Università degli Studi di L'Aquila - Dipartimento di Ingegneria e Scienze dell'Informazione e Matematica

Course catalogue

Page compiled on 18/09/2020

Programme of Module "Intelligent Autonomous Agents"

- Code: DT0172
- Type of course unit: Elective (Bachelor Degree in Computer Science curriculum General), Elective (Master Degree in Computer Science curriculum GSEEM), Compulsory (Master Degree in Computer Science curriculum General), Compulsory (Master Degree in Computer Science curriculum NEDAS), Elective (Master Degree in Computer Science curriculum SEAS), Compulsory (Master Degree in Computer Science curriculum UBIDIS)
- Level of course unit: Undergraduate Degrees, Postgraduate Degrees
- Semester: 2

Number of ects credits: (Master Degree in Computer Science) 6 (workload 150 hours)

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1	**Course objectives**	The huge pervasive success of Artificial Intelligence (AI) is evident to everybody. Autonomous Intelligent Agents, that can operate either on behalf of a user or according to their own objectives, are crucial in the construction of AI systems. Agents interact autonomously with users or among themselves, are able to perform complex reasoning tasks and to exploit and control machine learning activities. Agents drive cars, control medical appliances and procedures, and constitute the "brain" of intelligent Robots. All in all, the life of everybody will soon very widely depend upon Intelligent Agents. So, this is a crucial technology for every kind of perspective innovative applications, that a Computer Scientist should know and should be able to develop. Following this Course, a student will learn the main topics related to Intelligent Autonomous Software, Robotic Agents and Multi-Agent Systems (MAS). The student will be able to understand Agent-related: Architectures; Formalisms; Languages; Implementations; Knowledge Representation Issues. The student will also learn (hands-on) how to design and implement Intelligent Agents and MAS based on Computational Logic, and will experiment in practice how to build significant applications. The necessary software platforms will be distributed for free to all students attending the Course. Group-work is strongly encouraged in the practical part of the Course.
2	**Course content and learning outcomes (dublin descriptors)**	Topics of the module include: • Introduction: the agent metaphor, agent-oriented paradigm, agent architectures. • Agent Communications: survey on Speech-Act Theory, ACL Languages, the Commitment model. • The logic agent-oriented languages DALI and AgentSpeak • Knowledge representation and resoning in agent systems: Actions and planning - Assumption-based reasoning - Using uncertain knowledge • Coordination models in multi-agent systems • Concrete Architectures and Applications On successful completion of this module, the student should : • Upon successful completion of the course, the student should: • know and understand the basic concepts about the design of agent-oriented software, in particular in the Artificial Intelligence realm (Intelligent agents); • understand what is an agent, an agent architecture and a multi-agent system (MAS); • understand the main agent-related formalisms and languages; • understand the main agent-related knowledge representation and reasoning issue; • understand the key issues of agent-oriented software design; • learn the main agent-related computational-logic-based programming languages; • be able to apply the main agent-related computational-logic-based programming languages to the definition of agents and MAS by using suitable knowledge representation and reasoning techniques; • be able to identify fundamental concepts and techniques of agent-oriented software design concerning both single agents and MAS; • be able to recognize agent-oriented software and define key relational terminology

		and principles; • be able to use the main agent-oriented language even in significant applications involving agents and MAS; • be able to discuss agent-oriented architectures and design process; • demonstrate capacity to identify problems where agent-oriented software design is profitably applicable; • be able to survey and discuss important agent-related concepts, including issues concerning MAS and their application.
3	**Course prerequisites**	This Course is based on Computational Logic. It is required to have basic notions of first-order logic and prolog, and it is necessary to possess notions of basic Artificial Intelligence, that can be obtained either by attending the Artificial Intelligent I module or an equivalent Course, or by autonomous study.
4	**Teaching methodsand language**	Lectures and interactive exercise sessions. Periodical discussion with the teacher in relation to the development of a project. **Language**: English **Reference textbooks** • Stuart Russell and Peter Norvig , ***Artificial Intelligence: A Modern Approach, 3rd ed.***. McGraw Hill. (vol. 2) • D. Poole, A. Mackworth and R. Goebel, ***Computational Intelligence: a Logic Approach***. Oxford Univ. Press.. *http:// www.cs.ubc.ca/spider/poole/ci.html* • Robert A. Kowalski, ***How to Be Artificial Intelligent, the Logical Way***. *http://www.doc.ic.ac.uk/~rak/papers/newbook.pdf* • S. Costantini, ***Lecture Notes and Supplementary Material***.
5	**Assessment methods**	Pre-Assessment There is no formal pre-assessment, but Course pre-requisites are clearly stated on the Module website. Fulfilment of such pre-requisites is verified by formative assessment. Additional lectures or short seminars or individual homework are provided by the teacher in case significant problems are detected. Formative Assessment The formative assessment is performed via interactive interaction beteween teacher and students during lectures. Students are aware since the beginning of the Course that they will be involved (in turns) in: - Questioning and discussion, by means of open oral questions to the class or to single students. - Exit Slips: students are assigned written questions or exercises to be answered in 10 minutes, and a student is then selected for oral presentation of her/his solution to the class. - Short seminars: students may be assigned personalized homework, that they will have to illustrate to the class by means of 20 minutes' short seminars. Summative Assessment Written test followed by an optional oral exam + Project An optional mid-term written test is also be provided, which is meant to cover the first part of the course, in order to help the students to split the workload. The written test is aimed at: (1) verification of theoretical competences, and in particular of knowledge and comprehension of Course contents (2) verification of skills in understanding and solving significant exercises, and in explaining the proposed solutions. This in order to verify the ability of application of techniques learnt during the Course, of analysis of problems and synthesis of suitable solutions, and of evaluation of alternative solutions. Criteria of evaluation will be: the level of knowledge and practical ability; the property of use of the technical/mathematical language; the clarity and completeness of explanations. The oral exam will occur within one week of the written test and will typically cover the areas of the written answers that need clarification plus, possibly, additional subjects proposed by the teacher. The oral test can be required: (i) by the student, to improve final marks; (ii) by the teacher, in presence of significant mistakes/misunderstandings in the written test. Assessment breakdown: 100% mid-term plus end-of-semester summative assessment. The written test (2 hours) consists in: (a) Six multiple-choice questions, to cover point (1), 30% of total marks; (b) Two short essays (max 600 words) to cover point (1), 30% of total marks; (c) Two exercises, to cover point (2), 30% of total marks. All parts can result in negative marks if the answer is omitted or seriously flawed. The oral test (max 1 hour) consists of one question for each serious mistake in the written test (the answer compensates the negative marks obtained therein) and one question for each 3 extra points that the student intends to add to the written test marks. The Project is an hands-on implementation task to be performed in about one week in groups from 1 to three students (groupwork is strongly encouraged). The task requires the implementation of a MAS (Multi-Agent System) in one of the

		existing logic languages. The mark will be attributed in a range 1-5. The final marks of the Artificial Intelligence 12 CFU Module are obtained as the average among the marks of the Artificial Intelligence and Intelligent Autonomous Agents 6 CFU Modules, plus the Project mark.