Course guide
270706 - PAR - Planning and Approximate Reasoning

Last modified: 16/07/2024

Unit in charge: Barcelona School of Informatics
Teaching unit: 1042 - URV - Universitat Rovira i Virgili.

Degree: MASTER'S DEGREE IN ARTIFICIAL INTELLIGENCE (Syllabus 2017). (Compulsory subject).

Academic year: 2024 **ECTS Credits:** 5.0 **Languages:** English

LECTURER

Coordinating lecturer: AÏDA VALLS MATEU

Others: Primer quadrimestre:
AÏDA VALLS MATEU - 11, 12

PRIOR SKILLS

Some experience in programming is recommended.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEA2. Capability to understand the basic operation principles of Planning and Approximate Reasoning main techniques, and to know how to use in the environment of an intelligent system or service.
CEP1. Capability to solve the analysis of information needs from different organizations, identifying the uncertainty and variability sources.
CEP8. Capability to respect the surrounding environment and design and develop sustainable intelligent systems.

Generical:
CG3. Capacity for modeling, calculation, simulation, development and implementation in technology and company engineering centers, particularly in research, development and innovation in all areas related to Artificial Intelligence.

Transversal:
CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

CT6. REASONING: Capability to evaluate and analyze on a reasoned and critical way about situations, projects, proposals, reports and scientific-technical surveys. Capability to argue the reasons that explain or justify such situations, proposals, etc..

TEACHING METHODOLOGY

Oral exposition fo the teacher
Practical exercises with software tools.

LEARNING OBJECTIVES OF THE SUBJECT

1.Know the fundamental basis of Approximate Reasoning and Planning methods
2.Support the implementation with the use of programming languages user manuals.
3.Identify the possibilities and limitations of Artificial Intelligence
4.Apply the model of search space to decompose a problem.
5.Be able to discuss the results obtained on the basis of the theoretical models studied.
6.Formalize a problem in terms of fuzzy logic and apply reasoning methods on this uncertainty model.

STUDY LOAD

Type	Hours	Percentage
Hours small group	8,0	6.40
Self study	80,0	64.00
Hours large group	16,0	12.80
Hours medium group	16,0	12.80
Guided activities	5,0	4.00

Total learning time: 125 h

CONTENTS

Approximate reasoning

Description:
1.1 Probabilistic models
1.2 Fuzzy Logic and Fuzzy expert systems
1.3 Models based on the Theory of Evidence

Planning techniques

Description:
2.1 PDDL language
2.2 STRIPS
2.3 Linear planners
2.4 Graphplan
2.5 HTN
2.6 MDP
2.7 Reinforcement Learning

ACTIVITIES

Exam with questions and exercises. Exam focused mainly on Approximate Reasoning.

Specific objectives:
1, 3, 5, 6

Related competencies :
CEP8. Capability to respect the surrounding environment and design and develop sustainable intelligent systems.
CEP1. Capability to solve the analysis of information needs from different organizations, identifying the uncertainty and variability sources.
CEA2. Capability to understand the basic operation principles of Planning and Approximate Reasoning main techniques, and to know how to use in the environment of an intelligent system or service.
CG3. Capacity for modeling, calculation, simulation, development and implementation in technology and company engineering centers, particularly in research, development and innovation in all areas related to Artificial Intelligence.
CT6. REASONING: Capability to evaluate and analyze on a reasoned and critical way about situations, projects, proposals, reports and scientific-technical surveys. Capability to argue the reasons that explain or justify such situations, proposals, etc..

Full-or-part-time: 4h
Self study: 2h
Guided activities: 2h

Exercise about design and development of a fuzzy expert system, using specific software tools.

Specific objectives:
2, 4, 5, 6

Related competencies :
CEP1. Capability to solve the analysis of information needs from different organizations, identifying the uncertainty and variability sources.
CEA2. Capability to understand the basic operation principles of Planning and Approximate Reasoning main techniques, and to know how to use in the environment of an intelligent system or service.
CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

Full-or-part-time: 20h
Self study: 20h

Practical exercise to solve a case study using a planner.

Specific objectives:
2, 4, 5

Related competencies :
CEP1. Capability to solve the analysis of information needs from different organizations, identifying the uncertainty and variability sources.
CEA2. Capability to understand the basic operation principles of Planning and Approximate Reasoning main techniques, and to know how to use in the environment of an intelligent system or service.
CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

Full-or-part-time: 22h
Self study: 22h

Lectures and lab practise about Approximate Reasoning

Description:
Weakly, 2 hours theoretical lecture and1 h practise in laboratories.

Full-or-part-time: 37h
Self study: 17h
Theory classes: 13h
Laboratory classes: 7h

Lectures and exercises about Planning.

Description:
Weakly, 2 hours theoretical lecture and1 h practise in laboratories.

Full-or-part-time: 38h
Self study: 17h
Theory classes: 13h
Laboratory classes: 8h

Exam with questions and exercises about Planning.

Specific objectives:
1, 3, 4, 5

Related competencies :
CEP8. Capability to respect the surrounding environment and design and develop sustainable intelligent systems.
CEP1. Capability to solve the analysis of information needs from different organizations, identifying the uncertainty and variability sources.
CEA2. Capability to understand the basic operation principles of Planning and Approximate Reasoning main techniques, and to know how to use in the environment of an intelligent system or service.
CG3. Capacity for modeling, calculation, simulation, development and implementation in technology and company engineering centers, particularly in research, development and innovation in all areas related to Artificial Intelligence.
CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

CT6. REASONING: Capability to evaluate and analyze on a reasoned and critical way about situations, projects, proposals, reports and scientific-technical surveys. Capability to argue the reasons that explain or justify such situations, proposals, etc..

Full-or-part-time: 4h
Self study: 2h
Guided activities: 2h

GRADING SYSTEM

The student must do 2 exams, 30% each.
The student must solve several practical exercises, 40%

BIBLIOGRAPHY

Basic:
- Russell, S.J.; Norvig, P. Artificial intelligence: a modern approach. 4th ed., global ed. Harlow: Pearson Education Limited, 2022. ISBN 9781292401133.
- Ghallab, M.; Nau, D.S.; Traverso, P. Automated planning: theory and practice. Elsevier/Morgan Kaufmann, 2004. ISBN 1558608567.
- Klir, G.J.; Yuan, B. Fuzzy sets and fuzzy logic: theory and aplications. Prentice Hall, 1995. ISBN 0131011715.
- Ross, T.J. Fuzzy logic with engineering applications. 4th ed. Chichester: John Wiley & Sons, 2017. ISBN 9781119235866.
- Ghallab, M., Nau, D.; Traverso, P. Automated planning and acting [on line]. New York, NY: Cambridge University Press, 2016 [Consultation: 07/05/2025]. Available on: https://www-cambridge-org.recursos.biblioteca.upc.edu/core/books/automated-planning-and-acting/E6DE5715A2190651352DFB0869916BC3. ISBN 9781316718759.
- Haslum, P.; Lipovetzky, N.; Magazzeni, D.; Muise, C.; Brachman, R.; Rossi, F.; Stone, P. An introduction to the planning domain definition language [on line]. [New York]: Morgan & Claypool, 2019 [Consultation: 03/03/2025]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=5746725. ISBN 9781627057370.

RESOURCES

Hyperlink:
- http://campusvirtual.urv.cat