Hugo Lavenant

Assistant professor at Bocconi University

GENERAL INFORMATION

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

RESEARCH INTERESTS

Broadly: calculus of variations (including optimal transport), elliptic PDEs and convex optimization. More specifically:

- use of optimal transport for the analysis of biological data;
- harmonic mappings valued in the Wasserstein space (theory and numerics);
- numerical methods for dynamical formulations of optimal transport;
- variational formulations of Mean Field Games and incompressible Euler equations.

POSITIONS

Assistant professor 2020–present
Bocconi University, Milan, Italy

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 EXPERIENCES

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.

TEACHING EXPERIENCES

Instructor January 2020–Present

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

I have taught the following courses as an instructor:

- Mathematical Analysis 2 (Bocconi University, Spring 2021)
- PhD course Real Analysis 1 (Bocconi University, Fall 2020)
- 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*.

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.

RESPONSABILITIES

Organization of a seminar

I have been co-organizing 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, Information and Inference, Journal des Mathématiques Pures et Appliquées, Mathematical Modelling and Numerical Analysis, SIAM Journal on Control and Optimization, and SIAM Journal on Mathematical Analysis.
I also wrote 16 article reviews for MathScinet.

PUBLICATIONS

BEFORE THE PHD

[1] 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).

PEER REVIEWED JOURNALS

[2] 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.

[3] 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.

[4] 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.

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

[6] 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.

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

[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.

PEER REVIEWED PROCEEDINGS

[9] 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

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

PREPRINT

[11] Hugo Lavenant*, Stephen Zhang*, Young-Heon Kim and Geoffrey Schiebinger. Towards a mathematical theory of trajectory inference. *Arxiv Preprint Arxiv:2102.09204* (2021).

[12] 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).

TALKS

PRESENTATION IN A PEER REVIEWED CONFERENCE

1. SIGGRAPH Asia (Tokyo, Japan), December 2018.

INVITATIONS IN WORKSHOPS

2. Groupe de Travail en Calcul des Variations (Paris, France), May 2019.
3. ANR MAGA meeting (Nancy, France), December 2018.

CONTRIBUTED TALKS IN CONFERENCES AND WORKSHOPS

4. Canadian Mathematical Society 75+1 meeting (Ottawa, Canada, online), June 2021.
5. SIAM conference on analysis of PDE (La Quinta, United States), December 2019.
6. Workshop *People in Optimal Transport and Applications* (Cortona, Italy), June 2019.
7. PGMO days (Saclay, France), November 2018.
8. Oberwolfach seminar *Optimal Transport Theory and Hydrodynamics* (Oberwolfach, Germany), October 2018.
9. Workshop *An analyst, a probabilist and a geometer walk into a bar* (Cardiff, Wales), June 2018.

SEMINARS IN SCIENTIFIC INSTITUTIONS

10. Seminar of the SingleStatOmics team (Lyon, France, online), March 2021.
11. Durham University (Duhram, United Kingdom, online), November 2020.
12. Seminar of the INRIA MOKAPLAN team (Paris, France), May 2020.
13. Université de Strasbourg (Strasbourg, France), April 2020.
14. University of Alberta (Edmonton, Canada), October 2019.
15. University of British Columbia (Vancouver, Canada), September 2019.

16. Università di Pavia (Pavia, Italy), March 2019.
17. Tokyo Metropolitan University (Japan), December 2018.
18. Université Paris-Sud (Orsay, France), November 2018.
19. Université Paris-Sud (Orsay, France), May 2018.
20. University of California Los Angeles (Los Angeles, United States), April 2018.
21. New York University (New York, United States), March 2018.
22. Seminar of the INRIA MOKAPLAN team (Paris, France), May 2017.

PHD STUDENTS' SEMINAR

23. Université Pierre et Marie-Curie (Paris, France), May 2017.
24. Université Paris-Sud (Orsay, France), May 2017
25. Université Pierre et Marie-Curie (Paris, France), February 2017. (Physics PhD students' seminar)