

## INDUSTRIAL IMAGE ANALYSIS

**Imaging Systems:** Camera Imaging Model- Affine transformation, Warping, Perspective transformation and camera imaging model; Stereo vision-Epipolar geometry, Correspondence, Triangulation; Thermal Camera-Thermal science concepts of conductive, convective and radiation heat transfer, thermal capacitance, Thermal image interpretation; Lighting System- spectral power distribution (SPD) of light sources, Colorimetry: trichromatic vision, RGB colour specification system, CIE XYZ colour specification system, CIE standard illuminant; Medical Image Acquisition-X ray, fluoroscopy and angiography, CT angiography, MR Imaging.

**Image Improvements & Analysis:** Colour Spaces-RGB, LAB, CMY, YCC, HSV Colour Spaces, Colour Space Transformations; Image Enhancements -Histogram Modification, Contrast manipulation, Colour image enhancement, Multispectral image enhancement; Segmentation-Amplitude segmentation methods, Clustering segmentation methods, Region based segmentation methods; Morphological Operations- Binary image dilation and erosion, Binary image close and open operations, Grayscale Image morphological operations;

**Advanced Feature Extraction:** Fractal modelling of real world images: Introduction to IFS- Chaos and measures, The computation of images from IFS codes, The Collage Theorem; HMM Model-Bayesian Network, Expectation-maximization, Hidden Markov Models, Viterbi Algorithm; Feature Extraction- Principle Component Analysis(PCA), Scale Invariant Feature Transform(SIFT), Speeded Up Robust Features(SURF).

**Intelligent Vision System:** Tracking-Kalmanfilter, Condensation; Motion Estimation-Detection and tracking of point features, Optical flow; Model based object recognition-Shape Analysis: Distance, perimeter, area measurements, Spatial Moments, Shape orientation descriptors. Model Matching: Template Matching, Matched filtering; Classifications Model -Linear Discriminant/Perceptron Learning, Optimization by Gradient Descent, Support Vector Machines, K-Nearest-Neighbor Classification, Non-parametric Classification, Unsupervised Learning, Clustering, Vector Quantization, K-means

**Case Studies:** Vision based Quality Analysis, Shape Detection, Surveillance, Medical imaging, Thermal Imaging, Robotic Vision.

### References:

1. William K. Pratt, "Digital Image Processing", 3rd Ed., Wiley 2001.
2. Biophotonics, NPTEL Course by Dr. Manoj Varma, IISc Bangalore  
"http://nptel.ac.in/courses/117108037/11"
3. E Davies, "Computer and Machine Vision, Algorithms, Practicalities", 4th Edition, Elsevier, 2012.
4. M.F. Barnsley, R.L. Devaney, B.B. Manderbrot, H.O. Peitgen, D. Saupe, R.F. Voss, "The Science of Fractal Images" Springer-Verlag, 1988
5. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", John Wiley & Sons, 2001.