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संगणक विज्ञान एंव अभियांत्रिकी विभाग / DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
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No:- Date:

CSX4175: Image Processing Techniques

L-T-P-Cr: 3-0-0-3

Pre-requisites: Linear algebra, Matrices, Matrix Operations, Determinants, Systems of Linear Equations, Eigen values, Eigenvectors, Statistics and probability, Programming experience, preferably in matlab, and/or C/C++/C#/Python/Java

Objectives/Overview:

- The aim of the course is to introduce the student to various image processing techniques. The student learns about image fundamentals, describes the main characteristics of digital images, how they are represented, mathematical transforms such as such as Fourier, Cosine transforms, Singular value decomposition, 2D Wavelet transform, image enhancement techniques, Image restoration and denoising, segmentation, lossy and lossless data compression algorithms, binary and color image processing. The student will be exposed to dealing with image data through programming assignments using matlab, and/or C/C++/C#/Python/Java..

Course Outcomes:
At the end of the course, a student should:

Sl. No.	Outcome	Mapping to POs
1.	To understand the different images and its processing	PO1
2.	To understand the concept of Image transformation Algorithms/techniques	PO2
3.	To understand the concepts of lossy and Lossless compression Algorithms/techniques	PO2
4.	To understand the concepts of Image enhancement and Segmentation Algorithms/techniques	PO3
5.	To understand the concepts of **Image Restoration and Denoising** Algorithms/techniques	PO4
6.	To understand the concepts of Binary and Color image processing	PO2
7.	You shall be exposed to various recent Image Processing Applications	PO3

UNIT I: Introduction to Digital Image Processing **Lectures: 3**
Introduction to images and its processing, Components of image processing systems, image representations, Image file formats, Applications of digital image processing, image sampling and

quantization, Image Analysis, Intensity transformations, contrast stretching, Correlation and convolution, Smoothing filters, sharpening filters, gradient and Laplacian.

UNIT II: Image Transformation Techniques **Lectures: 8**

Need for transform, Fourier, Cosine transforms, Haar, KL Transform, Singular value decomposition, 2D Wavelet transform, Different properties of image transform techniques.

UNIT III: Image Compression Basics **Lectures: 8**

Concept of image compression, lossless techniques (Huffman Coding, Arithmetic and Lempel-Ziv Coding, Other Coding Techniques) and lossy compression techniques (Transform Coding & K-L Transforms, Discrete Cosine Transforms, and BTC), Multi-Resolution Analysis, and Still Image Compression Standards (JBIG and JPEG),

UNIT IV: Image Enhancement **Lectures: 5**

Enhancement in spatial and transform domain, histogram equalization DirectionalSmoothing, Median, Geometric mean, Harmonic mean, Contraharmonic mean filters, Homomorphic filtering,Color image enhancement.

UNIT V: Image Restoration and Denoising **Lectures: 5**

Image degradation, Type of image blur, Classification of image restoration techniques, ,image restoration model, Linear and nonlinear restoration techniques, Image denoising, Median filtering.

UNIT VI: Image Segmentation **Lectures: 5**

Classification of image segmentation techniques, Boundary detection based techniques, Point, line detection, Edge detection, Edge linking, local processing, regional processing, Hough transform, Thresholding, Iterative thresholding, Otsu's method, Moving averages, Multivariable thresholding, Region-based segmentation, Watershed algorithm, Use of motion in segmentation

UNIT VII: Binary and Color image processing **Lectures: 5**

Binarization, Basic Set theory, Binary morphological operations and its properties, Color Image Representation in MATLAB, Converting Between Color Spaces, The Basics of Color Image Processing, Color Transformations, Spatial Filtering of Color Images, Working Directly in RGB Vector Space.

UNIT VIII: Image Processing Applications**:** Case studies.

Text/Reference Books

1. Digital Image Processing, R.C. Gonzalez and R.E. Woods, 2nd edition, Pearson Prentice Hall, 2008
2. Anil K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, 1989.
3. Digital Image processing, S Jayaraman, TMH, 2012
4. William K. Pratt, Digital Image Processing, 3rd Edition, John Wiley, 2001.