AI Driving Robotics: From Theory to Real-world Applications

Basic information

Course Title	AI Driving Robotics: From Theory to Real-world Applications
Instructor	[redacted] Assistant Professor, Aerospace and Mechanical Engineering, University of Southern California
Prerequisites	There is no prerequisite for the class. However, background in either control, robotics, AI, or machine learning is highly encouraged. Students should also be familiar with one of popular programming languages in Robotics such as MATLAB, python, C++ to be able to effectively conduct research in this class.
Required Text & Tools	There is no required textbook for the course. However, readings will be recommended from the following resources: [1]. "Robot Modeling and Control", Mark W. Spong, Seth Hutchinson, and Mathukumalli Vidyasagar, John Wiley & Sons, 2020. [2]. "Modern Robotics: Mechanics, Planning, and Control", Kevin M. Lynch and Frank C. Park, Cambridge University Press, 2017.
Grading Criteria	TBD
Course Key Words	Artificial Intelligence, Robotics, Machine Learning, Neural Networks, Autonomous Systems, Deep Learning, Robot Operating System (ROS), Computer Vision, Natural Language Processing

Course Description

This is an intensive course specially designed to offer a comprehensive understanding of both Robotics and Artificial Intelligence (AI), and their interplay. Our objective is to provide students with a robust foundation in fundamental robotics concepts like kinematics and control theory while equipping them with solid insights into the critical concepts of AI, such as machine learning, deep learning, reinforcement learning, computer vision, and natural language processing.

As the course progresses, we focus on real-world applications, demonstrating how these AI technologies have been embedded in robotics to perform complex tasks, interpret their environments, and interact more naturally with people and surroundings.

Course Schedule

	Lecture
Day 1	Introduction to Robotics and Kinematics
Day 2	Robot Dynamics and Basic Control Systems :error detection, feedback, and decision-making processes.
Day 3	Linear and LQR Control Theory
Day 4	Advanced Control Systems - Model Predictive and Nonlinear Control
Day 5	Trajectory Optimization
Day 6	AI in Robotics -Machine Learning
Day 7	Deep Learning and Neural Networks
Day 8	Reinforcement Learning for Robotic Control
Day 9	Computer Vision in Robotics
Day 10	Natural Language Processing for Interactive Robots