Hugo Lavenant

Assistant professor at Bocconi University

GENERAL INFORMATION

Nationality	French
Languages	French (native speaker), English (fluent), Italian (fluent), Spanish (beginner)
Address	Department of Decision Sciences Bocconi University Milan, Italy
Email	`hugo.lavenant@unibocconi.it`
Webpage	`https://hugolav.github.io`
GitHub	`https://github.com/HugoLav`

POSITIONS

Assistant professor 2020–present

Bocconi University, Milan, Italy

Affiliated to the Bocconi Institute for Data Science and Analytics (BIDSA).

Postdoctoral fellow of the *Pacific Institute of Mathematical Sciences* 2019–2020

University of British Columbia, Vancouver, BC, Canada

Using optimal transport to analyze biological data under the supervision of Young-Heon Kim, Brendan Pass, Geoffrey Schiebinger and Dave Schneider.

EDUCATION

PhD. in mathematics 2016–2019

Université Paris-Sud, Orsay, France

PhD entitled *Optimal curves and mappings valued in the Wasserstein space* under the supervision of Filippo Santambrogio.

Defended on May 24th, 2019 (committee: Y. Brenier, P. Cardaliaguet, Q. Mérigot, F. Santambrogio, K.-T. Sturm, D. Tonon; referees: P. Cardaliaguet, G. Savaré)

MSc. and BSc. 2012–2016

École Normale Supérieure, Paris, France

Studies in: mathematics, physics, history and philosophy of science.

- (2015–2016) *Master 2* LOPHISS-SPH in history and philosophy of science, *summa cum laude*. Master thesis entitled *L'introduction du calcul des probabilités et de la statistique en France : l'exemple du* Calcul des probabilités à la portée de tous *de Fréchet et Halbwachs* under the supervision of Laurent Mazliak.
- (2014–2015) *Master 2* in mathematics on PDEs and scientific computing, *summa cum laude*. Master thesis entitled *Espaces de Sobolev par rapport à des mesures quelconques et application au transport optimal* under the supervision of Filippo Santambrogio.

RESEARCH INTERESTS

Broadly: optimal transport (and its entropic regularization), convex analysis and convex optimization, calculus of variations, and Bayesian statistics. More specifically:

- study of optimal curves and mappings in the Wasserstein space;
- numerical methods for dynamical formulations of optimal transport;
- use of optimal transport distances in Bayesian nonparametrics.

LONG RESEARCH VISITS

Visiting Student February–April 2018

MIT, Cambridge, USA

Working on the numerical simulation of geodesics and harmonic mappings valued in the Wasserstein space in the *Geometric Data Processing Group*, led by Justin Solomon.

Visiting Student Researcher February–July 2014

CalTech, Pasadena, USA

Study of the numerical instabilities due to the enforcement of boundary conditions in hyperbolic systems solvers, under the supervision of Oscar Bruno and Edwin Jimenez.

Research intern June–July 2013

CEA, Saclay, France

Experimental study of magnetization of small magnetic samples, under the supervision of Grégoire de Loubens.

PUBLICATIONS

PREPRINTS AND SUBMITTED ARTICLES

[1] Hugo Lavenant. Lifting functionals defined on maps to measure-valued maps via optimal transport (2023).

[2] Marta Catalano and Hugo Lavenant. Merging rate of opinions via optimal transport on random measures. *Arxiv Preprint Arxiv:2305.06116* (2023).

[3] Marta Catalano, Hugo Lavenant, Antonio Lijoi and Igor Prünster. A Wasserstein index of dependence for random measures. *Arxiv Preprint Arxiv:2109.06646* (2021). *Revised version submitted to* Journal of the American Statistical Association.

[4] Hugo Lavenant, Léonard Monsaingeon, Luca Tamanini and Dmitry Vorotnikov. Convex functions defined on metric spaces are pulled back to subharmonic ones by harmonic maps. *Arxiv Preprint Arxiv:2107.09589* (2021).

PEER REVIEWED JOURNALS

[5] Hugo Lavenant*, Stephen Zhang*, Young-Heon Kim and Geoffrey Schiebinger. Towards a mathematical theory of trajectory inference (2021). Accepted for publication in *Annals of Applied Probability*.

[6] Aymeric Baradat and Hugo Lavenant. Regularized unbalanced optimal transport as entropy minimization with respect to branching Brownian motion (2021). Accepted for publication in *Astérisque*.

[7] Hugo Lavenant and Filippo Santambrogio. The flow map of the Fokker–Planck equation does not provide optimal transport. *Applied Mathematics Letters* vol. 133 (2022).

[8] Nassif Ghoussoub, Young-Heon Kim, Hugo Lavenant and Aaron Palmer. Hidden convexity in a problem of nonlinear elasticity. *SIAM Journal on Mathematical Analysis* 53.1 (2021): p. 1070-1087.

[9] Hugo Lavenant. Unconditional convergence for discretizations of dynamical optimal transport. *Mathematics of Computation* 90.328 (2021): p. 739-786

[10] Daryl Deford, Hugo Lavenant, Zachary Schutzman and Justin Solomon. Total Variation Isoperimetric Profiles. *SIAM Journal on Applied Algebra and Geometry* 3.4 (2019): p. 585-613.

[11] Hugo Lavenant. Harmonic mappings valued in the Wasserstein space. *Journal of Functional Analysis* 277.3 (2019): p. 688-785.

[12] Hugo Lavenant and Filippo Santambrogio. New estimates on the pressure in density-constrained Mean Field Games. *Journal of the London Mathematical Society*, 100.2 (2019): p. 644–667.

[13] Hugo Lavenant and Filippo Santambrogio. Optimal density evolution with congestion: L^∞ bounds via flow interchange techniques and applications to variational Mean Field Games. *Communications in Partial Differential Equations* 43.12 (2018): p. 1761–1802.

[14] Hugo Lavenant. Time-convexity of the entropy in the multiphasic formulation of the incompressible Euler equation. *Calculus of Variations and Partial Differential Equations* 56.6 (2017): p. 170.

PEER REVIEWED PROCEEDINGS

[15] Hugo Lavenant, Sebastian Claici, Edward Chien and Justin Solomon. Dynamical optimal transport on discrete surfaces. *ACM Trans. Graph.* 37.6 (2018): Article 250. *Accepted for presentation in SIGGRAPH Asia 2018*.

LECTURE NOTES

[16] Hugo Lavenant and Bertrand Maury. Opinion propagation on social networks: a mathematical standpoint. *ESAIM: Proceedings and Surveys* 67 (2020): 285-335.

BEFORE THE PHD

[17] Hugo Lavenant, Vladimir Naletov, Olivier Klein, Grégoire De Loubens, Laura Casado, and José María De Teresa. Mechanical magnetometry of Cobalt nanospheres deposited by focused electron beam at the tip of ultra-soft cantilevers. *Nanofabrication*, 1.1 (2014).

SCIENTIFIC PRESENTATIONS

Presentation in a peer reviewed conference
SIGGRAPH Asia in Tokyo (12/2018).

Invitations in workshops

Emerging topics in applications of optimal transport in Zurich (06/2023),
Workshop on Optimal Transport, Mean-Field Models, and Machine Learning in Munich (04/2023),
Interpolation of measures in Paris (01/2023),
When AI meets Biology: a workshop online (10/2021),
Groupe de Travail en Calcul des Variations in Paris (05/2019),
ANR MAGA meeting in Nancy (12/2018).

Contributed talks in conferences and workshops

2023 LMS Invited Lecture Series by Filippo Santambrogio in Durham (07/2023),
Approximation Methods in Bayesian Analysis in Marseille (06/2023),
Optimal transport theory and applications to physics in Les Houches (03/2023),
13th Conference on Bayesian Nonparametrics in Puerto Varas (10/2022),
ISBA in Montreal (06/2022),
Curves and Surfaces in Arcachon (06/2022),
Stochastic Games and Martingale Optimal Transport in Milan (05/2022),
XXXI Convegno Nazionale di calcolo delle variazioni in Levico (05/2022),
Canadian Mathematical Society 75+1 meeting online (06/2021),
SIAM conference on analysis of PDE in La Quinta (12/2019),
Workshop *People in Optimal Transport and Applications* in Cortona (06/2022),
PGMO days in Saclay (11/2018),
Oberwolfach seminar *Optimal Transport Theory and Hydrodynamics* in Oberwolfach (10/2018),
Workshop *An analyst, a probabilist and a geometer walk into a bar* in Cardiff (06/2018).

Seminars in scientific institutions

INRIA HeKA online (04/2023),
Toulouse School of Economics (03/2023),
IST Austria (12/2022),
MPI Leipzig (11/2022),
Warwick University (03/2022),
UC San Diego (11/2021),
Université de Sophia Antipolis (11/2021),
SingleStatOmics team in Lyon (03/2021),
Durham University (11/2020),
INRIA MOKAPLAN team in Paris (05/2020),
Université de Strasbourg (05/2020),
University of Alberta (10/2019),
University of British Columbia (10/2019),
Università di Pavia (03/2019),
Tokyo Metropolitan University (12/2018),
Université Paris-Sud (11/2018),
UC Los Angeles (04/2018),
New York University (03/2018),
INRIA MOKAPLAN team in Paris (05/2017).

PhD students' seminars

Université Pierre et Marie-Curie (05/2017),
Université Paris-Sud (05/2017),
Université Pierre et Marie-Curie (02/2017).

TEACHING EXPERIENCES

Course director January 2020–Present

Bocconi University (Milan, Italy) and University of British Columbia (Vancouver, Canada)

I have taught the following courses as a course director:

- Mathematical Analysis 2 (Bocconi University, Spring 2021, Spring 2022 and Spring 2023).
- PhD course Real Analysis 1 (Bocconi University, Fall 2020, Fall 2021, Fall 2022).
- Introduction to Linear Programming (UBC, Spring 2020)

Teaching assistant September 2016–June 2019

IUT d'Orsay, Orsay, France

IUT d'Orsay is an engineering school. Classes given to first year and second year students, including: calculus, linear algebra, computer science and statistics.

Oral examiner in *Classe Préparatoires* September 2013–March 2016

Lycée Louis le Grand, Paris, France

Giving weekly oral examinations in Mathematics to students in *Classes préparatoires*.

Mathematics and Physics teacher at *Tremplin* September 2012–February 2014

Paris, France

The association *Tremplin* provides academic support to students coming from underprivileged areas.

Diffusion of scientific culture

I have participated to the diffusion of the scientific culture in the Paris area by:

- giving, in 2015 and 2016, 4 conferences in High School;
- animating a robotic workshop during the summer 2015 in the *Palais de la découverte*, a science museum.

RESPONSIBILITIES

Organization of seminars

I co-organize the Bocconi seminar series in Analysis and applied mathematics since February 2023 with Alessandro Pigati.

I co-organized the regular seminar *Groupe de Travail en Calcul des Variations* which took place in Paris during the Academic year 2018/2019.

Reviewing

I have been a reviewer for the following journals: Annals of Statistics, Biometrika, Calculus of Variations and PDEs, Computers and Mathematics with Applications, Information and Inference, Journal des Mathématiques Pures et Appliquées, Journal of Functional Analysis, Manuscripta Mathematica, Mathematical Modelling and Numerical Analysis, SIAM Journal on Control and Optimization, and SIAM Journal on Mathematical Analysis.

I also wrote 25 article reviews for MathScinet.