17CS016 FUNDAMENTALS OF IMAGE PROCESSING

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Course description and objectives:
To introduce the fundamentals of image processing at Low Level and Mid-Level; and it covers Spatial and Frequency domain image enhancement, Edge detection, Segmentation, image compression and morphological image processing. And to provide the student with programming experience from enhance the image and object recognition applications in MATLAB.

Course Outcomes:
The Student will be able to:
- ✓ Understand the basic concepts of Image Acquisition system.
- ✓ Describe known techniques of enhancement of image using spatial and frequency domain.
- ✓ Understand the various Segmentation methods based on discontinuity and similarity of pixels.
- ✓ Understand the design of a image compressor system.

Skills:
- ✓ Learn about various enhancement techniques using GIMP and MATLAB
- ✓ Analyze both smoothing and sharpening filters.
- ✓ Analyze the various Segmentation techniques for specific applications.
- ✓ Understand the application of various morphological operations.
- ✓ Study and implement of various Image Compressor systems.

Activities:
- ✓ Design the smoothing filter with average or weighted average template.
- ✓ Implement using the Laplacian operator to detect thin edges.
- ✓ Design &Implementation of edge based segmentation for Building images
- ✓ Design & Implementation of region based segmentation for Medical images
- ✓ Design and Implementation of Loss-Less Image Compression System .

Unit – 1
Fundamentals of Image Processing: Fundamental steps in digital image processing, components of image processing system. A simple image formation model, image sampling and quantization, basic relationships between pixels. Basic geometric transformations-Introduction to Fourier Transform and DFT – Properties of 2D Fourier Transform – FFT – Separable Image Transforms-Walsh – Hadamard – Discrete Cosine Transform.

UNIT – II
Image enhancement in the spatial and frequency domains : Basic gray-level transformation, histogram processing, enhancement using arithmetic and logic operators, basic spatial filtering, smoothing and sharpening spatial filters, combining the spatial enhancement methods, Frequency domain filters, homomorphic filtering. Image Restoration: Degradation Models, PSF, circulant and block - circulant matrices, DE convolution, restoration using inverse filtering.

UNIT – III
Image Segmentation : Segmentation and Edge detection region operations, basic edge detection, second order detection, crack edge detection, gradient operators, compass and

Laplace operators, edge linking and boundary detection, thresholding, region based segmentation, segmentation by morphological watersheds, color segmentation.

UNIT – IV

Image Compression: Fundamentals, image compression models, error-free compression, lossy predictive coding, image compression standards. Morphological Image Processing: Preliminaries, dilation, erosion, open and closing, hit or miss transformation, basic morphologic algorithms**.**

UNIT – V

Representation and Description: Chain codes, Polygonal approximation, Signature Boundary Segments, Skeletons, Boundary Descriptors, Regional Descriptors, Relational Descriptors, Principal components for Description, Relational Descriptors

TEXT BOOKS:

1. Digital Image Processing, Rafeal C Gonzalez, Richard E.Woods, Third Edition, Pearson Education/PHI.

REFERENCE BOOKS:

1. Image Processing, Analysis, and Machine Vision, Milan Sonka, Vaclav Hlavac and Roger Boyle, Second Edition, Thomson Learning.
2. Introduction to Digital Image Processing with Matlab, Alasdair McAndrew, Thomson Course Technology
3. Computer Vision and Image Processing, Adrian Low, Second Edition, B.S.Publications
4. Digital Image Processing using Matlab, RafealC.Gonzalez, Richard E.Woods, Steven L. Eddins, Pearson Education.
5. Digital Image Processing, William K. Prat, Wily Third Edition
6. Digital Image Processing and Analysis, B. Chanda, D. Datta Majumder, Prentice Hall of India, 2003.