Technical University of Crete
School of Electrical and Computer Engineering

INF/ΠΛΗ 412 – Autonomous Agents

Winter Semester | **Course Syllabus** | Academic Year 2023–2024

Lectures:	Tuesday, 15:00–17:00, 145.P58 (Science Building, 2nd floor) Thursday, 15:00–17:00, 145.P58 (Science Building, 2nd floor)
Labs:	as needed, please follow the announcements
Instructor:	Prof. Michail G. Lagoudakis
Contact:	145.A35, 28210-37244, `lagoudakis at tuc gr`
Info:	`www.intelligence.tuc.gr/~lagoudakis`
Web Site:	`www.eclass.tuc.gr/courses/HMMY313/`
Textbook 1:	Stuart Russell and Peter Norvig *Artificial Intelligence: A Modern Approach* [Eudoxus: 102070469]
Textbook 2:	Sebastian Thrun, Wolfram Burgard and Dieter Fox *Probabilistic Robotics* [Eudoxus: 12858802]
Textbook 3:	Ι. Βλαχάβας, Π. Κεφαλάς, Ν. Βασιλειάδης, Φ. Κόκκορας και Η. Σακελλαρίου *Τεχνητή Νοημοσύνη* [Eudoxus: 94700120]
Textbook 4:	Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, Giuseppe Oriolo *Robotics: Modelling, Planning and Control* [Eudoxus: 32997955]
Textbook 5:	Peter Corke *Robotics: Vision and Control* [Eudoxus: 94643354]
Textbook 6:	Δημήτριος Εμίρης και Δημήτριος Κουλουριώτης *Ρομποτική* [Eudoxus: 94692003]

Course Objectives

The purpose of the course is to introduce students to a programming model that departs from the conventional model of producing output for some input and focuses on the continuous and autonomous interaction of a hardware and software entity (agent) with the environment. The tools and techniques taught represent the latest developments in the fields of Artificial Intelligence, Machine Learning and Robotics and find application in a multitude of problems. In the lab part of the course, students will have the opportunity to get to know robotic simulation tools, as well as the robotic bipeds *Ubitech Alpha2* and *Aldebaran Nao*, to program them and demonstrate some non-trivial, intelligent behavior.

Course Logistics

The course assumes **very good knowledge** of basic mathematics (probability and linear algebra), algorithm design and analysis, procedural and object-oriented programming (C, C++, Java), as well as system programming (Linux, scripts, threads, cross-compiling). The laboratory assignments are **mandatory** (some of them will be conducted in the robot lab area and physical presence is required).

Course Topics (per week, for a total of 13 weeks)

1. Intelligent (robotic) agents and environments
2. Perception and action (sensors and actuators)
3. Robot navigation (path planning, motion control)
4. Uncertainty, Bayesian networks, probabilistic reasoning
5. Exact and approximate inference in Bayesian networks
6. Probabilistic reasoning in time, temporal probabilistic models
7. Robot navigation (localization, mapping, SLAM)
8. Decision making under uncertainty, Markov Decision Processes
9. Finding optimal policies (value iteration, policy iteration)
10. Reinforcement learning, prediction and control, approximate solutions
11. Basic and advanced reinforcement learning algorithms, applications
12. Partial observability, Partially Observable Markov Decision Processes
13. Competitive and cooperative agents (Markov Games, auction-based coordination)

Course Grading

Lab Assignments (25%), Semester Project (25%), Final Written Exam (50%)

Grades must be at least 50/100 in each of the above requirements for a passing grade in the course.