Doctoral Course

Machine Learning and Deep Learning with MATLAB

MathWorks

Short Abstract:

The Artificial Intelligence domain is present in our everyday life, from speech command recognition to face detection, from fitness tracking to autonomous driving, etc. This course aims to provide participants with a tool to identify, build, and use the best machine learning model for their specific use cases. Throughout the course, we will use MATLAB for different Machine and Deep Learning workflows and hands-on examples for regression and classification of signals and images.

Prerequisites

MATLAB Fundamentals: working with vector and matrices; creating scripts and functions; working with Live Scripts; data types (structure, cell, tables, logical, string, char, function handle); knowledge of programming constructs (for, if, while, switch); setting MATLAB Path; working with MATLAB debugging tools.

Familiarity with Machine Learning and Deep Learning theory

Students attending the event should bring their Personal Computer. During this course we will use the latest MATLAB release on MATLAB Online (no MATLAB Desktop installation is required).

Course Contents in brief:

- **Part 1: Data Pre-processing and Introduction to Machine Learning in MATLAB**
    - Import data into MATLAB. Automatic Code Generation for Importing Data - Filtering data and visualization. Using Datastores to import collection of files.
    - Overview of Machine Learning techniques. Unsupervised and Supervised techniques (clustering, regression, classification).
    - Create a custom data type with an object-oriented approach
    - Hands-on Project

- **Part 2: Introduction to Deep Learning in MATLAB**
    - Getting started with pretrained models
        - Choosing pretrained models for image classification
        - Import pretrained models from open-source frameworks (PyTorch, TensorFlow)
        - Using layer activations as features to train another machine learning model
    - Transfer Learning

- - Using Deep Network Designer App
    - Application Examples with most relevant Neural Networks

  - Building simple Neural Networks from scratch
    - Creating Network Architectures
    - Understanding Network Training and Monitoring Training Progress
    - Application Examples with CNN and LSTM

  - (Optional) Advanced techniques for deep learning in MATLAB
    - Extended framework with custom training loops
    - Defining custom layers
  - Hands-on Project

Total # of hours of lecture:

20 hours

Teachers

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Final Exam: Hands-on Projects

Room and Schedule

Room: *Aula Riunioni del Dipartimento di Ingegneria dell'Informazione, Via G. Caruso 16, Pisa – Ground Floor*

Schedule:

Tue March 14th from 13:00 to 18:00

Wed March 15th from 9:00 to 14:00

Thu March 23rd from 13:00 to 18:00

Fri March 24nd from 9:00 to 14:00