THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Applied Machine Learning for MAE and Robotics

MECHENG 5775

Credit Hours:
3.00

Course Levels:
Undergraduate (1000-5000 level)
Graduate

Course Components:
Lecture

Course Description:
Classical and modern methods of machine learning with specific applications to mechanical and aerospace engineering, and robotics.

Prerequisites and Co-requisites:
Prereq: Math 2177 or 2174, or 2415 and 2568; and Physics 1250 or 1250H or 1260 or 2300; and CSE 1221 or 1222 or Engr 1181 or 1281.01H or 1281.02H or 1221 or 1222; and AeroEng 3581 or MechEng 2850 or 5463; or Grad standing in Engineering.

Course Goals / Objectives:
- Provide an applied hands-on introduction to machine learning as relevant to MAE and robotics. Focus will be on using software for specific applications rather than ML theory.
- Work in teams to develop a machine learning system to model and control a robot that explores and navigates its world
- Learn to analyze different data sets from classical mechanical and aerospace engineering and understand how machine learning techniques can help complement classical engineering analysis and simulation methods

Course Topics:

- Overview: Machine Learning Fundamentals
- Uses of machine learning in robotics and MAE (including fields such as fluids, solids, controls, automotive, etc.): model building, model reduction, nonlinear control, system identification, inference, sensing, diagnostics, etc.
- Data processing and data issues
- Introduction to robotics software (Robot Operating System) and machine learning software
- Robot platform overview: control of wheeled robot/legged robot
- Model building, inference, and sensor fusion: simple regression problems
- Discrete decisions based on data: classification and clustering
- Learning from actions: reinforcement learning vs optimal control, exploration vs exploitation
- Robot sensors: IMUs, joint encoders, cameras, LIDARs, other sensing modalities
- Sensing and vision: nonlinear regression and neural networks
- Nonlinear/hybrid control and nonlinear system models using neural networks
- Robustness and fault tolerance

Designation:
Elective