

COURSE CODE	COURSE TITLE	L	T	P	C
1152CS113	COMPUTER VISION	3	0	0	3

Course Category: Program Elective

1. Preamble :

To understand the fundamental concepts, problems and solution techniques in computer vision including image formation, structure estimation, motion estimation and object estimation. This course treats vision as a process of inference from noisy and uncertain data and emphasizes probabilistic, statistical, data-driven approaches.

2. Prerequisite Courses:

Sl. No	Course Code	Course Name
1	1151CS113	Computer Graphics and Image Processing

3. Related Courses:

Sl. No	Course Code	Course Name
1	1156CS601	Minor Project
2	1156CS701	Major Project

4. Course Educational Objectives :

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

- Recall image processing techniques for computer vision
- Do shape and region analysis
- Elucidate Hough Transform and its applications to detect lines, circles, ellipses
- Apply three-dimensional image analysis techniques
- Exploit motion analysis
- Study real world applications of computer vision algorithms

5. Course Outcomes :

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Level of learning domain
CO1	Explain the basic image processing techniques	K2
CO2	Interpret in-shape , boundary tracking and apply chain codes in region detection	K2
CO3	Apply hough transform for detection of geometric shapes like line, ellipse and objects.	K3
CO4	Illustrate 3D vision process and motion estimation techniques	K2
CO5	Apply computer vision in real time scenario.	K3

6. Correlation of Cos with Program Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M		M		L								L	L	
CO2	H	M		M	M		L						L	L	
CO3	M	M	H	L	M		M						H	L	
CO4	H	M	L	L	M								L	L	
CO5			H	L	M		M						L	L	L

7. Course Content:

UNIT I IMAGE PROCESSING FOUNDATIONS 9

Fundamentals 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: Content Based Image Retrieval, Content Based Video Retrieval. Case Study: Face Recognition, Gait Recognition.

TOTAL: 45 Hours

H. Learning Resources

i) Text Books:

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

ii) Reference Books:

1. D. L. Baggio et al., (2012) “Mastering Open CV with Practical Computer Vision Projects”, Packet Publishing,.
2. Jan Erik Solem, (2012) “Programming Computer Vision with Python: Tools and algorithms for analyzing images”, O’Reilly Media.

iii) Online Resources:

1. <http://kercd.free.fr/linksKCD.html>
2. <http://www.cs.ubc.ca/spider/lowe/vision.html>
3. <http://www.visionscience.com/>