Master of Science in Artificial Intelligence (MSAI)

Course Name	Multi-Agent Syst	ems and Reinforcen	الأنظمة متعددة الوكلاء والتعلم المعزز		
Course	Course Code	Course No.	Credit Hour	Prerequisite(s)	
Information	0911-1679	679	3 (3-0-6)	Machine Learning	
Course Track	Program Core		Electives		

Course Description. The topic of Agents and Multi-Agent Systems examines environment that involve autonomous decision-making software actors to interact with their surroundings with the aim of achieving some individual or overall goal. More recently, significant global attention has focused on the vision of autonomous vehicles, which also follows the core principle of an agent attempting to achieve a set of defined goals. This course will cover several topics related to intelligent agents and multi-agent systems like; the design of intelligent agents - reasoning agents, agents as reactive systems, hybrid agents, layered agents, multi-agent interactions - cooperative versus non-cooperative, zero-sum and other interactions, how cooperation occurs - the Prisoner's dilemma and Axelrod's experiments, interactions between self-interested agents: auctions & voting systems: negotiation, interactions between benevolent agents: cooperative distributed problem solving (CDPS), partial global planning, coherence and coordination in addition to a range of Game Theoretic Models. It will also examine Adaptive Learning Agents using Reinforcement Learning algorithms. It takes a hands-on, practical approach to reinforcement learning theory, beginning with Markov Decision Processes, detailing practical learning examples in discrete environments and how to formulate a reinforcement learning task. It then extends this to continuous problem spaces, detailing Deep Reinforcement Learning with a practical implementation of a Deep Q Network.

Course Outcomes. After the completion of this course, the student will be able to:

- 1. Explain and discuss the principles underlying intelligent agents and multi-agent systems. [A]
- 2. Explain the role of game theory and games in agent design. [A, B]
- 3. Apply the principle of agents to a range of simulation problems. [C]
- 4. Understand the theory unpinning reinforcement learning. [A]
- 5. Apply reinforcement learning to a real-world problem end evaluate its performance. [D, E]

Assessment	Assignments	15%	Quiz		Capstone	40 %			
Policy (PC)	Midterm	15%	Final	30%	Project	40 /0			
Textbook	H. M. Schwartz, "Multi-Agent Machine Learning: A Reinforcement Approach", 1 st Edition, Wiley, 2014, ISBN-13: 978-1118362082.								
References	 Maxim Lapan, "Deep Reinforcement Learning Hands-On: Apply modern RL methods, with deep Q-networks, value iteration, policy gradients, TRPO, AlphaGo Zero and more", Packt Publishing, 2018. ISBN-13: 978-1788834247. Gerhard Weiss, "Multiagent Systems (Intelligent Robotics and Autonomous Agents series)", MIT Press, 2013, ISBN 978-0-262-01889-0. 								

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