

Computer Vision

Course No.	Type	Subject	L	T	P	Credits	CA	MS	ES	CA	ES	Pre-requisites
COCS C26		Computer Vision	3	1	0	4	25	25	50	-	-	

COURSE OUTCOMES

1. Implement fundamental image processing techniques required for computer vision.
2. Recognize Image formation process.
3. Perform shape analysis and extract features form Images and do analysis of Images.
4. Generate 3D model from images and develop applications using computer vision techniques.
5. Understand video processing, motion computation and 3D vision and geometry.

COURSE CONTENTS:

UNIT I

Digital Image Formation and Low-level processing: Overview and State-of-the-art, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing. Perspective space, Homography, DLT, RANSAC, 3-D reconstruction framework.

UNIT II

Feature Extraction: Edges - Canny, LOG, DOG; Line detectors, Hough Transform, Corners - Harris and Hessian Affine, Orientation, Histogram, SIFT, SURF, HOG, GLOH, : Eigen value, Eigen vector, Feature scoring, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.

UNIT III

Image Segmentation: Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection

UNIT IV

Pattern Analysis: Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Functions, Supervised, Un-supervised and Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods.

Motion Analysis: Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis; Dynamic Stereo; Motion parameter estimation.

UNIT V

Miscellaneous: Applications: CBIR, CBVR Activity Recognition computational photography, Biometrics, Healthcare, stitching and document processing; Modern trends - super-resolution; GPU, Augmented reality; cognitive models, fusion and SR&CS.

SUGGESTED READINGS

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.
3. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
4. K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990.
5. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall.
6. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012