Operations Research II : Optimization For Data Science

Description

Most data science algorithms are based on optimization. This course introduces the concept of optimization problems and the diverse methods to solve them. The idea is to lay the foundations of the gradient descent method which is considered as the Hello World of optimization and whose variants are implemented in a lot of machine learning models such as artificial neural networks.

Learning Objectives and Outcomes

- Understand what is an optimization problem
- Understand what convexity brings to optimization problems resolution
- Know how to find the gradient of a function
- Understand how to implement Newton's method
- Be able to use Lagrange multipliers to solve an optimization problem
- Know how to efficiently use the second derivative test

Course Schedule and Contents

Session #1	▪ Optimization: definition, connection with machine learning and data science ▪ Definition of an optimization problem ▪ Definition of a convex problem ▪ Importance of convexity in optimization problems
Session #2	▪ Derivatives and partial derivatives ▪ Vector fields ▪ Gradient
Session #3	▪ Newton's method ▪ Lagrangian function
Session #4	▪ Critical points, saddle points ▪ Second derivative test ▪ Python libraries for optimization ▪ Assignment or exam

Grading

Assignment/exam: 100%

Policies

- Any work submitted must be your own.
- I expect everyone to contribute equally to group assignments
- Attendance in every class is expected and class participation and discussion are strongly encouraged.
- Late work will not be accepted unless prior arrangements have been made directly with me.
- Cases will be decided on an individual basis.

Good Luck!