



Course Title:

Machine Learning with MATLAB

Course Purpose:

This three-day course focuses on data analytics and machine learning techniques in MATLAB using functionality within Statistics and Machine Learning Toolbox and Neural Network Toolbox™. The first day of the training will be used to provide introductory skills and know-how of preprocessing and analyzing signals for Data Analytics applications.

Pre- requisites:

MATLAB Fundamentals course or equivalent experience using MATLAB.



- ✓ 3 training day
- ✓ Hours: 09:00-17:00
- ✓ Total training hours: 24

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.

Part A:

In this day, you will use MATLAB®, Signal Processing Toolbox™, and Wavelet Toolbox™ to preprocess time-based signals and extract key features in the time and frequency domains. This course is intended for data scientists and engineers analyzing signals (time series) for data analytics applications. No prior knowledge on signal processing is needed for this course.

Topics include:

- Creating, importing, and visualizing signals
- Preprocessing to improve data quality, including filling data gaps, resampling, smoothing, aligning signals, finding and removing outliers, and handling non-uniformly sampled signals

עמוד מס' 1

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- Extracting features in the time and frequency domains, including finding patterns in signals, finding change points, locating peaks, and identifying trends

Course Objective:

Explore and Analyze Signals (Time Series) in MATLAB

Objective: Learn to easily import and visualize multiple signals or time series data sets to gain insights into the features and trends in the data.

- Import, visualize, and browse signals to gain insights
- Make measurements on signals
- Compare multiple signals in the time and frequency domain
- Perform interactive spectral analysis
- Extract regions of interest for focused analysis
- Recreate analysis with auto-generated MATLAB scripts

Preprocess Signals to Improve Data Set Quality

Objective: Learn techniques to clean signal sets with operations such as resampling, removing outliers, and filling gaps.

- Perform resampling to ensure a common time base across signals
- Work with non-uniformly sampled data
- Find gaps in data and remove or fill gaps
- Remove noise and unwanted frequency content
- Perform wavelet denoising
- Use the envelope spectrum to perform fault analysis
- Locate outlier values in data and replace them with acceptable data
- Locate signal changepoints and use boundaries to automatically create signal segments

Extract Features from Signals

Objective: Apply different techniques in time and frequency domains to extract features. Become familiar with the spectral analysis tools in MATLAB and explore ways to bring out features for multiple signals.

- Locate peaks
- Locate desired signals from patterns in the time and spectral domains
- Use spectral analysis to extract features from signals
- Perform classification using supervised learning
- Use the Classification Learner app to interactively train and evaluate classification algorithms

עמוד מס' 2

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Part B:

In this two days, you will focus on data analytics and machine learning techniques in MATLAB using functionality within Statistics and Machine Learning Toolbox and Neural Network Toolbox™. The course demonstrates the use of unsupervised learning to discover features in large data sets and supervised learning to build predictive models. Examples and exercises highlight techniques for visualization and evaluation of results.

Topics include:

- Organizing and preprocessing data
- Clustering data
- Creating classification models
- Interpreting and evaluating models
- Simplifying data sets
- Using ensembles to improve model performance

Course Objective:

Importing and Organizing Data

Objective: Bring data into MATLAB and organize it for analysis, including normalizing data and removing observations with missing values.

- Data types
- Tables
- Categorical data
- Data preparation

Finding Natural Patterns in Data

Objective: Use unsupervised learning techniques to group observations based on a set of explanatory variables and discover natural patterns in a data set.

- Unsupervised learning
- Self-Organizing Maps
- Clustering methods
- Cluster evaluation and interpretation

Building a Predictive Model

Objective: Use supervised learning techniques to perform predictive modeling, including creating, training, and simulating neural networks in MATLAB. Evaluate the accuracy of a predictive model.

- Supervised learning

עמוד מס' 3

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- Training and validation
- Classification methods
- Neural Networks

Improving the Model

Objective: Reduce the dimensionality of a data set. Improve and simplify machine learning models.

- Feature transformation
- Feature selection
- Cross validation
- Ensemble learning

עמוד מס' 4

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