Approval: 5th Senate Meeting

Course Name : Digital Image Processing
Course No. : EE-608
Credits : 3-0-2-4
Prerequisite : Basics of signal processing and Probability theory
Students Intended for : UG/MS/PhD
Elective or Compulsory : Elective
Semester : Odd

Preamble: The Visual experience is the principal way that humans sense and communicate with their world. We are visual being and images are being made increasing available to us in electronic digital format via digital camera, Internet, hand-held devices. With much of technology being introduced to the human life, digital image processing plays an important role in easing out the human processing. The objective of this course will be to cover fundamental of image processing and their applications. This course will take some real world problems that can be attacked with image processing

Course Outline:

1. Introduction to digital image processing (3hr): What is image processing, Different types of images, Visual perception, Image sensing and Acquisition, Quantization, Sampling, color image processing, Revision of Mathematical concepts for image processing
2. Intensity transformation, Filtering in spatial and Frequency domain (8hr): Image negatives, Log transformations, Histogram processing, Spatial filter: smoothing and Sharpening, Discrete Fourier transform, properties of 2-D DFT, Image smoothing and Sharpening in Fourier domain
3. Image transforms (5hr): Two-dimensional orthogonal and Unitary transforms, Optimum transform, Properties of Unitary transforms, 2D DFT, Cosine transforms, Hadamard transforms, KL transforms, Comparison of image transforms
4. Edge detection (3hr): Gradient and Laplacian based edge detection, Diffusion based edge detection: Isotropic and anisotropic diffusion.
5. Wavelet transform for Image Processing (5hrs): Multi resolution expansion, Wavelet functions, Wavelet Series expansion, Continuous and Discrete Wavelet transforms, Wavelet transforms for two-dimensional signals (images), Applications of wavelet transforms for edge extraction, noise suppression.
6. Image segmentation (5hr): Thresholding, region-based Morphological Watersheds, Bayesian based image segmentation.
7. Image restoration and reconstruction (5hr) :Models of image degradation, noise models, Spatial and Frequency domain based approaches for image restoration, Inverse filtering, Wiener Filtering, Bayesian denoising.
8. Image Compression (4hr): Spatial and Temporal redundancy, Basic image compression models, compression standards, basic compression methods: Huffman coding, Run-length coding, Block transform coding, Predictive coding

9. Color Image Processing (4hr): Color Fundamentals, Color Models, Color transformation, smoothing, sharpening and edge detection in color images.

Textbooks

R. C. Gonzalez and R. E. Woods, " Digital Image Processing" Third edition, Pearson Education, 2009

Anil K Jain, " Fundamental of Digital Image Processing", Prentice Hall, 1989

References:

1. A. C. Bovik, " The essential guide to image processing", Second edition, Academic Press, 2009
2. A. M. Teckalp, " Digital Video Processing", Prentice Hall PTR, 1995