PVP 23

PRASAD V. POTLURI SIDDHARTHA INSTITUTE OF TECHNOLOGY

(Autonomous)

Kanuru, Vijayawada-520007

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (Data Science)

III B. Tech II Semester

Computer Vision

Course Code	23DS4602C	**Year**	III	**Semester**	II
Course Category	PEC	**Branch**	CSE (Data Science)	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Machine Learning
Continuous Internal Evaluation	30	**Semester End Evaluation**	70	**Total Marks**	100

Course Outcomes		
Upon Successful completion of course, the student will be able to		
CO1	Describe the principles of camera models, radiometry, and color theory for image acquisition and scene to understand their role in capturing and interpreting visual information.	**L2**
CO2	Apply linear filters and edge detection techniques for analyzing image features such as texture, shading, and object boundaries to *extract and interpret important visual information*.	**L3**
CO3	Use segmentation and tracking algorithms such as clustering, Hough transform, EM algorithm, and Kalman filtering for object detection and motion estimation to *analyze and interpret dynamic scenes effectively*	**L3**
CO4	Analyze multi-view geometry and camera calibration methods to reconstruct 3D scenes and localize objects in real-world applications like robotics and medical imaging to *enable object localization and 3D scene analysis in practical applications*	**L4**

Contribution of course outcomes towards achievement of program outcomes & Strength of correlations (3: Substantial,2: Moderate,1: Slight)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P010**	**PO11**	**PSO1**	**PSO2**
CO1	**2**												
CO2	**3**												
CO3	**3**												
CO4		**3**									**2**		

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Syllabus		
Unit No	**Contents**	**Mapped CO**
I	**CAMERAS:** Pinhole Cameras Radiometry–Measuring Light: Light in Space, Light Surfaces, Important Special Cases Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color	CO1
II	**Linear Filters:** Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge **Detection:** Noise, Estimating Derivatives, Detecting Edges Texture 0: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.	CO1, CO2, CO4
III	**The Geometry of Multiple Views**: Two Views Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras Segmentation by Clustering: What Is Segmentation? Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,	CO1, CO2, CO4
IV	**Segmentation by Fitting a Model:** The Hough Transform, Fitting Lines, Fitting Curves, fitting as a Probabilistic Inference Problem, Robustness Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice. **Tracking With Linear Dynamic Models:** Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples	CO1, CO3, CO4
V	**Geometric Camera Models:** Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, **Case study**: Mobile Robot Localization Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Case study: Registration in Medical Imaging Systems, Curved Surfaces and Alignment.	CO1, CO3, CO4

Learning Resources
Text Books
1.Computer Vision: A Modern Approach, David A. Forsyth and Jean Ponce, 1st Indian Edition, 2009, PHI Learning.

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References

1. Computer and Machine Vision: Theory, Algorithms and Practicalities, E. R. Davies, 4th Edition, 2013, Elsevier (Academic Press).
2. Digital Image Processing, Rafael C. Gonzalez and Richard E. Woods, 3rd Edition, 2008, Addison-Wesley.
3. Computer Vision: Algorithms and Applications, Richard Szeliski, 1st Edition, 2011, Springer-Verlag London Limited.

E-Resources and other Digital Material

1. https://onlinecourses.nptel.ac.in/noc19_cs58/preview
2. https://archive.nptel.ac.in/courses/106/105/106105216/