know about median filtering? explain it.	BTL2	Understanding
9.	Infer edge detector.	BTL2	Understanding
10.	Rewrite the edges in a multi-spectral image?	BTL2	Understanding
11.	List down the objective of image sharpening.	BTL2	Understanding
12.	Determine the facet model.	BTL3	Applying
13.	Can you Justify the homomorphic-filetring?	BTL3	Applying
14.	Determine the formula for bi-cubic facet model.	BTL3	Applying
15.	When to use high-pass filter?	BTL3	Applying
16.	Claffy the canny edge detection criteria.	BTL4	Analyzing
17.	Examine the difference between Roberts and laplace operators.	BTL4	Analyzing
18.	Examine the high pass filter used in homomorphic-filtering.	BTL4	Analyzing
19.	Analyze on prewitt operator.	BTL4	Analyzing
20.	Justify the optimality of the detector based on the criteria?	BTL5	Evaluating
21.	What's the difference between magnitude and direction?	BTL5	Evaluating
22.	How do you make a feature synthesis approach?	BTL5	Evaluating
23.	How to create a scale-space filtering.	BTL6	Creating
24.	Write about band-pass filter.	BTL6	Creating

PART - B

1.	Define edge detector and explain in detail. (16)	BTL1	Remembering
2.	Define Canny edge detection and explain in detail about optimality of the detector based on criteria and its dimension? (16)	BTL1	Remembering
3.	Describe median filtering algorithm with a neat flow. (16)	BTL1	Remembering
4.	Describe in detail about deterministic or stochastic restoration technique. (16)	BTL1	Remembering

5.	Explain the following operators in detail (16) i)Roberts ii)Laplace iii)Prewitt iv)Sobel	BTL2	Understanding
6.	Show the process of implementing parametric-edge models in computer vision applications. Discuss how these models differ from non-parametric approaches and provide examples of scenarios where parametric edge models are advantageous. (16)	BTL2	Understanding
7.	Summarize the concept of zero-crossings of the second-derivative. (16)	BTL2	Understanding
8.	Explain the mechanisms involved in line detection using local-preprocessing operators, and discuss their advantages and limitations compared to other line detection methods. (16)	BTL2	Understanding
9.	Explain how to achieve image smoothing(16)	BTL3	Applying
10.	Explain the image restoration techniques. (16)	BTL3	Applying
11.	Examine the edges in a multi-spectral images. (8) Interpret about parametric edge-models.(8)	BTL3	Applying
12.	Compare inverse filtering and weiner filtering in the context of image restoration for the underlying principles of each method, their advantages, limitations and suitable scenarios for their applications with examples to illustrate the effectiveness of both techniques in restoring degraded images. (16)	BTL4	Analyzing
13.	How can you use the canny-edge detection algorithm to improve edge detection in a complex grayscale image? (16)	BTL4	Analyzing
14.	i) Organize how to perform aaveraging, statistical principles of noise suppression. (8) ii) Organize how to perform averaging with limited data validity. (8)	BTL4	Analyzing
15.	How do you justify the different filtering methods in image restoration. (16)	BTL5	Evaluating
16.	Can you summarize about laplacian of gaussian. (16)	BTL5	Evaluating
17.	i)Write notes on degradations that are easy to restore, relative motion of camera and object, wrong lens effect. (8) ii)Write about kirsch and sobel operator. (8)	BTL6	Creating

UNIT III - OBJECT DETECTION USING MACHINE LEARNING			
Object detection– Object detection methods – Deep Learning framework for Object detection– bounding box approach-Intersection over Union (IoU) –Deep Learning Architectures-R-CNN-Faster R-CNN-You Only Look Once(YOLO)-Salient features-Loss Functions-YOLO architectures.			
PART - A			
Q.No	**Questions**	**BT Level**	**Competence**
1.	Define object detection in machine learning.	BTL-1	Remember

2.	List any two traditional object detection methods.	BTL-1	Remember
3.	What is a bounding box in object detection?	BTL-1	Remember
4.	Differentiate between object classification and object detection.	BTL-2	Understand
5.	State the purpose of Intersection over Union (IoU).	BTL-1	Remember
6.	Illustrate the importance of IoU in evaluating model performance.	BTL-2	Understand
7.	What is the main objective of the R-CNN algorithm?	BTL-1	Remember
8.	Summarize how YOLO differs from traditional object detection techniques.	BTL-2	Understand
9.	Name any two deep learning architectures used in object detection.	BTL-1	Remember
10.	What are salient features in the context of object detection?	BTL-1	Remember
11.	Describe the role of the loss function in object detection.	BTL-2	Understand
12.	Outline the structure of Faster R-CNN.	BTL-2	Understand
13.	Identify the key components in a YOLO architecture.	BTL-1	Remember
14.	Define Non-Maximum Suppression (NMS).	BTL-1	Remember
15.	List the stages involved in R-CNN.	BTL-1	Remember
16.	Explain anchor boxes.	BTL-2	Understand
17.	What is region proposal in object detection?	BTL-1	Remember
18.	Illustrate the significance of backbone networks in detection.	BTL-2	Understand
19.	Compare R-CNN and Fast R-CNN.	BTL-2	Understand
20.	What do you understand by feature map?	BTL-2	Understand
21.	Name two loss components in YOLO.	BTL-1	Remember
22.	Show how grid cells are used in YOLO.	BTL-3	Apply
23.	Outline the steps of object localization.	BTL-2	Understand
24.	State any two advantages of YOLO.	BTL-1	Remember
	PART - B		
1.	Explain in detail the different methods of object detection with examples.	BTL-4	Analyze
2.	Analyze the advantages and limitations of using bounding boxes in object detection.	BTL-4	Analyze
3.	Compare and contrast R-CNN, Fast R-CNN, and Faster R-CNN.	BTL-5	Evaluate
4.	Elaborate the YOLO architecture with neat diagram and flow of operations.	BTL-4	Analyze
5.	Explain the concept of Intersection over Union (IoU) and how it affects model accuracy.	BTL-4	Analyze
6.	Discuss in detail the working of Faster R-CNN and its improvements over R-CNN.	BTL-4	Analyze

7.	Illustrate various loss functions used in object detection models and their impact.	BTL-4	Analyze
8.	Design a custom object detection pipeline using YOLO for real-time applications.	BTL-6	Create
9.	Evaluate the performance metrics used to assess object detection models.	BTL-5	Evaluate
10.	Justify the importance of salient features in object detection.	BTL-5	Evaluate
11.	Examine deep learning frameworks used for object detection with suitable case studies.	BTL-4	Analyze
12.	Develop an object detection system using YOLOv5 and explain each step in the workflow.	BTL-6	Create
13.	Interpret the working of anchor boxes and how they improve object detection accuracy.	BTL-4	Analyze
14.	Summarize the role of feature extraction in deep learning-based object detection.	BTL-4	Analyze
15.	Propose a solution using object detection techniques for an industrial automation problem.	BTL-6	Create
16.	Critically analyze the speed vs accuracy trade-off in YOLO and Faster R-CNN.	BTL-5	Evaluate
17.	Compare traditional object detection techniques with deep learning-based approaches.	BTL-5	Evaluate

UNIT IV - FACE RECOGNITION AND GESTURE RECOGNITION

Face Recognition-Introduction-Applications of Face Recognition-Process of Face Recognition DeepFace solution by Facebook-FaceNet for Face Recognition- Implementation using FaceNetGesture Recognition.

PART - A

Q.No	Questions	BT Level	Competence
1.	Define face recognition.	BTL-1	Remember
2.	List any two applications of face recognition.	BTL-1	Remember
3.	What are the main steps in the face recognition process?	BTL-1	Remember
4.	Differentiate between face detection and face recognition.	BTL-2	Understand
5.	Mention any two advantages of using DeepFace.	BTL-1	Remember
6.	What is the main role of FaceNet in face recognition?	BTL-1	Remember
7.	State the purpose of embedding in FaceNet.	BTL-1	Remember
8.	Summarize the key features of DeepFace.	BTL-2	Understand
9.	What is the accuracy of FaceNet on LFW dataset?	BTL-1	Remember
10.	List two components of the face recognition system.	BTL-1	Remember
11.	Define gesture recognition.	BTL-1	Remember
12.	List any two types of gestures.	BTL-1	Remember
13.	Mention any two applications of gesture recognition.	BTL-1	Remember
14.	Differentiate between static and dynamic gestures.	BTL-2	Understand

15.	Explain the role of CNN in face recognition.	BTL-2	Understand
16.	What is the purpose of feature extraction in face recognition?	BTL-2	Understand
17.	Illustrate how gesture recognition is used in gaming.	BTL-2	Understand
18.	What is a face embedding?	BTL-1	Remember
19.	List the stages of gesture recognition.	BTL-1	Remember
20.	Explain how FaceNet maps faces into Euclidean space.	BTL-2	Understand
21.	Give any two differences between DeepFace and FaceNet.	BTL-2	Understand
22.	Show the steps involved in training FaceNet.	BTL-3	Apply
23.	What is triplet loss in FaceNet?	BTL-1	Remember
24.	Identify the use of face recognition in security systems.	BTL-3	Apply
	PART - B		
1.	Explain in detail the applications and process of face recognition.	BTL-4	Analyze
2.	Analyze the working of DeepFace and how it performs face recognition.	BTL-4	Analyze
3.	Compare DeepFace and FaceNet in terms of architecture and performance.	BTL-5	Evaluate
4.	Illustrate the step-by-step working of FaceNet with a diagram.	BTL-4	Analyze
5.	Discuss the advantages and limitations of using FaceNet for face recognition.	BTL-5	Evaluate
6.	Design a face recognition system using FaceNet and explain the implementation steps.	BTL-6	Create
7.	Summarize the key challenges in gesture recognition.	BTL-4	Analyze
8.	Explain the implementation of gesture recognition using machine learning.	BTL-4	Analyze
9.	Evaluate the performance metrics used in face recognition models.	BTL-5	Evaluate
10.	Justify the use of face recognition in modern security applications.	BTL-5	Evaluate
11.	Examine the role of CNN and embeddings in the FaceNet architecture.	BTL-4	Analyze
12.	Develop a system for gesture-based control using computer vision.	BTL-6	Create
13.	Interpret the concept of triplet loss and its importance in FaceNet.	BTL-4	Analyze
14.	Summarize the contribution of Facebook's DeepFace to facial recognition research.	BTL-4	Analyze
15.	Propose a real-time application combining face and gesture recognition.	BTL-6	Create
16.	Critically analyze the ethical issues involved in face recognition technologies.	BTL-5	Evaluate
17.	Compare traditional methods of gesture recognition with deep learning approaches.	BTL-5	Evaluate

UNIT-V: VIDEO ANALYTICS			
Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem-RestNet architecture-RestNet and skip connections-Inception Network-GoogleNet architecture-Improvement in Inception v2-Video analytics-RestNet and Inception v3.			
PART – A			
Q.No	**Questions**	**BT Level**	**Competence**
1.	What is 4 use cases of video analytics?	BTL1	Remembering
2.	What are two powerful Deep Learning architectures?	BTL1	Remembering
3.	How does the video analytics used in crowd management?	BTL1	Remembering
4.	What are local minima and global minima?	BTL1	Remembering
5.	Which is the heart of the residual networks?	BTL1	Remembering
6.	What is video processing?	BTL1	Remembering
7.	Explain the improvements in inception v2.	BTL2	Understanding
8.	What is the improvement in inception v3 when compared to inception v1 networks?	BTL2	Understanding
9.	What is meant by vanishing gradient?	BTL2	Understanding
10.	What is identity mapping?	BTL2	Understanding
11.	What is inception v3?	BTL3	Applying
12.	Explain the term exploding gradient.	BTL3	Applying
13.	Explain residual networks and their role in video analytics.	BTL3	Applying
14.	Explain what are the learning methods a neural network trained on?	BTL4	Analyzing
15.	Analyze how the ResNet solves the vanishing gradient problem?	BTL4	Analyzing
16.	Infer “error term”.	BTL4	Analyzing
17.	Explain the steps in video classification using Deep Learning.	BTL5	Evaluating
18.	Discriminate local minima and global minima.	BTL5	Evaluating
19.	Express the job of backpropagation algorithm.	BTL6	Creating
20.	Develop the basic neural architecture having an input layer, hidden layers, and an output layer.	BTL6	Creating
21.	Define GoogleNet.	BTL2	Understanding
22.	Design the two versions of the Inception module in ResNet.	BTL3	Applying
23.	Differentiate the different activation function used in neural networks?	BTL4	Analyzing
24.	Summarize the signs to check for the vanishing gradient Problem.	BTL5	Evaluating
PART-B			
1.	Describe the basic steps of video processing. (16)	BTL1	Remembering
2.	Examine in detail about fundamental design principles under the GoogleNet. architecture and how do they enable efficient processing in deep neural networks. (16)	BTL1	Remembering
3.	Identify the convolution blocks, pooling blocks and softmax blocks and explain the properties of the network in which it resides. (16)	BTL1	Remembering
4.	Describe in detail about inception v3.(16)	BTL1	Remembering
5.	Infer skip connections in the RestNet architecture contribute to improve the performance of deep neural networks and give	BTL2	Understanding

	examples of how this technique is applied in practical image recognition tasks. 16)		
6.	Discuss in detail about inception network? (16)	BTL2	Understanding
7.	Interpret how the inception v2 improves performance in tasks like image classification and object detection.	BTL2	Understanding
8.	Explain with examples of how video analytics is used across industries like retail, healthcare and transportation and explain its impact on operations and decision-making? (16)	BTL3	Applying
9.	Illustrate in detail about the following: i) Few suggested solutions for the vanishing gradient. (8) ii) Solution to exploding gradient problem. (8)	BTL3	Applying
10.	Analyze the following concepts: i) ResNet and skip connections. (8) ii) Inception network. (8)	BTL4	Analyzing
11.	Explain the following: i)Two versions of the Inception module. (8) ii) Few challenges that are faced while training on deep networks(8)	BTL4	Analyzing
12.	Differentiate between inception v2 and inception v3.	BTL4	Analyzing
13.	Summarize the vanishing gradient and exploding gradient problem in detail. (16)	BTL5	Evaluating
14.	Design an Python solution using ResNet and Inception v3 (16)	BTL6	Creating
15.	Discuss in detail about the utilization of deep Learning–based capabilities across domains and business functions.(16)	BTL2	Understanding
16.	Illustrate RestNet architecture applied to enhance image-classification tasks with real world examples of its effectiveness.(16)	BTL3	Applying
17.	Summarize the improvements in inception v2 network.(16)	BTL5	Evaluating