**Title: MATLAB Course on Artificial Intelligence Algorithms and Machine Learning Techniques**

Duration: 14 hours

2.8 credits

Date: June 17th and 18th 2025, from 9:00 to 12:30 and from 14:00 to 17:30

Address: TBD

**Overview/Description**

Join us for an immersive workshop designed to empower you with the skills necessary to harness the power of AI using MATLAB and Simulink platforms. This course, made of 4 hands-on sessions, will focus on the applications of Machine Learning and Deep Learning, providing you with the most relevant tools and workflows to efficiently implement AI models.

**Key Takeaways**

* Dive into key concepts of Machine Learning, such as supervised learning, classification vs regression tasks, data preprocessing, feature selection and model evaluation, using apps to streamline the workflows.
* Transition into Deep Learning fundamentals, understanding neural networks and their architectures. Gain hands-on experience with MATLAB’s Deep Learning Toolbox to design, train, and evaluate deep neural networks
* Discover real-world applications of AI, such as image recognition, object detection, time series classifications, battery state of charge estimation, etc. Work on projects that demonstrate how AI can solve complex problems across various industries.
* Use Simulink and Simscape to generate synthetic dataset and then simulate intelligent systems with embedded AI. Understand the need to compress the neural network to reduce the size and memory requirements
* Get an overview of end-2-end Ai workflows to from design requirements, through verification and validation of AI model, as far as deployment of edge devices, embedded systems, or cloud platforms
* Work on practical examples inspired by real-world applications
* Learn best practices for model optimization, hyperparameter optimization and deployment strategies to enhance the performance and scalability of your specific AI challenges

**Session Highlights**

Session 1: Review of Machine Learning in MATLAB

Supervised learning: classification vs regression examples. Feature extractions, choosing machine learning algorithms using Classification/Regression Learner Apps, confusion matrix, predictive analytics.

Session 2: Deep Learning with MATLAB

Data preparation, building neural networks from scratch using Deep Network Designer and concatenating layers; using pretrained models and transfer learning; exploring different model architectures (feed-forward, CNN, LSTM); train network using different training options; interoperability with open source platforms (PyTorch, Tensorflow, ONNX)

Session 3: Deep Learning for Model-Based Design

Using Simulink models to generate synthetic datasets; using compression methods; export networks to Simulink; hints for V/V for AI and code generation; using AI for virtual sensoring (i.e. battery state of charge estimation) . Optional: using AI for ROM (Reduced-order Modeling)

Session 4: Advanced Deep Learning

Understand extended AI framework (dlarray, dlnetwork, automatic differentiation); using custom training loops; using function models. Using PINN (physics-Informed NN) and graph NN to solve heat transfer. Optional: generative AI models in MATLAB

**Who Should Attend**

Students, researchers, educators and domain experts who are exploring how to apply AI in their domain or who are interested in integrating deep learning into their physical system models or simulations.

**Prerequisites**

* Solid familiarity with MATLAB and basics of Simulink
* Familiarity with Machine learning concepts
* Completion of at least 3 onramps among
	+ [MATLAB Onramp](https://it.mathworks.com/support/learn-with-matlab-tutorials.html?ef_id=CjwKCAjw-qi_BhBxEiwAkxvbkARe7ndqZnfaEWNOUKMGYuuKBvotkdwBCI8-6Bfkjb6BT0YTFhv-IhoCPP4QAvD_BwE%3AG%3As&s_kwcid=AL%218664%213%21547132864300%21p%21%21g%21%21matlab+onramp&s_eid=ppc_125771590792&q=matlab+onramp&gad_source=1&gclid=CjwKCAjw-qi_BhBxEiwAkxvbkARe7ndqZnfaEWNOUKMGYuuKBvotkdwBCI8-6Bfkjb6BT0YTFhv-IhoCPP4QAvD_BwE)
	+ [Signal Processing Onramp](https://matlabacademy.mathworks.com/it/details/signal-processing-onramp/signalprocessing)
	+ [Image Processing Onramp](https://matlabacademy.mathworks.com/it/details/image-processing-onramp/imageprocessing)
	+ [Machine Learning Onramp](https://matlabacademy.mathworks.com/it/details/machine-learning-onramp/machinelearning)
	+ [Simulink Onramp](https://matlabacademy.mathworks.com/it/details/simulink-onramp/simulink)
	+ [Simscape Onramp](https://matlabacademy.mathworks.com/it/details/simscape-onramp/simscape)
	+ [Multibody Simulation Onramp](https://matlabacademy.mathworks.com/it/details/multibody-simulation-onramp/ormb)