Digital Image Processing(404184)

Teaching Scheme:
Lectures: 3 Hrs/ Week

Examination Scheme:
In Semester Assessment:
Phase I : 30
End Semester Examination:
Phase II: 70

Course Objectives:

- To learn the fundamental concepts of Digital Image Processing.
- To study basic image processing operations.
- To understand image analysis algorithms.
  To expose students to current applications in the field of digital image processing.

Course Outcomes:

After successfully completing the course students will be able to

Develop and implement algorithms for digital image processing.
Apply image processing algorithms for practical object recognition applications.

Unit I : Fundamentals of Image Processing [5]

Steps in image processing, Human visual system, Sampling & quantization, Representing digital images, Spatial & gray-level resolution, Image file formats, Basic relationships between pixels, Distance Measures. Basic operations on images-image addition, subtraction, logical operations, scaling, translation, rotation. Image Histogram. Color fundamentals & models – RGB, HSI YIQ.

Unit II: Image Enhancement and Restoration [8]

Spatial domain enhancement: Point operations-Log transformation, Power-law transformation, Piecewise linear transformations, Histogram equalization. Filtering operations- Image smoothing, Image sharpening.

Frequency domain enhancement: 2D DFT, Smoothing and Sharpening in frequency domain. Homomorphic filtering.

Restoration: Noise models, Restoration using Inverse filtering and Wiener filtering

Unit III: Image Compression [5]

Types of redundancy, Fidelity criteria, Lossless compression – Runlength coding, Huffman coding, Bit-plane coding, Arithmetic coding. Introduction to DCT, Wavelet transform. Lossy compression – DCT based compression, Wavelet based compression. Image and Video Compression Standards – JPEG, MPEG.

Unit IV : Image Segmentation and Morphological Operations [7]

Image Segmentation: Point Detections, Line detection, Edge Detection-First order derivative – Prewitt and Sobel. Second order derivative – LoG, DoG, Canny. Edge linking, Hough

Transform, Thresholding – Global, Adaptive. Otsu's Method. Region Growing, Region Splitting and Merging. Morphological Operations: Dilation, Erosion, Opening, Closing, Hit-or-Miss transform, Boundary Detection, Thinning, Thickening, Skeleton.

Unit V : Representation and Description [5]

Representation – Chain codes, Polygonal approximation, Signatures. Boundary Descriptors – Shape numbers, Fourier Descriptors, Statistical moments. Regional Descriptors – Topological, Texture. Principal Components for Description.

Unit VI : Object Recognition and Applications [6]

Feature extraction, Patterns and Pattern Classes, Representation of Pattern classes, Types of classification algorithms, Minimum distance classifier, Correlation based classifier, Bayes classifier. Applications: Biometric Authentication, Character Recognition, Content based Image Retrieval, Remote Sensing, Medical application of Image processing

Text Books:

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Third Edition, -

   S Sridhar, "Digital Image Processing", Oxford University Press.

   Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins, "Digital Image Processing Using MATLAB", Second Edition, - Tata McGraw Hill Publication
   S Jayaraman, S Esakkirajan, T Veerakumar, "Digital Image Processing", Tata McGraw Hill Publication

List of Experiments:

Note: Experiments are to be performed using software preferably open source.

To perform basic operations on images.
To perform conversion between color spaces.
To perform histogram equalization.
To perform image filtering in spatial domain.
To perform image filtering in frequency domain.

To perform image compression using DCT / Wavelet transform.

8. To perform edge detection using various masks.
9. To perform global and adaptive thresholding.
10. To apply morphological operators on an image.
11. To obtain boundary / regional descriptors of an image.
12. To perform image classification / recognition.