

Computer Vision and Image Understanding

Executive M.Tech. (AI & Data Science)

Digital Image Fundamentals

Imaging and image representation, graylevel and histogram, Intensity transformation and image enhancement – contrast intensification, noise cleaning, sharpening, Edge preserving smoothing.

Image binarization, segmentation of grey level images, Detection of edges and lines in 2D images, Canny's edge detection algorithm, Hough transform for detecting lines and curves,

Colour models, colour representation, colour image processing. **(4+4+2)**

Image Representation and Description

Connected-component labelling, connected-component counting, distance transform, medial axis, skeletonization, thinning,

Run-length code, Chain code, Polygonal approximation, Boundary descriptors, Moment, Texture (GLCM). **(2+2)**

Projective and Camera Geometry

Geometric transformations, projective Geometry, homography properties, Camera geometry, Camera calibration, Stereo vision system, 3D reconstruction, structured light. **(8)**

Motion analysis and tracking

Motion field, optical flow, motion estimation algorithms – Lucas-Kanade method and Horn-Schunck method, object mean-shift tracking. **(6)**

Feature Detection and Description

Harris corner detection, histogram of oriented gradients, Scale Invariant Feature Transform (SIFT), Feature description, Matching and model fitting, Dimensionality reduction. **(4+2)**

Machine Learning in Object Detection

Clustering and Classification, Application of machine learning in object detection and recognition,

Basics of neural network, Convolutional neural network, Deep neural architecture, Application of deep neural network in computer vision problems. **(4+4)**

Text / References

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, Pearson.
2. Andrew Zisserman, Multiple View Geometry in Computer Vision, Cambridge University Press.
3. R. Szeliski, Computer Vision: Algorithms & Applications, Springer.
4. Forsyth and Ponce, Computer vision: A modern approach, Pearson
5. Sonka, Hlavac and Boyle, Image processing, analysis, and Machine vision, Cengage Learning, 2015.