

### **1) Title of the tutorial**

Deep Learning Applications for Radar Systems with MATLAB

### **2) Instructors name and affiliation**

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### **3) a 300 word abstract describing the proposed topic and including an outline of the contents**

#### **Abstract:**

Modulation identification and target classification are important functions for intelligent RF receivers. These functions have numerous applications in cognitive radar, software-defined radio, and efficient spectrum management. Machine Learning and Deep Learning techniques can be used in these applications to successfully classify radar data.

In this tutorial, we will demonstrate a range of different techniques to:

- Collect data from off-the-shelf radars and software-defined radios to train and test classifiers
- Label I/Q data collected from radar hardware
- Synthesize data to train Deep Learning and Machine Learning networks for a range of radar and wireless communications systems
- Explore radar signals in the spectral and time-frequency domains
- Perform pre-processing and feature extraction for machine learning and deep learning applications
- Input data and features into networks and configure network architectures for the best performance
- Interface to deep learning networks outside MATLAB

We will use real world examples to demonstrate these techniques including:

- Radar RCS identification
- Radar/comms waveform modulation ID
- Micro-Doppler signatures for target identification (for example, pedestrians, bicycles, aircraft with rotating blades)
- RF Fingerprinting
- Anomaly detection for tracking and sensor fusion applications
- Synthetic Aperture Radar (SAR)

Attendees will learn:

- How to make data set trade-offs between machine learning and deep learning workflows
- Implement efficient ways to work with 1D and 2D (time-frequency) signals
- Extract features that can be used to improve classification results
- Validate designs with over-the-air signals from software-defined radios (SDR) and radars.

A pdf version of the slides, all of the tutorial examples, along with a temporary license, will be provided for attendees to explore the concepts covered in this tutorial.

### **4) target audience and assumed knowledge**

Radar engineers interested in learning about deep learning and machine learning in radar applications.