COURSE DETAILS

"ELEMENTI DI INTELLIGENZA ARTIFICIALE"

SSD ING-INF/05

DEGREE PROGRAMME: BACHELOR DEGREE IN COMPUTER ENGINEERING

ACADEMIC YEAR: 2023-2024

GENERAL INFORMATION – TEACHER REFERENCES

TEACHER:
PHONE:
EMAIL:

SEE THE STUDY COURSE WEBSITE

GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE (IF APPLICABLE): N.A.
MODULE (IF APPLICABLE): N.A.
CHANNEL (IF APPLICABLE): N.A.
YEAR OF THE DEGREE PROGRAMME (I, II, III): III
SEMESTER (I, II): II
CFU: 6

REQUIRED PRELIMINARY COURSES (IF MENTIONED IN THE COURSE STRUCTURE "REGOLAMENTO")

Programmazione.

PREREQUISITES (IF APPLICABLE)

None.

LEARNING GOALS

The course aims to provide the basic methodologies and techniques to understand and address the problems of Artificial Intelligence.
Students will acquire the theoretical foundations related to intelligent agents, their interaction with the surrounding environment; problem solving, research strategies and research with opponents. You will learn about game theory methods and techniques, great, imperfect real-time decisions, games that include random elements, and the state of the art of gaming programs.
Students will acquire the fundamental concepts of first-order logic, inference and deduction; master the methods and techniques of logical programming and language of the ProLog logical paradigm; uncertain knowledge and reasoning to establish how to act under uncertainty. They will be introduced to the concepts behind probabilistic reasoning and machine learning.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding
The course aims to provide students with the necessary knowledge to understand and analyze problem solutions based on Artificial Intelligence techniques.
Tools will be provided to master both theory and methodologies for solving problems and solution-finding strategies, as well as elements of logical programming. The knowledge that underpins probabilistic reasoning and machine learning will be introduced.

Applying knowledge and understanding
The course is aimed at transmitting the methodological and operational skills and tools necessary to apply the knowledge of Artificial Intelligence techniques, as well as to promote the ability to use the methodological tools acquired for the realization of solutions based on Artificial Intelligence techniques. The proposed techniques and models will be applied during the course to specialized domains.

COURSE CONTENT/SYLLABUS

Part I: Introduction to Artificial Intelligence

Intelligent agents: Agents and environments, the concept of rationality, the nature of environments, the structure of agents

Part II: Troubleshooting

Solve problems with search: Problem solver agents, Example problems, Search for solutions, Uninformed search strategies, Broad search, Uniform cost search, In-depth search, Depth search Depth research Iterative deep search, Bidirectional search, Comparison of uninformed search strategies, Avoid repetition in states, Search with partial information.
Informed search: Informed or heuristic search strategies, Best-first greedy or "greedy" search, A* search, Heuristic search with limited memory, Local search algorithms and optimization problems, Hill-climbing search, Simulated annealing, Local-beam search, Genetic algorithms.
Search with opponents: Games, Best decisions in games, The minimax algorithm, Alpha-beta pruning, Real-time imperfect decisions, Games that include random elements, The state of the art of game programs.

Part III: Knowledge and reasoning

Logical agents: Knowledge-based agents, The world of wumpus, Logic, Propositional calculus, Reasoning schemes in propositional calculus, Forward and backward concatenation.
First-order logic: First-order logic syntax and semantics, Using first-order logic.
Inference in first-order logic: Propositional inference and first-order inference, Unification
Forward Concatenation, Backward Concatenation, Logic Programming, Prolog, Prolog Lists, Extralogical Operators: not, cut, fail

Part IV: Uncertain knowledge and reasoning

Uncertainty: Acting under uncertainty, Basic notation of probability theory, Inference based on complete joint distributions, Independence, Bayes' rule and its use.
Probabilistic reasoning: Representation of knowledge in an uncertain domain, Semantics of Bayesian networks Efficient representation of conditional distributions.

Part V: Learning

Learning from observations: Forms of learning. Inductive learning.
Neural Networks: Definition of neural network, Training and Learning, Training mode, Learning laws.
Rosenblatt's Perceptron, The Multilevel Perceptron, Kolmogorov's Theorem, Learning Vector Quantization Network (LVQ)
Self-Organizing Maps of Kohonen (SOM).

READINGS/BIBLIOGRAPHY

Recommended textbooks:
S.J.Russell, P. Norvig,"*Intelligenza artificiale. Un approccio moderno, volumi 1 (3/ed, 2010) e 2 (2/ed, 2005)*", Pearson Education Italia.

Otherteaching materials:
Material produced and provided by the Teachers

TEACHING METHODS

The course will take place with lectures (70% of the total hours) and laboratory exercises (30% of the total hours).

EXAMINATION/EVALUATION CRITERIA

a) Exam type:

Exam type	
written and oral	X
only written	
only oral	
project discussion	X
other	

In case of a written exam, questions refer to:	**Multiple choice answers**	
	Open answers	X

	Numerical exercises	

The project will be proposed at the center of the course.

b) Evaluation pattern: The exam will aim to ascertain the achievement of the training objectives provided for the course, is divided into a written test and an oral test focused on the topics of the course.