



Course Title:

Image Processing with MATLAB

Course Purpose

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:

- ✓ Introduction
- ✓ Working with Images in MATLAB
- ✓ Image Enhancement Techniques
- ✓ Filtering Images
- ✓ Image Restoration Techniques
- ✓ Feature Extraction Using Segmentation and Edge Detection
- ✓ Image Registration and Image Reconstruction
- ✓ Case Studies
- ✓ Conclusion

Pre- requisites

MATLAB Fundamentals



- ✓ 2 training days
- ✓ Hours: 09:00-17:00
- ✓ Total training hours: 16

Teaching method

The course combines lectures, demonstrations and practical exercises in MATLAB, using original training books from MathWorks. The course is in Hebrew, but the training materials are in English.

עמוד מס' 1

Training Center Systematics - Contact information:

Phone number: 03-7660111 Ext: 6 Email: training@systematics.co.il

Website: <http://www.systematics.co.il/courses/mathworks/details/>



Course Objective:

Introduction

Objective: Understand MathWorks products, a brief company history (The MathWorks & Systematics Limited), and course schedule.

Working with Images

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

- ✓ Image types
- ✓ Importing and exporting images
- ✓ Displaying images
- ✓ Finding image characteristics
- ✓ Converting image formats

Applying Image Enhancement Techniques

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

- ✓ Adjusting image intensity
- ✓ Enhancing images using arithmetic operations
- ✓ Correcting image alignment – Rotating images
- ✓ Cropping and resizing images

Filtering Images

Objective: Understand how block processing works and investigate the implementation of both spatial domain and frequency domain filters.

- ✓ Block processing
- ✓ Image convolution and correlation
- ✓ Spatial domain filtering
- ✓ Frequency domain filtering
- ✓ Region of interest processing

עמוד מס' 2

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Image Restoration Techniques

Objective: Reduce the effects of unwanted distortions, such as noise, blurring, and background illumination.

- ✓ Reducing noise
- ✓ Deblurring images
- ✓ Correcting background illumination

Feature Extraction Using Segmentation and Edge Detection

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

- ✓ Image thresholding
- ✓ Edge detection
- ✓ Transforms
- ✓ Morphological segmentation
- ✓ Color-based image segmentation
- ✓ Watershed segmentation

Image Registration and Image Reconstruction

Objective: Implement image registration using the Image Processing Toolbox and review examples of reconstruction methodologies.

- ✓ Basics of image registration
- ✓ Basics of object reconstruction
- ✓ Morphological reconstruction

Case Studies

Objective: Investigation and problem solving using a set of case studies: Motion detection, Text recognition, finding particles, Bouncing ball, Ball tracking and Microarray analysis.

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

Conclusion

עמוד מס' 3

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Course Title:

Computer Vision with MATLAB

Course Purpose:

This one-day course provides hands-on experience with performing computer vision tasks. Examples and exercises demonstrate the use of appropriate MATLAB® and Computer Vision Toolbox™ functionality.

Topics include:

- Importing, displaying, and annotating images and videos
- Detecting, extracting, and matching object features
- Automatically aligning images using geometric transformations
- Detecting objects in images and videos
- Tracking objects and estimating their motion in a video

Pre- requisites:

MATLAB Fundamentals or equivalent experience using MATLAB.

Image Processing with MATLAB and basic knowledge of image processing and computer vision concepts.



- ✓ 1 training day
- ✓ Hours: 09:00-17:00
- ✓ Total training hours: 8

Teaching method

The course combines lectures, demonstrations and practical exercises in MATLAB, using original training books from MathWorks. The course is in Hebrew but the training materials are in English.

עמוד מס' 1

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Course Outline:

Importing, Visualizing, and Annotating Videos

Objective: Import videos into MATLAB, as well as annotate and visualize them.

The focus is on using System Objects™ for performing iterative computations on video frames.

- Importing and displaying video files
- Highlighting objects by drawing markers and shapes like rectangles
- Combining and overlaying two images
- Performing iterative computations on video frames

Detecting, Extracting, and Matching Image Features

Objective: Use corner and blob detectors to detect local features in images.

Extract and match features from two images. Use matched features to automatically align and stitch images.

- Detecting and extracting features in an image
- Matching features between two input feature sets
- Estimating geometric transformation between images
- Aligning and stitching images

Object Detection

Objective: Train a detector for flexible object detection. Detect moving objects by using a foreground detector.

- Marking objects of interest in training images
- Training and using the cascaded object detector
- Using foreground detection to detect objects

Motion Estimation

Objective: Estimate direction and strength of motion in a video sequence.

- Understanding motion perception in images
- Estimating motion using block matcher
- Estimating motion using optical flow methods

עמוד מס' 2

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Tracking*

Objective: Track single and multiple objects and estimate their trajectory. Handle occlusion by predicting object position.

- Tracking objects using histogram of pixel values
- Tracking points using a point tracker
- Predicting object position using the Kalman filter
- Tracking multiple objects

* If time permits



עמוד מס' 3

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