ECE 7202: Reinforcement Learning

Course Description
Fundamentals of Markov decision processes and reinforcement learning algorithms

Transcript Abbreviation: ReinforceLearning
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Graduate
Student Ranks: Masters, Doctoral
Course Offerings: Autumn, Spring
Flex Scheduled Course: Never
Course Frequency: Every Year
Course Length: 14 Week
Credits: 3.0
Repeatable: No
Time Distribution: 3.0 hr Lec
Expected out-of-class hours per week: 6.0
Graded Component: Lecture
Credit by Examination: No
Admission Condition: No
Off Campus: Never
Campus Locations: Columbus
Prerequisites and Co-requisites: Graduate standing in Engineering or Math
Exclusions: Not open to students with credit for ISE 7202
Cross-Listings: Cross-listed with ISE 7202

Course Rationale: no course in RL @ OSU; RL is key set of methods in ML; is in demand (in R&P); RL

is

taught at peer institutions

The course is required for this unit's degrees, majors, and/or minors: No
The course is a GEC: No
The course is an elective (for this or other units) or is a service course for other units: Yes

Subject/CIP Code: 14.3501
Subsidy Level: Doctoral Course

Programs

Abbreviation	Description
CpE	Computer Engineering
EE	Electrical Engineering

Course Goals

Familiarize students with the framework of Markov decision processes
Introduce students to different classes of reinforcement learning algorithms
Help students gain experience in programming RL algorithms
Guide students through identifying research problems that can be addressed using RL methods

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Introduction to RL and applications	3.0							
Sequential decision making and multi-armed bandits	3.0							
Markov decision processes	4.5							
Exact dynamic programming, value/policy iteration	6.0							
Reinforcement learning algorithms (including Monte Carlo and TD methods, Q-learning, policy gradient, actor-critic)	21.0							
Selected advanced topics: multi-agent RL, inverse RL, on-policy vs off-policy, imitation learning, e	4.5							

Representative Assignments

Formulating a problem as a Markov decision process
Solving a given MDP using dynamic programming
Implementation of the Q-learning/SARSA/REINFORCE algorithm in Python/MATLAB

Grades

Aspect	Percent
Homework	60%
Final Project	40%

Representative Textbooks and Other Course Materials

Title	Author
No mandatory textbook required. Suggested references included in the syllabus.	

ABET-EAC Criterion 3 Outcomes

Course Contribution		College Outcome
	a	An ability to apply knowledge of mathematics, science, and engineering.
	b	An ability to design and conduct experiments, as well as to analyze and interpret data.
	c	An ability to design a system, component, or process to meet desired needs.
	d	An ability to function on multi-disciplinary teams.
	e	An ability to identify, formulate, and solve engineering problems.
	f	An understanding of professional and ethical responsibility.
	g	An ability to communicate effectively.
	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.
	i	A recognition of the need for, and an ability to engage in life-long learning.
	j	A knowledge of contemporary issues.
	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

CpE ABET-EAC Criterion 9 Program Criteria Outcomes

Course Contribution		Program Outcome
	1	an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
	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
	3	an ability to communicate effectively with a range of audiences
	4	an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
	5	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
	6	an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
	7	an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

EE ABET-EAC Criterion 9 Program Criteria Outcomes

Course Contribution		Program Outcome
	1	an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
	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
	3	an ability to communicate effectively with a range of audiences
	4	an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
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Prepared by: Betty Lise Anderson