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
- Enhancing images
- Detecting edges and shapes
- Segmenting objects based on their color and texture
- Modifying objects' shape using morphological operations
- Measuring shape properties
- Performing batch analysis over sets of images
- Aligning images with image registration
- Detecting, extracting, and matching image features

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 and visualize different image types in MATLAB. Manipulate images for streamlining subsequent analysis steps.

- Importing, inspecting, and displaying images
- Converting between image types
- Visualizing results of processing
- Exporting images

Preprocessing Images (2.0 hrs)

Objective: Enhance images for analysis by using common preprocessing techniques such as contrast adjustment and noise filtering.

- Adjusting contrast
- Reducing noise with spatial filtering
- Equalizing inhomogeneous background
- Processing images in distinct blocks
- Measuring image quality

Color and Texture Segmentation (2.0 hrs)

Objective: Segment objects from an image based on color and texture. Use statistical measures to characterize texture features and measure texture similarity between images.

- Transforming between image color spaces
- Segmenting objects based on color attributes and color difference
- Segmenting objects based on texture using nonlinear filters
- Analyzing image texture using statistical measures like contrast and correlation

Improving Segmentation (1.0 hrs)

Objective: Improve binary segmentation results by refining the segmentation mask. Use interactive and iterative techniques to segment image regions.

- Using morphological operations to refine segmentation masks
- Segmenting images and refining results interactively
- Using iterative techniques to evolve segmentation from a seed

Day 2 of 2

Finding and Analyzing Objects (1.5 hrs)

Objective: Count and label objects detected in a segmentation. Measure object properties like area, perimeter, and centroids.

- Extracting and labeling objects in a segmentation mask
- Measuring shape properties
- Separating adjacent and overlapping objects with watershed transform

Detecting Edges and Shapes (2.5 hrs)

Objective: Detect edges of objects and extract boundary pixel locations. Detect objects by shapes such as lines and circles.

- Detecting object edges
- Identifying objects by detecting lines and circles
- Performing batch analysis over sets of images

Spatial Transformation and Image Registration (1.5 hrs)

Objective: Compare images with different scales and orientations by geometrically aligning them.

- Applying geometric transformations to images
- Aligning images using phase correlation
- Aligning images using point mapping

Automating Image Registration with Image Features (1.5 hrs)

Objective: Detect, extract, and match sets of image features to automate image registration.

- Detecting and extracting features
- Matching features to estimate geometric transformation between two images