MARMARA UNIVERSITY - FACULTY OF ENGINEERING

2022-2023 Fall

CSE4093 Special Topics in Computer Engineering

COURSE DESCRIPTION FORM

Offering Department	Department of Computer Engineering		Technical Elective
Course Code	CSE4093		
Course Name	Special Topics in Computer Engineering		
Language of Instruction	English		
ECTS	5		
Contact Hours	Theoretical (T): 3	Practice (P): 0	Laboratory(L): 0
Pre-requisites			
Instructor	**Name**	Borahan Tümer	
	E-mail	borahan.tumer@marmara.edu.tr	
Course Materials	**Mandatory**		
	Recommended	1. Introduction to Reinforcement Learning: an Introduction by R.S. Sutton and A.G. Barto, MIT Press 2. Selected papers such as Between MDPs and Semi-MDPs: Learning, Planning, and Representing Knowledge at Multiple Temporal Scale, Sutton RC, Precup D; Transfer Learning for Reinforcement Learning Domains: A Survey, Taylor ME Stone P; Evolving Neural Networks through Augmenting Topologies, Stanley KO, Miikkulainen R	
Course Objectives	The goal of this class is to equip the undergraduate students with the basic principles of reinforcement learning (RL). RL is inspired from the way humans and other mammals use to develop strategies/solutions to fulfill their daily tasks. RL is a learning technique that the learner extracts from its experience by interacting with its environment. The following outline will be followed throughout the class:		
Course Content	Evaluative versus instructive Feedback – How to set up an RL Problem – Dynamic programming for policy evaluation & search – Monte Carlo Methods – Temporal Difference Learning: model-free RL agents – Eligibility Traces – Planning and Learning: Model based RL agents – Advanced topics in RL - Potential research areas		
Learning Outcomes	**LO1**	Explain the difference between evaluative (RL) and instructive (supervised learning) feedback.	
	LO2	Model environment and use policy evaluation and iteration methods in sequential decision making (SDM) problems	
	LO3	Explain the difference between and implement Monte-Carlo and Temporal Difference (TD) methods to SDM problems	
	LO4	Explain the improvement capacity of eligibility traces when integrated to TD methods	
	LO5	Describe planning in RL context and implement model-based RL agents to SDM problems.	

Program Outcomes		**LO1**	**LO2**	**LO3**	**LO4**	**LO5**		
PO1	Adequate knowledge in mathematics, science (a) and computer engineering subjects (b) pertaining to the relevant discipline (1); ability to use theoretical and applied information in these areas to model and solve engineering problems (2)..	1b	1b	1b	1b	1b		
PO4	Ability to devise (a), select, and use (b) modern techniques and tools needed for engineering practice (1); ability to employ information technologies effectively (2).		1b	1b		1b		
PO5	Ability to design (a) and conduct experiments, gather data (b), analyze and interpret results for investigating engineering problems (c).		abc	abc		abc		

	No	**Week**	**Subjects**	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**		
Subjects (Knowledge, Skills and Behaviours), Contributions of Subjects to Learning Outcomes, Assessment Methods	**S1**	1	Introduction+basic concepts							
	S2	2-3	Evaluative Feedback & its Differences with Instructive Feedback							
	S3	4-5	Setting up an RL Problem – Elements of RL							
	S4	6-7	Use of Dynamic Programming – the case of Perfect environment model							
	S5	8	Monte Carlo Methods – Case of Imperfect model							
	S6	9	Temporal Difference Learning – how value adjustments are improved over MC methods by anticipatory value estimates – use of the concept “bootstrapping”							
	S7	10	Eligibility Traces							
	S8	11-12	Planning & Learning – partial models							
	S9	13-14	Advanced Topics in RL (HRL, Non-Markov Envs., NEAT, TL, etc)							

Assessment Methods and Weights

No	Type	Weight	Implementation Rule	Make-up Rule
MF	Midterm, Final	%(75)	It is allowed to have an A4 size handwritten cheat sheet in the exams. Any kind of calculators or communication devices are not allowed.	Marmara University regulations will be followed for make-up exams.
P	Project	%20	2 projects are assigned each with a due date 2 weeks after the assignment.	Late projects are evaluated on a prorated basis up to 5 days with 10% off per day of their original grade. The grade for unsubmitted project is zero.
Q	Quiz	%5	There are 2-3 pop-up quizzes. Any kind of notes, calculators or communication devices are not allowed.	No make-up for quizzes.
TOTAL		%100		

Determining Letter Grades

- The letter grades will be determined based on the midterm and final exams, quizzes and project.
- In order to determine the letter grade, a curve or catalog based method will be followed based on the total average scores of the students.
- The final exam score and the total average score of the student must be at least 35 to pass the course.
- Marmara University Undergraduate regulations for the final exam apply: (the final exam's weight is at least 40 out of 100.

Assessment	Midterm	Project	Quizzes	Final	TOTAL
Weight	35	20	5	40	100

Teaching Method, Student Work Load

Time Applied by Instructor

No	Method	Explanation	Hours
1	Lectures	Lectures are given in class using the board or via presentations. Example questions are solved to enhance the concepts.	14x3=42
2	Problem Session/ Practice	Problems related to the course topics are solved on the board.	-
3	Laboratory	Experiments are done in the laboratory or theoretical concepts covered during the lectures are practiced using computer exercises.	-
4	Interactive Courses	Questions are asked to students during lectures and they are encouraged to guess the answers (peer learning is also in this category)	-
5	Field Work	Students attend activities outside the campus.	-
6	Midterm	Midterm exam is given during the midterm week.	2
7	Final	Final exam is given during the final exam week.	2

Estimated Time to be Allocated by a Student

8	Project	The students carry out research about the problem given in the project, design and implement their solution and prepare a report.	2x24=48
9	Homework	The students solve the problems given as homework.	
10	Pre-class learning of Course Material	The students study and learn the new subjects from course materials.	14
11	Review of Course Material	Students review the course subjects from course materials to prepare for the exams and homework.	14
12	Office Hour	Students ask questions to the instructor or the assistant during office hours.	2
TOTAL			124

Academic Honesty

Violations of scholastic honesty include, but are not limited to cheating, plagiarizing, fabricating information or citations, facilitating acts of dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of other students.

In case academic dishonesty is observed, the decision maker as the first authority is the instructor of the course. Based upon its severity, the instructor may decide to give the student zero for the homework(s)/lab(s)/exam(s), give the letter grade FF, or may take disciplinary action.