

Year: M. Tech. II (Semester – III)

**Subject Name:** Computer Vision

**Subject Code:** MTCO14303

**Type of course:** Professional Elective - V

**Prerequisite (if any):** Exposure to basic mathematics: calculus, linear algebra and probability.

**List of Courses where this course will be prerequisite: --**

**Rationale:** Computer vision is a fast evolving area and has been applied in many disciplines. This course will introduce students to fascinating fields. This course will enable students to apply computer vision techniques and algorithms to solve various real-world problems and develop skills for research in the fields.

**Teaching and Examination Scheme:**

Teaching Scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	4	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests. CA2: Sincerity in attending classes/class tests/ timely submissions of assignments / self-learning attitude/ solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

**Content:**

Sr.No.	Content	Total Hrs
1	Unit 1: Low Level Vision: Introduction to computer vision / The Four Rs of Computer Vision, Color perception and representation, Color model and inference from color, Convolutions, Correlation filter as templates, Scale and image pyramid, Working with Image gradients and corners, SIFT and HOG features, Texture and Filters, Textons, Texture Synthesis and shape from texture	10
2	Unit 2: Mid-Level Vision : Image in painting, Image fusion, Image captioning, Segmentation/clustering – Breaking an image or image sequence into a few	10

	meaningful pieces with internal similarity, Hough Transform, Fitting lines and planes, Fitting using probabilistic models: EM algorithm, Motion Segmentation: Optical flow, Simple tracking strategies: Detection, matching, Particle filtering	
3	Unit 3: High-level Vision :Revision Learning to classify: Error, loss, classification strategies, classifying images: Features, Single subjects, Object detection: Face, detecting humans, State of the art in Object detection: Mask RCNN, Finding and parameterizing a known object – Assignment to known categories using statistics/probability to make best choice, Hidden Markov Model, Fitting an HMM with EM, parsing people in image, structure model, Tracking people: Kinematic tracking	10
4	Unit 4: Computer Vision using Machine Learning :Convolutional Neural Networks architectures, Convolution and Pooling, training CNN, Data Augmentation and Transfer Learning, Recurrent Neural Networks, LSTM, GRU	10
5	Unit 5: Applications of Computer Vision : Visual Perception for Self-Driving Cars, Facial Expression Recognition, Recent trends in computational photography, Biometrics,	5

**Reference Books:**

Sr No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Computer Vision: Algorithms and Applications	Richard Szeliski			
2	Computer Vision – A modern approach	D.Forsyth and J.Ponce,	Prentice Hall Robot Vision,		

		B.K.P. Horn	McGraw-Hill.		
3	Computer Vision: A Modern Approach	D. Forsyth and J. Ponce,	Prentice Hall, ISBN 978- 9332550117.b)	2015.	(2 ed.)
4	Computer vision: models, learning, and inference Digital Image Processing by S.shreedhar	Prince, Simon JD.	Cambridge University  Press, ISBN 978-1107011793	2012.	(1 ed.)
5	Digital Image Processing	S.shreedhar			

**Course Outcomes:**

Sr. No.	CO statement	Marks % weightage
CO-1	Understand key features of Computer Vision to analyse and interpret the visible world around us.	30%
CO-2	Design and implement feature extraction, pattern analysis, visual geometric modelling, and object tracking.	30%
CO-3	Design and apply models based on deep neural networks.	20%
CO-4	Apply the computer vision concepts to Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering.	20%

**List of Open learning website:**

MOOC

<https://www.udacity.com/course/introduction-to-computer-vision--ud810>

<http://csrcv.ucf.edu/videos/lectures/2014.php>

**List of Open Source Software:** Open CV , Python

**FOR LAB SESSIONS:**

**List of Experiments:**

Sr. No	Practical
1	Implement the following Opencv Program for Object Tracking <ul style="list-style-type: none"> <li>i. Face detection using haar-cascades</li> <li>ii. Meanshift and Camshift algorithms to find and track objects in videos.</li> </ul>
2	Feature extraction <ul style="list-style-type: none"> <li>i. SIFT(Scale-Invariant Feature Transform)</li> <li>ii. SURF(Speeded-Up Robust Features)</li> <li>iii. GIST</li> <li>iv. FAST</li> <li>v. BRIEF</li> <li>vi. ORB</li> </ul>
3	Implement Opencv Program that remove small noises, strokes etc in old photographs by a method called inpainting
4	To perform various pattern classification and analysis techniques on images.
5	To perform various pattern clustering and analysis techniques on images.
6	Mini Project for modelling of any one computer vision application