GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering Syllabus

Subject Code : ME02004041

Subject Name : Computer Vision and Application

WEF Academic Year :	2024-25
Semester :	2
Category of the Course :	PEC-03

Prerequisite :	Linear Algebra, Vector Calculus, Data Structures and Programming
Rationale :	Be familiar with both the theoretical and practical aspects of computing with images. Have described the foundation of image formation, measurement, and analysis. Understand the geometric relationships between 2D images and the 3D world. Grasp the principles of state-of-the-art deep neural networks.

Course Scheme :

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
				Theory		Practical		
L	T	PR	C	ESE (E)	PA(M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Course Content :

Sr. No.	Course Content	No. of Hours	% of Weightage
1	Overview of computer vision and its applications: Image Formation and Representation: Imaging geometry, radiometry, digitization, cameras and Projections, rigid and affine transformation.	8	12
2	Overview, computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis	8	12
3	Edge detection, Edge detection performance, Hough transform, corner detection.	7	15
4	Segmentation, Morphological filtering, Fourier transform.	7	15
5	Feature extraction, shape, histogram, color, spectral, texture, using CV IP tools, Feature analysis, feature vectors, distance /similarity measures, data preprocessing.	7	19
6	Pattern Analysis : Clustering: K-Means, K-Medoids, Mixture of Gaussians Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA, and Non-parametric methods.	7	19
7	Recent trends in Activity Recognition, computational photography, Biometrics	4	8

	Total	48	100

Reference Book:

1. Computer Vision: Algorithms and Applications by Richard Szeliski.
2. Computer Vision – A modern approach, by D.Forsyth and J.Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.
3. Deep Learning, by Goodfellow, Bengio, and Courville.
4. Dictionary of Computer Vision and Image Processing, by Fisher et al.
5. Three-Dimensional Computer Vision, by Olivier Faugeras, The MIT Press.

Course Outcome :

After Completion of the Course, Student will be able to :

No	Course Outcomes	RBT Level*
01	Identify basic concepts, terminology, theories, models and methods in the field of computer vision.	RM
02	Describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition.	UN
03	Developed the practical skills necessary to build computer vision applications.	AP
04	To have gained exposure to object and scene recognition and categorization from images	EL

*RM: Remember, UN: Understand, AP: Apply, AN: Analyse, EL: Evaluate, CR: Create

Suggested Course Practical List :

1. To perform variants of linear filter on an image.
2. To perform median filter on an image.
3. To perform all morphological filter operations on the image.
4. To perform edge detection on an image using Sobel, Prewitt, Roberts and Canny Method.
5. To perform Hough transform on an image.
6. Generate histogram and perform histogram equalization of an image.
7. To perform clustering using any technique on the image.
8. To perform various pattern classification and analysis techniques on images.
9. To perform various pattern clustering and analysis techniques on images.

List of Laboratory/Learning Resources Required :

OpenCV, Python

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