

POLI ESCOLA SUPERIOR TECNOLOGIA GESTÃO TÉCNICO GUARDA	SUBJECT DESCRIPTION	MODELO PED.013.03
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Course	Data Science and Artificial Intelligence					
Subject	Topics of Artificial Intelligence					
Academic year	2023-2024	Curricular year	2nd	Study period	1st semester	
Type of subject	Compulsory	Student workload (H)	Total: 196	Contact: 60	ECTS	7
Professor(s)	Celestino Pereira Gonçalves					
<input checked="" type="checkbox"/> Area/Group Coordinator <input type="checkbox"/> Head of Department	(select)	José Carlos Fonseca				

PLANNED SUBJECT DESCRIPTION

1. LEARNING OBJECTIVES

1. To characterize Artificial Intelligence (AI) and its applicability.
2. To learn about emerging themes in Artificial Intelligence.
3. To characterize and to apply intelligent agents in problem solutions, using systematic search, heuristic search, knowledge representation, learning, adaptive and with multi-agents strategies.
4. To learn the logic programming paradigm.

2. PROGRAMME

1. Introduction and context of Artificial Intelligence.
 - 1.1. Definition, characterization and application domains.
 - 1.2. Artificial Intelligence paradigms.
 - 1.3. Historical overview.
 - 1.4. Emerging themes and impact.
 - 1.5. Artificial Intelligence application regulation.
2. Reactive Agents.
 - 2.1. Architecture.
 - 2.2. Pure reactive agents.
 - 2.3. Reactive agents with memory.
3. Search Agents.
 - 3.1. Architecture.
 - 3.2. Uninformed (blind) search.
 - 3.3. Informed (heuristic) search.
 - 3.4. Stochastic search.
 - 3.5. Selection criteria.
4. Knowledge-Based Agents.
 - 4.1. Architecture.
 - 4.2. Knowledge and reasoning representation systems (computational, connectionist and biological approaches).

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5. The Logic Programming Paradigm.
 - 5.1. First-order predicate logic.
 - 5.2. Declarative knowledge represented in logic programming.
 - 5.3. Rule Systems based on Fuzzy Logic.
 - 5.4. Logic programming.
6. Evolutionary Computation.
 - 6.1. Genetic Algorithms.
 - 6.2. Genetic Programming.
 - 6.3. Evolutionary Strategies.
 - 6.4. Evolutionary Programming.
7. Distributed Intelligence and Agent Societies.
 - 7.1. Two-agent societies.
 - 7.2. Multiagent systems.
 - 7.3. Deliberative agents.
 - 7.4. Collective intelligence systems.

3. COHERENCE BETWEEN PROGRAMME AND OBJECTIVES

1. Content 1 is consistent with Objectives 1 and 2 since it focuses on aspects of characterization and evolution of the area of Artificial Intelligence, as well as the various application domains, regulation, presentation of emerging themes and discussion of their impact.
2. Contents 2, 3, 4, 6 and 7 are consistent with Objective 3 since several strategies are analyzed and used to construct intelligent agents for problem solutions, like systematic search, heuristic search, knowledge representation, adaptive and with multiagent strategies.
3. Content 5 is consistent with Objective 4 since the concepts and techniques of logic programming are presented and the different programming elements in a logic programming language are applied.

4. MAIN BIBLIOGRAPHY

Mandatory:

1. Costa, E., Simões, A., Inteligência Artificial - Fundamentos e Aplicações, 2.^a Edição, FCA, 2008. ISBN: 978-972-722-340-4.
2. Russel, S., Norvig, P., Artificial Intelligence: A Modern Approach, 4th Edition, Pearson, 2021. ISBN: 978-1292401133.
3. Martins, J.P., Lógica e Raciocínio, Coleção Ensino da Ciência e da Tecnologia, IST Press, 2021.
4. List of scientific papers selected from reference sources.

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Recommended:

5. Kouziokas, G., Swarm Intelligence and Evolutionary Computation: Theory, Advances and Applications in Machine Learning and Deep Learning, CRC Press, 2023. ISBN: 978-1032162508.
6. Peckol, J.K., Introduction to Fuzzy Logic, Wiley, 2021. ISBN: 978-1119772613.
7. Poole, D.L., Mackworth, A.K., Artificial Intelligence: Foundations of Computational Agents, 3rd Edition, Cambridge University Press, 2023. ISBN: 978-1009258197.
8. Wooldridge, M., An Introduction to MultiAgent Systems, 2nd Edition, Wiley, 2009. ISBN: 978-0470519462.
9. Moroney, L., AI and Machine Learning for Coders: A Programmer's Guide to Artificial Intelligence, O'Reilly Media, 2020. ISBN: 978-1492078197.
10. Berthold, M.R., Borgelt, C., Höppner, F., Klawonn, F., Silipo, R., Guide to Intelligent Data Science: How to Intelligently Make Use of Real Data, Second Edition, Springer, 2020. ISBN: 978-3030455767.
11. Rich, E., Knight, K., Nair, S., Artificial Intelligence, Third edition, Tata McGraw-Hill, 2010. ISBN: 978-0070678163.
12. Rocha, M., Ferreira, P.G., Análise e Exploração de Dados com R, FCA, 2017. ISBN: 978-972-722-863-8.
13. Bramer, M., Logic Programming with Prolog, Second edition, Springer, 2013. ISBN: 978-1-4471-5486-0.

5. TEACHING METHODOLOGIES (INCLUDING EVALUATION)

Teaching Methodologies:

1. Lecture.
2. Interactive lesson.
3. Problem solving.
4. Tutorial session.

Evaluation methodologies:

Continuous evaluation

1. Written test: 40% (Minimum: 6/20).
2. Practical component: 50%. Individual and presential evaluation of student performance in the development of practical works in classroom (Maximum number: 1 per week). Must be concluded by the last week of lessons.
3. Attendance and participation: 10%. Attendance and participation in classroom with the elaboration of the proposed practical works, validated in class and with report delivered the following week.
4. The “student-worker” can ask the teacher, if needed, for alternative hours for his practical component evaluation, but must accomplish the same requirements of that evaluation component.

Final exam evaluation (Normal, recourse or special exam periods)

1. Component 1 (written test): 50% (Minimum: 6/20).
2. Component 2 (practical component): 50%. The student may be excused from this component if he has obtained the practical component assessment in the continuous evaluation.

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6. COHERENCE BETWEEN TEACHING METHODOLOGIES AND OBJECTIVES

1. Lecture is consistent with the objectives due to the need to provide students with the theoretical contents and their relationship, namely the characterization of Artificial Intelligence and its applicability (Objective 1), the need for regulation, the presentation of emerging themes in the field of AI and the discussion of their impact (Objective 2), the characterization and analysis of diverse strategies for the solution to AI problems (Objective 3) and the elements and techniques of a logic programming language (Objective 4).
2. Interactive lessons are consistent with the objectives since interaction between the participants in the classroom favors the concepts and skills acquisition needed to use the diverse strategies for the solution of AI problems (Objective 3) and for the development of logic programming practice (Objective 4).
3. Problem solving is consistent with the objectives since the application of theoretical contents to solve real life practical exercises related to typical problems Artificial Intelligence (Objectives 3 and 4) helps to consolidate the acquired skills, enhancing the student know-how and expertise.
4. Tutorial sessions are consistent with the objectives since they are used to supervise and to control the independent student work, namely through the weekly development of practical assignments to solve typical Artificial Intelligence problems, considering diverse strategies for the construction of intelligent agents (Objectives 3 and 4), allowing students to see their work validated by the teacher and to clarify any existing doubts.

7. ATTENDANCE

There are no minimum requirements.

8. CONTACTS AND OFFICE HOURS

Name	E-Mail	Telephone	Office #	Office hours
Celestino Gonçalves	celestin@ipg.pt	1202	2	Tuesday: 18:30-20:30 Wednesday: 16:00-20:00

DATE

September 25, 2023.

SIGNATURES

Professor

(signature)

Area/Group Coordinator

(signature)