

MATLAB for Image Processing

Course Description

This two-day course shows how to perform various image processing techniques using the Image Processing Toolbox. The course explores the different types of image representations, how to enhance image characteristics, image filtering, and how to reduce the effects of noise and blurring in an image. It also introduces different methods used to extract features and objects within an image, image registration, and a few techniques for reconstructing images/objects.

Prerequisites

MATLAB Fundamentals or equivalent experience using MATLAB®.

A basic knowledge of image processing concepts is strongly recommended.

Course Outline

1. Working with Images

Objective: Understand different image types available in MATLAB, and how they can be read into MATLAB.

- Exploring image types
- Supported MATLAB data types for representing images
- Binary image
- Grayscale images
- Indexed image
- RGB image
- Importing and exporting images in MATLAB
- Viewing the image
- Single image
- Multiple image frames
- Finding image pixel values: IMPIXELINFO
- Calculating image statistics
- Converting image formats

2. Image Enhancement Techniques

Objective: Enhance image characteristics by adjusting the image intensity and isolating a region of interest.

- Adjusting image intensity
- Histogram stretching
- Histogram equalization
- Histogram adjustment
- Using arithmetic functions to enhance images
- Addition - increase brightness
- Multiplication - increase sharpness
- Subtraction - detect change
- Division - detect change
- Correcting image alignment: rotating
- Cropping and resizing images
- Exploring the basics of image registration
- Selecting control points
- Registering an image
- Correcting lens distortion

3. Filtering Images

Objective: Understand how block processing works; investigate the implementation of both spatial domain and frequency domain filters; investigate how to use filtering techniques to reduce the effects of unwanted distortions such as noise, blurring, and background illumination or to enhance an image.

- Defining filtering
- Filtering process
- Performing filtering
- Filtering applications: smoothing, edge detection, and sharpening
- Frequency domain filter design
- Modeling and removing noise
- General block operations
- Region of interest processing
- Specific applications of filtering

4. Feature Extraction and Segmentation

Objective: Extract image features and measurements using different segmentation methodologies.

- Isolating image features using thresholding
- Performing morphological segmentation
- Creation of structuring elements
- Erosion and dilation
- Measurement of region properties
- Reconstructing images and objects
- Performing morphological reconstruction
- Detecting edges in an image
- Edge detection functions
- Hough transform
- Applying color-based image segmentation
- Isolating objects using watershed segmentation
- Segmenting images based on texture

5. Optional: Case Studies

Objective: Investigate and solve problems using a set of case studies.

- Motion detection
- Text recognition
- Finding particles
- Bouncing ball
- Ball tracking
- Microarray analysis
- Pattern matching
- Face recognition

6. Summary