Master of Science in Computer Science
a.a. 2017-18

year	code	course name	ECTS	type	semester	educational activity type	ECTS	hours	faculty
2	F1801Q106	Artificial Intelligence	6	elective	First semester	lecture	5	40	Bandini Stefania
						practice exercise	1	10	Palmonari Matteo

Professors' CV: http://www.unimib.it/go/176181440

Contents The course will introduce to two main topics of modern Artificial Intelligence (AI) that are particularly relevant in contemporary technological scenarios: symbolic knowledge computation and collective intelligence. For both the topics the main focus will be on innovative conceptualizations, methods and computational models of AI, in order to illustrate present and future technological scenarios useful in the design of solutions of complex problems and of new generations of advanced computer-based systems.
The first part of the course will deal with the agent-based AI Paradigm, Multi-agent systems (MAS) and collective AI; in this part of the course, students will be introduced to models whose intelligent overall behavior is resulting from the action and interaction of agents that are not necessarily characterized by a sophisticated individual behavior. Exemplary applications of this paradigm will be discussed in relation to the simulation of complex systems, self-organization and ambient intelligence. During the classes the presentation and critical discussion of advanced AI based real projects and paradigmatic case studies will be provided, in order to introduce also the multidisciplinary scenario of the faced problems.
The second part of the course will focus on intelligence considered as capability to integrate information and infer new knowledge by leveraging semantic engines; models and techniques to represent and process knowledge at large scale will be discussed, with a special attention to the Web as a global knowledge platform and to technologies that have become recently part of innovative ICT technology stacks in use in several cutting-edge application domains (e.g., IBM Watson, Google Knowledge Graph, BBC and New York Time web portals), also through the development of machine learning techniques.

Textbooks :
S.J. Russell, P. Norvig, "Intelligenza Artificiale: un approccio moderno", 2a edizione, Pearson - Prentice Hall, 2005 (volume 1)
J. Ferber, Multi-agent systems: An introduction to distributed artificial intelligence, Addison-Wesley Professional, 1999.
Emanuele Della Valle, Irene Celino, Dario Cerizza. Semantic Web. Dai fondamenti alla realizzazione di un'applicazione. 1° ed. (Person, Addison Wesley, 2009), pp. 273.

Recommended reading:
Libri consigliati:
Tom Heath, Christian Bizer. Linked Data: Evolving the Web into a Global Data Space. 1° ed. (Morgan & Claypool, 2011), pp. 136.
C. Cornoldi, L'intelligenza, Il Mulino Ed., 2009.
Cesare Cornoldi. Formicai, imperi, cervelli: introduzione alla scienza della Complessità (Il Mulino, 2007), pp. 235.

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Course objectives The main aim of the course is to give the student the ability to manage knowledge and basic techniques to face the comprehension, use and creation of Artificial Intelligence based systems joint to abilities to analyze classes of problems to be managed with methods and techniques characterizing this discipline.
The application-oriented and experimental nature of Artificial Intelligence invites the student to face both the usability of modern solutions and innovative directions of the research in the field. The course will provide basic conceptual, methodological and computational instruments of Artificial Intelligence. The course is addressed to students looking for research and working environments dealing with challenging and multidisciplinary problems.

Prerequisiti Basic knowledge of logics and mathematics.

Teaching methods - The course will be organized into lectures, classroom exercises, and use case discussion. Materials will be provided by teachers and published on the Moodle eLearning platform.

Learning assessments - Students will be assigned a research project and will be evaluated on a discussion about their results. The project can consists in: the design and/or development of a solution based on techniques/models explained during the course to a specific problem defined together with the teachers; a critical essay on a topic of interest and related to the topics addressed in the course; the design and/or development of experiments to evaluate the effectiveness of models/techniques explained in the course or related to course topics. The students can choose between individual and group project assignments.

Extended Syllabus

1. Historical and epistemological introduction to Artificial Intelligence
2. Conceptual, methodological and computational characteristics of IA: reaction, cognition and decision.
3. The two souls od the current trend of AI: Data Science, Cyber-physical Systems, “and back”.
4. Models for knowledge representation and automated learning: interpretation, reasoning, prevision and control.
5. Autonomous agents: definition, classification, behavior, agent-bases models with simple reflexes, with memory, goal-based and utility-based.
6. Models and interaction mechanisms in multi-agent systems (MAS).
7. Collective Artificial Intelligence, Network Science e Complex Systems; modeling, simulation, and analysis of self-organizing behavior.
8. Introduction to Artificial Intelligence as ability to integrate information sources and infer new knowledge through data and semantic engines. Semantics and information representation models on the Web (semantics-based engines and query mechanisms for databases and research engines, folksonomies, ontologies and metadata).
9. Architectures for the integration of information ("One size does not fit all": composition of semantic engines for complex domains; overview on innovative technologies for information and knowledge extraction; roles of machine learning for semantic technologies).
10. Models and techniques of semantic matching for the integration of heterogeneous information sources (link discovery in the semantic Web; ontology matching on schemes and instances).