

# AIBT105 – Optimization topics for AI

From the Advanced Master AIBT

(Artificial Intelligence and Business Transformation)



## Highlights

- Foundations of AI algorithms
- Generic approaches and improvements
- Practical courses

Artificial Intelligence almost always implies an underlying optimization process. Getting to know the optimization methods behind modern AI is therefore a crucial asset.

How to find the most intelligent imaging plan for a satellite constellation, or the best dispatching of aircraft around an airport? How to minimize the number of calls to a CSM solver when looking for the perfect aircraft wing design? Why is convergence in Deep Learning such a critical issue?

## Prerequisites

- General knowledge on computer science, mathematics, and algorithmics.
- The Python programming language will be used throughout the course, but only a prior basic experience in programming is required.

## Key elements

Dates: 3 - 6 February 2020

Duration: 28 hours, 4 days

For whom:

**recent graduates, jobseekers and experienced employees**

Location:

**ISAE-SUPAERO, Toulouse**

Course fees: 2 300 €

Language: **English**

## 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;
- Choose an appropriate optimization algorithm for a specific problem.

## Practical information and registration

Natalia Perthuis - 05 61 33 80 47 – [info.exed@isae-supaeero.fr](mailto:info.exed@isae-supaeero.fr)

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## Course Content

- Introduction;  
Artificial Intelligence, Machine Learning and Optimization: what? why? how?
- Gradient Descent Optimization: walking downhill;  
Interactive introduction: linear regression, linear separation;  
Overview of gradient based optimization methods;  
Hands-on: Program your own gradient descent;  
Concluding remarks: Why is convergence in Deep Learning such a critical issue?
- Discrete optimization: solving combinatorial problems;  
Overview of discrete satisfaction and optimization methods;  
Interactive session: Branch and Bound applied to MILP and CSP;  
Hands-on: Modelling exercises;  
Challenge: the Orbit Transition Problem;  
Concluding remarks: Scaling issues, opening on metaheuristics;
- Metaheuristics: the compromise between speed and quality;  
Overview: Single-state methods and Population methods;  
Hands-on: Program your own simulated annealing;  
Interactive session: Discovering genetic algorithms;  
Challenge: Aircraft conflict resolution with Genetic Algorithms;  
Concluding remarks: other stochastic methods, CMA-ES, cross-entropy.