MACHINE LEARNING AND AI (ML)

ML 221 - Applied Probability (4 Credit Hours)
This course introduces students to the key conceptual ideas of probability. Students explore these concepts through the use of empirical investigation with data. The course offers substantial programming labs where students increase their algorithmic design and coding proficiency, and also gain familiarity with various Python modules and toolboxes.
Prerequisite(s): MATH 145 and CS 145 or one course from CS 109-CS 114 range.
Crosslisting: MATH 221.

ML 222 - Applied Probability Seminar (1 Credit Hour)
The Applied Probability Seminar complements the pedagogy in the ML 221 Applied Probability course. Students explore the key concepts of probability theory through an empirical investigation methodology. They conduct experiments designed to grow an intuitive level understanding of randomness, distribution, and probability. A key goal of this seminar is to strengthen students' program development skills, introducing key software libraries and design techniques.
Prerequisite(s): ML 221 (coreq) or MATH 221 (coreq).

ML 240 - Introduction to Machine Learning (4 Credit Hours)
An introduction to the fundamental ideas and algorithms of machine learning, emphasizing applications over theory. The course provides early exposure to key concepts and techniques in machine learning.
Prerequisite(s): MATH 145 and CS 105 or CS 145 or one from the CS 109-CS 114 course range or CS 271 or CS 231.
Crosslisting: CS 240.

ML 310 - Intermediate Machine Learning (4 Credit Hours)
This course offers a mathematical treatment of modern machine learning, building on prior exposure to linear models and optimization, emphasizing the analysis and implementation of core algorithms from both a theoretical and practical perspective. Emphasis is placed on connecting mathematical theory with algorithmic implementation and on developing a rigorous understanding of how and why modern machine learning techniques work. Topics include convex optimization, regularization techniques, kernel methods, Bayesian learning, support vector machines, dimensionality reduction, neural networks, and reinforcement learning.
Prerequisite(s): MATH 213 and ML 221 or MATH 221 and ML 222 (coreq).
Crosslisting: MATH 428.

ML 400 - Advanced Machine Learning (4 Credit Hours)
This course is an exploration of the deep learning paradigm that is the foundation of current state-of-the-art AI technology. Students completing this course will understand how the deep learning structure of networks facilitates the learning of advanced concepts. The course introduces the mathematical operations of loss functions and optimization techniques that form the backbone of deep learning architectures. The course then examines two models of deep learning: the convolution neural network used in image processing and the transformer architecture used in large language models.
Prerequisite(s): ML 240 or CS 240 and ML 310 or MATH 428.