Optimal transport

ECTS : 4

Volume horaire : 18

Description du contenu de l'enseignement :

Optimal transport (OT) is a fundamental mathematical theory at the interface between optimization, partial differential equations and probability. It has recently emerged as an important tool to tackle a surprisingly large range of problems in data sciences, such as shape registration in medical imaging, structured prediction problems in supervised learning and training deep generative networks.
This course will interleave the description of the mathematical theory with the recent developments of scalable numerical solvers. This will highlight the importance of recent advances in regularized approaches for OT which allow one to tackle high dimensional learning problems.

The course will feature numerical sessions using Python.

- Motivations, basics of probabilistic modeling and matching problems.
- Monge problem, 1D case, Gaussian distributions.
- Kantorovitch formulation, linear programming, metric properties.
- Shrödinger problem, Sinkhorn algorithm.
- Duality and c-transforms, Brenier's theory, W1, generative modeling.
- Semi-discrete OT, quantization, Sinkhorn dual and divergences