

Image Processing

1st Sessional Syllabus 2023

1. Introduction

- What is Digital Image Processing?
- Applications of DIP in Various bands of Electromagnetic Spectrum
- Fundamentals steps of DIP
- Components of Image Processing System.

2. Digital Image Fundamentals

- Elements of Visual Perception
 - Structure of Human Eye, Match Band Effect, Optical illusions, Weber Ratio
 - Brightness Adaptation
 - Image Formation
- Image Sensing and Acquisition
 - Single Sensor, Sensor Strip and Sensor Array.
 - Image Formation Model
- Image Sampling and Quantization
- Some Basic Relationships between Pixels
 - Neighborhood of Pixel, Connectivity, Region and Boundary

3. Intensity Transformations and Spatial filtering

- Some basic Intensity Transformation Functions
 - Image Negatives
 - Log Transformations
 - Power-Law (Gamma) Transformations
- Piecewise – Linear Transformation Functions
 - Contrast Stretching
 - Intensity Level Slicing
 - Bit – Plane Slicing
- Histogram Processing
 - Histogram Equalization
 - Histogram Matching (Specification)
 - Local Histogram Processing
 - Using Histogram Statistics for Image Enhancement
- Fundamentals of Spatial Filtering
 - The Mechanics of Spatial filtering
 - Spatial Correlation and Convolution
 - Vector Representation of Linear Filtering
 - Generating Spatial Filter Masks
- Smoothing Spatial Filters
 - Smoothing Linear Filters
 - Order-Statistic (Nonlinear Filters)
- Sharpening Spatial filters

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- Foundation
 - Using Second Derivative for Image Processing – The Laplacian
 - Unsharp Masking and High Boost Filtering
 - Using First-Order Derivative for (Nonlinear) Image Sharpening – the Gradient.
 - Combining spatial enhancement Methods.
4. Filtering in Frequency Domain
- Preliminary Concepts
 - Complex Numbers
 - Fourier Series
 - Impulses and their Sifting Property
 - The Fourier Transform of Functions of One Continuous Variable
 - Convolution
 - Sampling and the Fourier Transform of Sampled Functions
 - Sampling
 - The Fourier Transform of Sampled Functions
 - The Sampling Theorem
 - Extension to functions of Two variables
 - The 2D impulse and its sifting property
 - The 2D Continuous Fourier Transform Pair