Course Code	21CSE454T	Course Name	COMPUTER VISION	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	School of Computing	Data Book / Codes / Standards		Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	Introduce students the foundations of Image Processing Techniques.
CLR-2:	Understand the shape and region analysis.
CLR-3:	Understand the Hough Transform and its applications to detect lines, circles, ellipses.
CLR-4:	Understand the Three-dimensional image analysis techniques and Motion Analysis.
CLR-5:	Study some applications of computer vision algorithms.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO)												Program Specific outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Modern Tool Usage	The engineer and society	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Perform basic Point detection and Morphology.	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Perform shape analysis, implement boundary tracking techniques and a apply chain codes and other region descriptors	2	2	1	-	-	-	-	-	-	-	-	-	3	-	-
CO-3:	Apply Hough Transform for line, circle, and ellipse detections.	3	2	1	-	1	-	-	-	-	-	-	-	3	-	-
CO-4:	Apply 3D vision techniques. Implement motion related techniques.	2	-	-	-	-	-	-	-	-	-	-	-	3	-	2
CO-5:	Develop applications using computer vision techniques.	2	-	1	1	1	-	-	-	-	-	-	-	3	-	2

Unit-1 - Image Processing Foundations	**9 Hour**
Image processing techniques - classical filtering operations - thresholding techniques - edge detection techniques - corner and interest point detection - mathematical morphology - texture.	
Unit-2 - Shapes and Regions	**9 Hour**
Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moment.	
Unit-3 - Hough Transform	**9 Hour**
Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem –ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform (GHT) – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation.	
Unit-4 - Vision and Motion	**9 Hour**
Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – Introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline-based motion – optical flow – layered motion.	
Unit-5 - Applications	**9 Hour**
Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.	

Learning Resources	1. *Computer Vision: Algorithms and Applications,* 2. *Richard Szeliski, Springer-Verlag London Limited 2011* 3. *E. R. Davies, —Computer & Machine Vision‖, Fourth Edition, Academic Press, 2012* 4. *D. L. Baggio et al., —Mastering OpenCV with Practical Computer Vision Projects‖, Packt Publishing, 2012* 5. *Computer Vision: A Modern Approach, Forsyth, J. Ponce, Pearson Education, 2003.*	6. *Jan Erik Solem, —Programming Computer Vision with Python: Tools and algorithms for analyzing images‖, O'Reilly Media, 2012.* 7. *Mark Nixon and Alberto S. Aquado, —Feature Extraction & Image Processing for Computer Vision‖, Third Edition, Academic Press, 2012.]* 8. *Davies, E. R. (2017). Computer Vision: Principles, Algorithms, Applications, Learning. Netherlands: Elsevier Science.* 9. *8. Bhuyan, M. K. (2019). Computer Vision and Image Processing: Fundamentals and Applications. United States: CRC Press.*

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life-Long Learning CLA-2 (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	*20%*	-	*15%*	-
Level 2	*Understand*	*25%*	-	*25%*	-	*25%*	-
Level 3	*Apply*	*30%*	-	*30%*	-	*30%*	-
Level 4	*Analyze*	*30%*	-	*25%*	-	*30%*	-
Level 5	*Evaluate*	-	-	-	-	-	-
Level 6	*Create*	-	-	-	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers

Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
1. *Mr. BharathKumar, Senior Software Developer, MalwareBytes, Estonia, sadanandam@malwarebytes.com*	1. *Dr. K. Vivekanandan , Ph.D., Professor in Computer Science and Engineering , Pondicherry Engineering College, Puducherry-605014, k.vivekanandan@pec.edu*	1. *Dr M Suchithra, Associate Professor, Dept. of Computing Technologies.*