MCA 521 Digital Image Processing

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Prerequisite:- Basic Logical operations, Computer Graphics.

Course Objectives:

1. To describe and explain basic principles of digital image processing.
2. To study basic image operations.
3. To understand the algorithms that perform basic image processing (e.g. noise removal and image enhancement).
4. To design and implement algorithms for advanced image analysis (e.g. image morphing, image segmentation).
5. To expose students to current applications in the field of DIP.

Detailed Syllabus

UNIT I (6 Hours) Elements of Visual Perception, Image Sensing and Acquisition, Steps of DIP and its Applications, Components of Image Processing system, Image sampling and Quantization.
UNIT II (10 Hours) Image Enhancement in Spatial Domain: Basic Gray Level Transformation, Histogram Processing, Spatial Filtering, Smooth Spatial Filtering: Smoothing Linear Filters, Order-Statistics filters. Enhancement using arithmetic/Logic Operations: Image subtraction, Image Averaging, Use of Second Derivatives for Enhancement-The Laplacian.
UNIT III (10 Hours) Image Enhancement in Frequency Domain: one dimensional Fourier frequency domain and its inverse, Two dimensional Fourier frequency domain and its inverse, Basic properties of frequency domain, Smoothing Frequency-Domain Filters- Ideal Lowpass Filters, Butterworth Lowpass Filters, Gaussian LowpassFilters, Sharpening Frequency Domain Filters- Ideal Highpass Filters, Butterworth Highpass Filters, Gaussian Highpass Filters, Unsharp Masking, High-Boost Filtering.
UNIT IV (10 Hours) Image Restoration: Model of the Image Degradation/Restoration Process, Noise Models- Spatial and Frequency Properties of Noise, Important Noise Probability Density Functions, Periodic Noise, Restoration in the Presence of Noise- Mean Filters, Order-Statistics Filters, Linear, Position-Invariant Degradations, Estimating the Degradation Function- Estimation by Image Observation, Estimation by Experimentation, Estimation by Modeling Inverse Filter, Minimum Mean Square Error (Wiener) Filter, Geometric Mean Filter.
UNIT V (10 Hours) Morphological Image Processing: Basic Concepts from Set Theory, Logic Operations Involving Binary Images, Dilation and Erosion, Opening and Closing, Hit or Miss Transformation, Morphological Algorithms- Boundary Extraction, Region Filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening, Skeletons, Pruning, Extensions to Gray-Scale Images- Dilation, Erosion, Opening and Closing.

UNIT VI (10 Hours) Image Segmentation: Detection of Discontinuities- Point Detection, Line Detection, Edge Detection, Edge Linking and Boundary Detection- Local Processing, Global Processing via the Hough Transform, Global Processing via Graph-Theoretic Techniques, Thresholding- Foundation, Basic Global Thresholding, Basic Adaptive Threshold, Region-Based Segmentation- Basic Formulation, Region Growing, Region Splitting and Merging.

Text and Reference Books

1. Fundamentals of Digital Image Processing, Anil K. Jain, Pearson, IIIrd, 2004.
2. Digital Image Processing, Rafel C. Gonzalez & Richard E. Woods, PHI, 10th, 2005.
3. Digital Image Processing using MATLAB, Rafel, Richard & Steven, Pearson, IInd, 2007.
4. Digital Image Processing, JayaramanS,VeerakumarT,Esakkirajan S, TMH, Ist, 2009.

Course Outcomes:

After completing the course, students will be able to:

1. Understand general terminology of digital image processing.
2. Examine various types of images, intensity transformations and spatial filtering.
3. Develop Fourier transform for image processing in frequency domain.
4. Evaluate the methodologies for image segmentation, restoration etc.
5. Implement image process and analysis algorithms.
6. Apply image processing algorithms in practical applications.