Image Processing and Machine Vision (404204)

Teaching Scheme:
Lectures: 3 Hrs/ Week

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

Course Objectives:
- To cover the basic analytical methods which are widely used in image processing; linear and nonlinear filtering; and image transformations for coding and restoration.
- To design and implement algorithms for advanced image analysis.
- To develop experience using computer to process images.

Course Outcomes:
After successfully completing the course students will be able to
- Apply principles and techniques of digital image processing in applications related to digital imaging system design and analysis.
- Analyze and implement image processing algorithms.
- Hands-on experience in using software tools for processing digital images.

Unit I : **Digital Image processing Fundamentals** 6L

Components of Image Processing System. , Elements of Visual Perception, MTF of Visual System, Image Sensing and Acquisition, Image formation model, Image Sampling & Quantization Spatial and Gray Level Resolution, Basic Relationships between Pixels. Statistical parameters, Measures and their significance, Mean, standard deviation, variance, SNR, PSNR etc.

Unit II : **Image Enhancement** 6L

Gray level transformations, histogram processing, equalization, Arithmetic and logical operations between images, Basics of spatial filtering, smoothening and sharpening spatial filters. Image Enhancement in frequency Domain: smoothening and sharpening frequency domain filters. Color Image processing: Intensity filtering, gray level to color transformation, Basics of full color image Processing.

Unit III : **Image Transforms** **6**L

FFT, DCT, the KL Transform, Walsh/Hadamard Transform, Haar Transform, Wavelet Transform.

Unit IV : **Image Segmentation**   6L

Point, line & Edge detection, Gradient operators, Canny edge detector, Edge linking & boundary detection, Hough transform, Thresholding, Use of boundary characteristic for histogram improvement & Local thresholding, Region based segmentation.

Unit V : **Image compression**   6L

Data redundancies, Variable length coding, Predictive coding, Transform coding, Image compression standards, subband coding, Lossless Predictive, Lossy Compression- Lossy Predictive. Fundamentals of JPEG, MPEG, fractals.

Unit VI : **Image restoration and Image Processing Applications**   6L

Image Degradation Mode, Noise Models, and Restoration in Presence of Noise in spatial Domain, Linear Filtering, Applications: Character Recognition, Fingerprint Recognition, Remote Sensing. Applications using different Imaging modalities such as acoustic Imaging, Medical imaging, electron microscopy etc.

Text Books

1. Gonzalez and Woods, "Digital Image Processing", Pearson Edu
2. Arthur Weeks Jr., "Fundamentals of Digital Intake Processing", PHI.

Reference Books

1. A. K. Jain, "Fundamentals of Digital Image Processing"; Pearson Education
2. Pratt William, "Digital Image Processing", John Wiley & Sons

List of Experiments

Note: Experiments are to be performed using preferably open source software or MATLAB or C

1. Study of BMP file format & conversion of 24 bit colour image 8 bit image.
2. Study of statistical properties- Mean, Standard deviation, Variance & histogram plotting.
3. Histogram equalization & Modification.
4. Gray level transformation.
5. Spatial domain filtering –Smoothing & sharpening filters.
6. DCT/IDCT of given image.
7. Edge detection using Sobel, Roberts operators.
8. Morphological operations –Erosion, Dilation, Opening, Closing.
9. Pseudo Coloring
10. Creating noisy image & filtering.