Image Processing with MATLAB

Training Objectives

This two-day course provides hands-on experience with performing image analysis. Examples and exercises demonstrate the use of appropriate MATLAB® and Image Processing Toolbox™ functionality throughout the analysis process.
Topics include:

- Importing and exporting images
- Analyzing images interactively
- Removing noise
- Aligning images and creating a panoramic scene
- Detecting edges, lines, and circles in an image
- Segmenting objects based on their color and texture
- Modifying objects' shape using morphological operations
- Measuring shape properties
- Performing batch analysis over sets of images

Prerequisites

MATLAB Fundamentals or equivalent experience using MATLAB. Basic knowledge of image processing concepts is strongly recommended.

Products

- MATLAB
- Image Processing Toolbox

Course Outline

Day 1 of 2

Importing and Visualizing Images (2.0 hrs)

Objective: Import images into MATLAB and visualize them. Convert the images to a format that is useful for subsequent analysis steps.

- Importing and displaying images
- Converting between image types
- Exporting images

Interactive Exploration of Images (1.5 hrs)

Objective: Interactively explore object details such as size and color to find start values for subsequent image processing steps. To apply the steps repeatedly, you can create custom image exploration tools from the interactive modules.

- Obtaining pixel intensity values
- Extracting a region of interest (ROI)
- Computing pixel statistics on a region of interest
- Measuring object sizes
- Creating a custom interactive tool

Preprocessing Images (2.0 hrs)

Objective: Preprocess images by filtering, and using contrast adjustment to simplify or allow for image analysis steps.

- Adjusting image contrast
- Reducing noise in an image by filtering
- Handling inhomogenous background
- Applying custom functions block by block

Spatial Transformation and Image Registration (1.5 hrs)

Objective: Compare images with different scaling and orientation by aligning them. Use the same techniques for creating panorama images.

- Geometric transformations
- Image registration using point mapping
- Creating a panoramic scene

Day 2 of 2

Edge and Line Detection (2.5 hrs)

Objective: Segment edges of objects and extract boundary pixel locations. Detect lines and circles in an image.

- Segmenting object edges
- Detecting straight lines
- Performing batch analysis over sets of images
- Detecting circular objects

Color and Texture Segmentation (2.0 hrs)

Objective: Segment objects based on color or texture. Use texture features for image classification.

- Color space transformation
- Color segmentation
- Texture segmentation
- Texture-based image classification

Feature Extraction (2.5 hrs)

Objective: Analyze and modify the objects' shape to improve segmentation results. Count the detected objects and calculate object features like area or centroids.

- Counting objects
- Measuring shape properties
- Using morphological operations
- Performing watershed segmentation