DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

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CSXX2023 Image Processing Techniques **L-T-P: 3-0-0**

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

Objective: The aim of the course is to introduce the student to various image processing techniques. The student familiar 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:

S.NO	Course outcomes (Image Processing)	Level of Attainment
CO-1	To understand the digital image fundamentals	Familiarity
CO-2	To understand the concept of image transformation algorithms/techniques	Assessment
CO-3	To understand the basic concepts compression algorithms/techniques	Assessment
CO-4	To understand the basic concepts of image enhancement and segmentation algorithms/techniques	Assessment
CO-5	To understand the basic concepts of image restoration and denoising algorithms/techniques	Technical skills
CO-6	To understand the basic concepts of binary and color image processing	Assessment

Course contents:

S. No.	Topic	L
1	**Introduction to Digital Image Processing** Introduction to images and its processing, Components of image processing systems, image representations, Image file formats, recent 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.	4
2	**Image Transformation Techniques** Need for transformations, Fourier, Cosine transforms, Haar, KL Transform, Singular value decomposition, 2D Wavelet transform, Different properties of image transform techniques.	8
3	**Image Compression Basics** 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),	8
4	**Image Enhancement** Enhancement in spatial and transform domain**,** histogram equalization DirectionalSmoothing, Median, Geometric mean, Harmonic mean, Contr aharmonic mean filters, Homomorphic filtering,Color image enhancemen .	5
5	**Image Restoration and Denoising** Image degradation, Type of image blur, Classification of image restoration techniques, ,image restoration model, Linear and non linear restoration techniques, Image denoising, Median filtering	5
6	**Image Segmentation** 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	5
7	**Binary and Color image processing** 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	5
	Total Hours	**42**

Recommended 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.

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Image Processing)	**Level of Attainment**	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**Weightage**
To understand the digital image fundamentals	Familiarity	H	H	H	M	H	H	M	M	M	M	M	H	60%
To understand the concept of image transformation algorithms/techniques	Assessment	H	H	H	M	M	M	M	M	M	M	M	H	77%
To understand the basic concepts compression algorithms/techniques	Assessment	H	H	H	M	H	M	M	M	M	M	M	H	85%
To understand the basic concepts of image enhancement and segmentation algorithms/techniques	Assessment	H	H	H	M	H	M	M	M	M	M	M	H	85%
To understand the basic concepts of image restoration and denoising algorithms/techniques	Technical skills	H	H	H	M	H	M	M	M	M	M	M	H	85%
To understand the basic concepts of binary and color image processing	Assessment	H	H	H	M	H	M	M	M	M	M	M	H	85%
Weightage		100%	100%	100%	70%	80%	90%	60%	80%	100%	70%	80%	100%	

Graduate Attributes/Program Outcomes	
PO-1	Engineering knowledge
PO-2	Problem analysis:
PO-3	Design/development of solutions:
PO-4	Conduct investigations of complex problems:
PO-5	Modern tool usage:
PO-6	The engineer and society:
PO-7	Environment and sustainability:
PO-8	Ethics:
PO-9	Individual and team work:
PO-10	Communication:
PO-11	Project management and finance:
PO-12	Life-long learning: