Getting to know the optimization methods behind modern AI is a crucial asset.
Extracting knowledge and value from finite data in an automated way is the goal of Machine Learning. It aims at giving computers the ability to learn with data, without being explicitly programmed.
Reasoning and planning ahead. Understanding the foundations and mechanics of Reinforcement Learning, AI planning and scheduling techniques.

Prerequisites
- General knowledge on computer science, mathematics, and algorithmics.
- Good knowledge and acceptable practice of major Learning algorithms.

Highlights
- Mainstream Machine Learning algorithms
- Reinforcement Learning algorithms
- Interpretability and explainability issues
- Practical courses

Learning objectives
After completing this course, participants will be able to:
- Model a decision making problem as an optimization problem;
- Know the main categories of optimization algorithms for AI;
- Link some field problems to their formal Machine Learning counterparts;
- Decide which method is relevant to solve a sequential decision problem;
- Understand certification and qualification of systems based on AI.

Key elements
Dates: 3 February 2020 – 9 July 2020
Duration: 112 hours, 16 days
For whom: recent graduates, jobseekers and experienced employees
Location: ISAE-SUPAERO, Toulouse
Course fees: 6 500 €
Language: English

Practical information and registration
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Course Content

AIBT105 – Optimization topics for AI (28h):

- Artificial Intelligence, Machine Learning and Optimization;
- Gradient Descent Optimization;
- Overview of gradient based optimization methods;
- Convergence in Deep Learning;
- Discrete optimization: solving combinatorial problems;
- Metaheuristics: the compromise between speed and quality;
- Interactive session: Discovering genetic algorithms;
- Challenge: Aircraft conflict resolution with Genetic Algorithms;
- Concluding remarks: other stochastic methods, CMA-ES, cross-entropy;

AIBT106 – Machine learning and data analytics (28h):

- The data analytics workflow;
- General overview of Machine Learning;
- Unsupervised Learning;
- Geometrical & probabilistic approaches in Supervised Learning;
- Bio-inspired ML, Neural Networks and Deep Learning;
- Feature engineering and data preprocessing;

AIBT108 – Sequential Decision Making in AI (28h):

- Reinforcement Learning (RL);
- Scheduling and different optimization methods and modeling frameworks;
- Shortest path algorithms, heuristic search, motion planning;
- Decentralized decision making;
- Multi-agent concepts and game theory. Collaborative and adversarial decision making.

AIBT110 – AI certification, robustness and dependability (28h):

- Learning algorithms and the questions of robustness, certificability;
- The evolution of norms, especially in the aerospace and automotive industries;
- The human/machine couple in the decision process.