COURSE CODE	COURSE TITLE	L	T	P	C
1152IT128	Computer Vision	3	0	0	3

Course Category:

~~Foundation (0)/ Program Core (1)~~ **/ Program Elective (2)** ~~/ Allied Elective (3) / University Elective (4) / Value Education Elective (5) / Independent Learning (6) / Industry - Higher Learning Institute Interaction (7)~~

a. Preamble :

How can computers understand the visual world of humans? This course treats vision as a process of inference from noisy and uncertain data and emphasizes probabilistic, statistical, data-driven approaches. Topics include image processing; segmentation, grouping, and boundary detection; recognition and detection; motion estimation and structure from motion.

b. Prerequisite Courses:

Sl. No	Course Code	Course Name
1		Image Processing

c. Related Courses:

Sl. No	Course Code	Course Name
1		Computer Graphics and Image Processing

d. Course Educational Objectives :

- To review image processing techniques for computer vision
- To teach mathematical concepts and techniques
- To solve real vision problems
- To understand shape and region analysis
- To understand Hough Transform and its applications to detect lines, circles, ellipses
- To understand three-dimensional image analysis techniques
- To understand motion analysis
- To study some applications of computer vision algorithms

e. Course Outcomes :

Upon Completion of the course, the students will be able to

- Implement fundamental image processing techniques required for computer vision
- perform shape analysis
- implement boundary tracking techniques
- apply chain codes and other region descriptors
- apply Hough Transform for line, circle, and ellipse detections
- apply 3D vision techniques
- implement motion related techniques
- develop applications using computer vision techniques

i. Correlation of COs with Program Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**H**	**M**	**L**	**L**								
CO2			**M**	**L**	**L**							
CO3		**M**	**M**	**M**		**L**						
CO4		**M**	**M**	**M**	**L**	**H**						
CO5			**M**	**L**	**M**		**L**					

H- High; M-Medium; L-Low

g. Course Content:

UNIT I IMAGE PROCESSING FOUNDATIONS 9 Geometric Camera Models - Geometric Camera Calibration - Radiometry - Measuring Light – Shadows and shading - Color - Review of image processing techniques –classical filtering operations –thresholding techniques –edge detection techniques –corner and interest point detection –mathematical morphology –texture

UNIT II SHAPES AND REGIONS 9 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 –moments

UNIT III HOUGH TRANSFORM 9

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 –spatial matched filtering –GHT for ellipse detection –object location –GHT for feature collation

UNIT IV 3D VISION AND MOTION 9

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 V APPLICATIONS 9

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

d. Learning Resources

Text Books:

- E. R. Davies, “Computer & Machine Vision”, Fourth Edition, Academic Press, 2012.
- R. Szeliski, “Computer Vision: Algorithms and Applications”, Springer 2011.
- Simon J. D. Prince, “Computer Vision: Models, Learning, and Inference”, Cambridge University Press, 2012.
- Mark Nixon and Alberto S. Aquado, “Feature Extraction & Image Processing for Computer Vision”, Third Edition, Academic Press, 2012.

ii. Reference Books:

1. D. L. Baggio et al., “Mastering OpenCV with Practical Computer Vision Projects”, Packt Publishing, 2012.
2. Jan Erik Solem, “Programming Computer Vision with Python: Tools and algorithms for analyzing images”, O'Reilly Media, 2012.
3. Forsyth D A and Ponce J Computer Vision : A Modern Approach– Prentice Hall 2003
4. Horn B K P Robot Vision Cambridge MIT press 1986.
5. Haralick R M And Shapiro L G Computer And Robot Vision Vo I and II Addison Wesley 1993
6. Jain R C Kasturi R Machine Vision McGrawHill 1995

iii. Online Resources:

1. http://kercd.free.fr/linksKCD.html
2. http://www.cs.ubc.ca/spider/lowe/vision.html
3. http://www.teiath.gr/seyp/optics/Vision.htm
4. http://www.visionscience.com/