Variational problems and optimal transport

ECTS : 6

Volume horaire : 24

Description du contenu de l'enseignement :

Chapter 1: Convexity in the calculus of variations
-separation theorems, Legendre transforms, subdifferentiability,
-convex duality by a general perturbation argument, special cases (Fenchel-Rockafellar, linear programming, zero sum games, Lagrangian duality)
-calculus of variations: the role of convexity, relaxation, Euler-Lagrange equations

Chapter 2: The optimal transport problem of Monge and Kantorovich
-The forrmulations of Monge and Kantorovich, examples and special cases (dimension one, the assignment problem, Birkhoff theorem), Kantorovich as a relaxation of Monge
-Kantorovich duality
-Twisted costs, existence of Monge solutions, Brenier's theorem, Monge-Ampère equation, OT proof of the isoperimetric inequality
-the distance cost case and its connection with minimal flows

Chapter 3: Dynamic optimal transport, Wasserstein spaces, gradient flows
-Wasserstein spaces
-Benamou-Brenier formula and geodesics, displacement convexity
-gradient flows, a starter: the Fokker-Planck equation, general theory for lambda-convex functionals

Chapter 4: Computational OT and applications
-Entropic OT, Sinkhorn algorithm and its convergence
-Matching problems, barycenters,
-Wasserstein distances as a loss, Wasserstein GANs

Compétence à acquérir :

Mastering of variational and optimal transport methods used in economy.

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