CREST - GENES
Cours doctoraux 2024 – 2025

X-OT: ON VARIANTS OF OPTIMAL TRANSPORT PROBLEM AND UNDERSTANDING MODEL ROBUSTNESS

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SCHEDULE	Wednesday	6 May 13 May	9:00 – 12:30	Room : 2045 (6/5) Room : 2043 (13/05)
	Thursday	7 May 14 May	9:00 – 12:30	Room : 2045

Topics

This course offers a whistle stop tour of several variants of the optimal transport problem that were introduced recently, often motivated by applications on stochastic analysis and mathematical finance. I plan to give an overview of the field with enough details for the participants to come out with a mental map of this fascinating research landscape and pointers for further individual studies. Accordingly, for each of our X-OT problems, I will provide an introduction, some fundamental theoretical results alongside with motivating applications and/or numerical methods allowing to implement and use these techniques.

Particular topics discussed will include (most of the following):

- the classical Optimal Transport (OT) problem and the resulting distances on the space of probability measures, and their applications in distributionally robust optimization;
- the Martingale Optimal Transport (MOT) and its relation to robust pricing and hedging problems;
- Adapted/Causal Optimal Transport (AOT) and its relation to continuity of stochastic control problems w.r.t. the law of the process;
- Entropic Optimal Transport (EOT) problem and its applications to numerical methods, including the Sinkhorn algorithm;
- Weak Optimal Transport (WOT) and its relation to stretched Brownian motions;
- Semimartingale Optimal Transport (SOT) and its applications to model calibration;
- Distributionally Robust Optimisation (DRO) with Wasserstein distances and non-paramteric sensitivities;

Format, pre-requisites and audience

Course is addressed to PhD students and early career researchers. Solid background in measure theoretic probability theory will be assumed, but it will not be necessary to understand most of the course. No prior knowledge of OT problems is required, but these topics will be covered at speed so background reading could be beneficial.

Evaluation

To be confirmed, will depend on numbers attending. Could indlude class participation and mini projects.

References

Introductory chapters in any of the standards books would offer a good preparatory reading, including:

- C. Villani, Optimal Transport: Old and New, Springer.
- C. Villani, Topics in Optimal Transportation, AMS.
- G. Peyre and M. Cuturi. Computational optimal transport: With applications to data science. Foundations and Trends in Machine Learning, 11(5-6):355–607, 2019.
- F. Santambrogio. Optimal Transport for Applied Mathematicians. Springer

A list of research papers will be provided during the course.