Course Title:

Predictive Maintenance with MATLAB

Course Purpose:

This two-day course focuses on data analytics, signal processing, and machine learning techniques needed for predictive maintenance and condition monitoring workflows. Attendees will learn how to use MATLAB to import data, extract features, and estimate the condition and remaining useful life of equipment.

Pre- requisites:

MATLAB Fundamentals course or equivalent experience using MATLAB.

Course Duration

- ✓ 2 training day
- ✓ 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.

Course Objective:

Importing Data and Processing Data

Objective: Bring data into MATLAB and organize it for analysis, including handling missing values. Process raw imported data by extracting and manipulating portions of data.

- Store data using MATLAB data types
- Import with datastores
- Process data with missing elements
- Process big data with tall arrays

Finding Natural Patterns in Data

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

- Find natural clusters within data

Training Center Systematics - Contact information:

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

Website: http://www.systematics.co.il/mathworks

www.systematics.co.il	מוקד שירות: 03-7660101 info@systematics.co.il :דוא"ל	טלפון: 03-7660111 פקס: 03-7660120	סיסטמטיקס בע"מ רחוב ראול ולנברג 4, תל אביב 69719

- Perform dimensionality reduction
- Evaluate and interpret clusters within data

Building Classification Models

Objective: Use supervised learning techniques to perform predictive modelling for classification problems. Evaluate the accuracy of a predictive model.

- Classify with the Classification Learner app
- Train classification models from labeled data
- Validate trained classification models
- Improve performance with hyperparameter optimization

Exploring and Analyzing Signals

 Objective: Interactively explore and visualize signal processing features in data.

- Import, visualize, and browse signals to gain insights
- Make measurements on signals
- Compare multiple signals in the time and frequency domains
- Perform interactive spectral analysis
- Extract regions of interest
- Generate MATLAB scripts for automation

Preprocessing Signals to Improve Data Set Quality and Generate Features

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

- Use resampling to handle nonuniformly sampled signals
- Fill gaps in uniformly sampled signals
- Perform resampling to ensure common time base across signals
- Use the Signal Analyzer app to design and apply filters
- Use File Ensemble Datastore to import data
- Use the Diagnostic Feature Designer app to automatically generate and rank features
- Perform machinery diagnosis using envelope spectrum
- Locate outliers and replace with acceptable samples
- Detect changepoints and perform automatic signal segmentation

Estimating Time to Failure

Objective: Explore data to identify features and train decision models to predict remaining useful life.

- Select condition indicators
- Use lifespan data to estimate remaining useful life using survival models
- Use run-to-threshold data to estimate remaining useful life using degradation models
- Use run-to-failure data to estimate remaining useful life using similarity models

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