EL 718: Machine Vision

Introduction to Machine Vision: Fundamental concept, Image Geometry, Parts of machine vision system, Levels of Computation.

Image Segmentation: Deformable curves and surfaces, Edge-based - voting, optimization, perceptual grouping, Pixel-based – clustering, Texture Segmentation, Snakes and active contours.

Feature Extraction: Geometric features - lines, circles, ellipses, Blobs, Edges - Canny; Line detectors, Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.

Shape Representation and Boundary descriptors: Shape from shading, Shape from monocular images, surface geometry, Boundary descriptors.

Object Recognition: System Components, Complexity of Object Recognition, Matching, Classification, Template Matching.

Image Formation Models: Monocular imaging system, Orthographic & Perspective Projection, Camera model and Camera calibration.

3D vision, Geometry: Methods for 3D vision, Projection schemes, Shape from shading, Photometric stereo, Shape from texture, Active range finding – Surface representations, 3D object recognition, and 3D reconstruction.

Motion Analysis: Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion.

Text Books:

1. R. Jain, R. Kasturi and B. G. Schunck, Machine Vision, McGraw-Hill, 1995.
2. D. A. Forsyth and J. Ponce, Computer Vision: A Modern Approach, Pearson Education, 2003.
3. Dana H. Ballard & Christopher M. Brown, Computer Vision, Prentice-Hall, 1982.

Reference Books:

1. B. Horn, Robot Vision, MIT Press, 1986.
2. Robert M. Haralick & Linda G. Shapiro, Computer & Robot Vision, Addison-Wesley, 1993.
3. Anil K. Jain, Fundamentals of Digital Image Processing, Pearson, 2013.
4. Rafael C. Gonzalez, Richard E. Woods, & Stevev L. Eddins, Digital Image Processing using Matlab, Prentice-Hall, 1st edition, 2003, ISBN: 0130085197.
5. Tom M. Mitchell, Machine Learning, McGraw-Hill, 1997. 6. E.R. Davies, Machine Vision – Theory Algorithms Practicalities, 3rd Ed., Elsevier, 2005.