Course Content

Image Processing & Computer Vision

Image Processing & Computer Vision *topics :* Introduction to digital image processing & computer vision, Digital image fundamentals, Image enhancement in the spatial domain, Image enhancement in the frequency domain, image restoration, Color image processing, Wavelets and multi resolution processing, Image compression, Morphological image processing, Image segmentation, Image representation & description, Object recognition.

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	Content	Hrs
01	**Introduction to Digital Image Processing & Computer Vision** Digital Image, Image Processing origins; Imaging in X-Rays, ultraviolet, visible infrared, visible, microwave, and radio bands; Fundamentals of image processing; Components of image processing systems; Glossary of terms & definitions of Low level processing, Mid level analysis, High level understanding, Pattern recognition, Computer vision, Computer graphics.	1-2
02	**Digital Image Fundamentals** Visual perception – human eye, brightness adaptation and discrimination, Electromagnetic spectrum; Image sensing and acquisition – single, strip and array sensors, Image formation models; Image sampling and quantization – basic concepts, representation of image, special and gray level resolution, aliasing, zooming and shrinking; Relationships between pixels – nearest neighbor, adjacency, connectivity, regions, and boundaries; Distance measures; Image operations on a pixel basis; Linear and nonlinear operations.	3-4
03	**Image Enhancement in the Spatial Domain** Gray level transformations - image negatives, log, power-law and piecewise linear transformation functions; Histogram processing– equalization, matching; Enhancement operations - arithmetic, logic, subtraction and averaging; Spatial Filtering – linear & order-statistics for smoothing and first & second derivatives/gradients for sharpening;	5-10
04	**Image Enhancement in the Frequency Domain** 2-D Fourier transform, its inverse and properties; Discrete and Fast fourier transform; Convolution and Correlation theorems; Filtering in frequency domain - low pass smoothing, high pass sharpening, homomorphic filtering.	11-12
05	**Image Restoration** Image degradation and restoration processes; Noise models - spatial properties, noise probability density functions, periodic noise, estimation of noise parameters; Restoration in the presence of noise - mean Filters, order - statistics filters, adaptive filters; Linear position - invariant degradations and estimation; Geometric Transformations - spatial transformation, gray-level interpolation.	13-16
06	**Color Image Processing** Color fundamentals; Color models – RGB, CMY and HIS; Pseudocolor image processing; Full-color image processing - transformations, smoothing, sharpening, segmentation and compression.	17-18
07	**Wavelets and Multiresolution Processing** Background - Image pyramids, sub-band coding, Haar transform; Multiresolution expansions - series expansions, scaling functions, wavelet functions; Wavelet transforms in one and two dimensions; Wavelet packets.	19-20