ADVANCED TOPICS IN ARTIFICIAL INTELLIGENCE

COURSE OUTLINE

Responsible: Emmanouil Marakakis

1. GENERAL			
SCHOOL	School of Engineering		
ACADEMIC UNIT	Department of Electrical and Computer Engineering		
LEVEL OF STUDIES	Postgraduate		
COURSE CODE	8000.1.121.0	**SEMESTER**	2nd
COURSE TITLE	Advanced Topics in Artificial Intelligence		

INDEPENDENT TEACHING ACTIVITIES if credits are awarded for separate components of the course	**WEEKLY TEACHING HOURS**	**CREDITS**
	5	7.5
Total	**5**	**7.5**

COURSE TYPE general background, special background, specialised general knowledge, skills development	
PREREQUISITE COURSES	All students are expected to have background from the following undergraduate courses: Algorithms, Data Structures, Discrete maths, Logic and Introduction to AI.
LANGUAGE OF INSTRUCTION and EXAMINATIONS	English
OFFERED TO ERASMUS STUDENTS	Yes (in English) — Spring Semester
COURSE WEBSITE (URL)	https://eclass.hmu.gr/courses/TP281/

2. LEARNING OUTCOMES

Learning outcomes

The students are expected to get the required knowledge in order to be able to develop projects and to carry out research in selected, state of the art topics of AI. That is, in *Machine Learning* and in particular in Statistical relational learning.

General Competences

The primary aim of this course is to teach students advanced techniques of modern AI. In addition, it equips students with the appropriate programming tools for developing AI applications. Moreover, the course fosters an appreciation for the engineering issues underlying the design and development of AI systems.

3. SYLLABUS

Overview of Machine Learning. Statistical Relational Learning. Probability Theory & Bayes' Rule. Probability & Random Variables. Reasoning under Uncertainty I. Reasoning under Uncertainty II. Probabilistic Graphical Models - Bayesian Networks. Markov Networks. Probabilistic Inference. Probabilistic Logic Programming: ProbLog, Cplint. Implementation of Markov Models & HMM.

<table>
<tr><th colspan="2">4. TEACHING and LEARNING METHODS - EVALUATION</th></tr>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Lectures using power-point slides.</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>Programming, Word and Power-point are used for developing assignments. Internet is used for assignments and lectures. For example, eClass is used for uploading lectures, assignments, bibliography etc.</td></tr>
<tr><td>TEACHING METHODS
The manner and methods of teaching are described in detail.</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Assignments and projects</td><td>7</td></tr>
<tr><td>class attendance</td><td>5</td></tr>
<tr><td>Course total</td><td>12</td></tr>
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<tr><td>STUDENT PERFORMANCE EVALUATION
Description of the evaluation procedure</td><td>• 4 assignments 40% (each assignment is graded 10%).
• 1 project 60%.</td></tr>
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5. ATTACHED BIBLIOGRAPHY

1. D. Poole, A. Mackworth, *Artificial Intelligence – Foundations of Computational Agents*, Cambridge University Press, Third Edition, 2023.
2. S. Russell, P. Norving, *Artificial Intelligence – A Modern Approach*, 4th edition, Pearson, 2022.
3. M. P. Deisenroth, A. A. Faisal, C. S. Ong, *Mathematics for Machine Learning*, Cambridge University Press, 2020.
4. G. Bontempi, *Handbook of Statistical Foundations for machine Learning*, Comp. Science Department, Universite Libre de Bruxelles, Belgique, 2017.
5. L. De Raedt, K. Kersting, S. Natarajan, D. Poole, *Statistical Relational Artificial Intelligence*, Morgan & Claypool Publ, 2016.
6. D. Koller, N. Friedman, *Probabilistic Graphical Models – Principles and Techniques*, The MIT Press, 2009.
7. L. De Raedt, *Logical and Relational Learning*, Springer, 2008.
8. D. Bertsekas, J. Tsitsiklis, *Introduction to Probability*, 2nd Edition, Athena Scientific, 2008.
9. L. Getoor, B. Taskar, *Introduction to statistical relational learning*, The MIT Press, 2007.