

## Informatique

### Artificial Intelligence for Telecommunications

#### IDENTIFICATION

CODE : TC-4-S2-EC-IAT  
ECTS : 2.0

#### HOURS

Lectures : 14.0 h  
Seminars : 10.0 h  
Laboratory : 8.0 h  
Project : 0.0 h  
Teacher-student  
contact : 32.0 h  
Personal work : 10.0 h  
Total : 42.0 h

#### ASSESSMENT METHOD

#### TEACHING AIDS

#### TEACHING LANGUAGE

French

#### CONTACT

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#### AIMS

This course aims to introduce students to the tools studied in Artificial Intelligence as a means to address problems encountered in telecommunication systems.

Students will acquire knowledge useful for:

- (i) the choice of the formal framework for a good representation of a problem
- (ii) the selection of the appropriate tool to solve the problem in the selected frame and according to predefined objectives
- (iii) the choice of a methodology to evaluate performance achieved in time

This EC is part of the Networks and Distributed Systems teaching unit and contributes to the following skills:

- C3: Specify, design and model algorithms and computer programs (level 3)
- C8: Operate, analyze, improve digital systems (level 2)
- Ability: Knowing how to choose a formal framework appropriate to a given problem
- Knowledge: Frameworks for classical planning including (un)weighted graphs
- Knowledge: Frameworks for combinatorial, continuous, or mixed optimization problems
- Knowledge: Frameworks for control of dynamic and uncertain systems including (partially observable) Markov decision processes, (hidden) Markov chains
- Ability: Knowing how to choose a methodology for solving a given problem
- Knowledge: Stochastic, heuristic and meta-heuristic methods including genetic algorithms, ACO, gradient descent, Monté-Carlo algorithm
- Knowledge: Tools for solving planning problems (tree search methods), constraint satisfaction, linear programming, integer, or mixed
- Knowledge: Tools for solving dynamic and uncertain problems via reinforcement learning and deep learning

In addition, it requires the mobilization of the following skills:

A6: Communicating an analysis or a scientific approach with scenarios adapted to their specialty

#### CONTENT

##### Course

- General introduction to Artificial Intelligence
- Combinatorial, continuous or mixed optimization
- Follow-up of a dynamic and uncertain system
- Control of a dynamic and uncertain system

##### TD / TP

- Heuristics, meta-heuristics, genetic algorithms, ACO, Monté-Carlo method
- Tree search, branch-and-bound,
- Dynamic programming
- Linear programming,
- Satisfaction of constraints,
- Reinforcement learning
- Deep learning
- Deep reinforcement learning

#### BIBLIOGRAPHY

#### INSA LYON

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Artificial Intelligence: A Modern Approach  
Stuart Russell, Peter Norvig,  
Réédition 2016

Renforcement Learning: An Introduction  
Andrew Barto, Richard Sutton  
Réédition 2018

Markov Decision Processes  
Martin L. Puterman  
2005

Understanding Machine Learning  
Shai Shalev-Shwartz, Shai Ben-David  
Réédition 2015

Deep Learning  
Ian Goodfellow, Yoshua Bengio  
2016

Convex Optimization  
Stephen Boyd, Lieven Vandenberghe  
Réédition 2016

#### PRE-REQUISITE

3TC-Algo  
3TC-PPC  
3TC-ELP  
4TC-PRF  
4TC-

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