

The LNMIIT, Jaipur
Electronics and Communication Department
Computer Vision: Foundations and Applications (ECE-XXX)



Subject Code: ECE-XXX	Course Title: Computer Vision: Foundations and Applications	Total Contact Hours: 40	L: 3	T: 0	P: 0	C: 3
Pre-requisite: Mathematics		Year:	Semester:			

** L → Lectures, T → Tutorials, P → Projects C → Credit

Learning Objective:

The intent of this course is to familiarize the students to explain the fundamental concepts/issues of Computer Vision and major approaches that address them. This course provides an introduction to computer vision including image acquisition and image formation models, image processing concepts, concept of detection, feature extraction and selection for pattern classification/recognition, and advanced concepts like motion estimation and tracking, image classification, scene understanding, object classification and tracking, image fusion, and image registration, etc.

Course outcomes (COs):

On completion of this course, the students will have the ability:		Bloom's Level
CO-1	Understand the need for image transforms, edge detection, filters for image enhancement	1
CO-2	Understand the different features and image descriptors used for identifying an image and how to apply it in real life problems	2, 3
CO-3	Understand and implement the segmentation and clustering algorithms to find the region of interest	2, 3
CO-4	Understand different object detection and tracking algorithms and implement it in different challenging environments.	2, 4
CO-5	Understand the basic machine learning algorithms and implement it to recognize a given object.	2, 4
CO-6	Implement and evaluate real life problem using computer vision algorithms.	3, 5

Course Topics	Lecture Hours
UNIT – I Introduction	3
Introduction and Goals of Computer Vision and Image Processing, Image Formation Concepts, Geometric Transformations, Image Formation in a Stereo Vision Setup, Image Transforms, Image Enhancement, Image Filtering, Edge detection, Color Image Processing	
UNIT – II Image Descriptors and Features	6
RANSAC, Local Invariant Features, Harris Corner detector, Scale invariant keypoint detection, Scale Invariant Feature Transform, Histogram of Oriented Gradients, Speeded up Robust Features, Panorama	

UNIT – III Segmentation, Clustering and Retargeting	5
Gestalt theory for perceptual grouping, Agglomerative clustering, Graph-based segmentation, K-means clustering, Mean shift clustering, image resizing, seam carving algorithm	
UNIT – IV Visual Recognition	10
Visual recognition tasks and challenges, K-nearest neighbors, visual bag of words algorithm, Applications: Image search, Action recognition, spatial pyramid matching, Naïve Bayes algorithm.	
UNIT – V Object detection, motion and tracking	12
Object detection: task and evaluation, simple object detector, deformable parts model, Optical flow, Lucas-Kanade method, Pyramids for large motion, Horn-Schunk method, motion segmentation and applications, feature tracking and its challenges, KLT Tracker, basics of ANN and CNN	
UNIT – VI Applications	4
Smart car lane detection, Panorama, estimating 3D structure, Super resolution, Street score, Scene understanding, Image captioning, Gesture Recognition, Face and Facial Expression Recognition	

Textbook References:

Textbooks:

1. Forsyth & Ponce, “Computer Vision-A Modern Approach”, Pearson Education.
2. M.K. Bhuyan , “ Computer Vision and Image Processing: Fundamentals and Applications”, CRC Press, USA, ISBN 9780815370840 - CAT# K338147.

Reference Books:

1. Mark Nixon, Alberto S. Aguado, “Feature Extraction and Image Processing for Computer Vision”, 4th ed. , Elsevier Academic Press, ISBN: 97802128149768.
2. Rafael C. Gonzalez., Richard E. Woods, “Digital Image Processing”, 4th ed., Pearson Education.2018, ISBN: 9789353062989

Additional Resources (Web resources)

<https://nptel.ac.in/courses/108/103/108103174/>

Evaluation Method	
Item	Weightage (%)
Quiz	10
Assignment/Case study	10
Midterm	20
Project	20
Final Examination	40

***Please note, as per the existing institute's attendance policy the student should have a minimum of 75% attendance. Students who fail to attend a minimum of 75% lectures will be debarred from the EndTerm/Final/Comprehensive examination.**

CO and PO Correlation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	-	-	-	-	-	-	3	1	-	-
CO2	3	3	1	3	1	-	-	-	-	-	-	2	1	-	-
CO3	3	3	1	3	2	-	-	-	-	-	-	1	1	-	-
CO4	3	3	1	1	1	-	-	-	2	2	-	1	2	1	-
CO5	3	3	1	3	3	-	-	-	2	2	-	1	2	2	-
CO6	3	3	1	3	3	-	-	-	3	2	-	1	3	2	-

Last Updated On: 01-07-2021
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Approved By: