Department of Electrical and Computer Engineering

ECE 381: Applied Machine Learning

Credits and contact hours: 3 credits, 3 contact hours

Instructor: Dr. Tao Han,
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Catalog Course Description:

This course is to prepare the students for the new environment of machine learning and artificial intelligence. The course is composed of two main parts: 1) basic applied machine learning techniques including deep learning, regression, classification, convolutional neural networks, generative adversarial networks, and model compression; and 2) introduction to PyTorch, colab, and jupyter notebook and provide students with hands-on experience of developing and implementing machine learning solutions.

Prerequisites:

1. Basic programming languages, e.g. Python.

Textbook:

The instructor will provide the reading materials for the courses. Since the course focuses on state-of-the-art machine learning technologies, most of the reading materials will be technical papers and reports.

Specific Course Learning Outcomes (CLOs):

The student who completes the course will:

1. Understand the basics of machine learning and neural networks
2. Gain an understanding of the design and optimization of machine learning models
3. Gain knowledge of convolutional neural networks (CNN) for computer vision
4. Gain knowledge of reinforcement learning (RL)
5. Gain knowledge of generative adversarial networks (GAN) for AI content generation and Transformer
6. Gain hands-on knowledge and experience in designing and implementing machine learning algorithms on mobile and IoT devices

Relevant student outcomes (ABET):

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (CLO 1-5)
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors (CLO 1-5)
3. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies (CLOs 1-5)
4. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives (CLO 6)
5. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions (CLO 6)

Course Outline

Weeks	Lecture
1	Introduction to Machine Learning
2-3	Deep Learning Techniques
3	**Assignment 1**: Regression Experiments
4-5	Deep Reinforcement Learning
5	**Assignment 2**: DRL Experiments
6-7	Convolutional Neural Network (CNN) and Transfer Learning
8-9	**Lab 1**: Image Classification (Jetson AI)
9-10	Generative Adversarial Networks (GAN) and Transformer
11	**Lab 2**: Image Regression (Jetson AI)
12	Neural Network Compression
13	**Lab 3**: Realtime Video Applications (Jetson AI)
14	**Lab 4**: Final Project
15	Final Project Report

Grading Policy:

Quizzes	30% (6 quizzes, 5% each quiz)
Assignments & Labs	50% (2 assignments and 3 labs,10% each)
Final Project	20%