Hugo Lavenant

PIMS postdoctoral fellow at the University of British Columbia

CONTACT INFORMATION

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POSITION

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

University of British Columbia, Vancouver, BC, Canada

Using optimal transport to analyze the shape of dendritic structures, under the supervision of Young-Heon Kim, Brendan Pass 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

Courses taken included : 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.
- (2013–2014) *Master 1* in Mathematics.
- (2012–2013) *Licence 3* (equivalent to a Bachelor's degree) in mathematics and physics, *summa cum laude*. Bachelor's thesis untitled *Quelques aspects de micromagnétisme*, under the supervision of Grégoire de Loubens, Radu Ignat and Éric Vincent.

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

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.

RESPONSABILITIES

Organization of seminar

I have been co-organizing the regular seminar *Groupe de Travail en Calcul des Variations* during the Academic year 2018/2019.

Reviewing

I have been a reviewer for the following journals:

- Mathematical Modelling and Numerical Analysis,
- SIAM Journal on Control and Optimization,
- Information and Inference.

TALKS

Unconditional convergence for discretizations of dynamical optimal transport June 2019
Palazzone di Cortona, Cortona, Italy (Workshop People in Optimal Transport and Applications*)*

Isoperimetric profile in a domain with boundary and its convex relaxation May 2019
Université Pierre et Marie Curie, Paris, France (Groupe de travail en Calcul des Variations)

Harmonic mappings valued in the Wasserstein space March 2019
Università di Pavia, Pavia, Italy (Applied mathematics seminar)

Benamou-Brenier formulation for geodesics and harmonic mappings valued in the Wasserstein space: discretization and convergence December 2018
Loria, Nancy (Rencontres MAGA à Nancy)

Curves and maps valued in the Wasserstein space: theory, numerics and applications December 2018
Tokyo Metropolitan University, Japan

Dynamical Optimal Transport on Discrete Surfaces December 2018
Tokyo International Forum, Tokyo, Japan (SIGGRAPH Asia)

Variational Mean Field Games: on estimates on the density and the pressure November 2018
EDF Lab, Saclay (PGMO days)

Mappings valued in the Wasserstein space and their links with Q-functions November 2018
Université Paris-Sud, Orsay (Harmonic analysis seminar)

Optimal density evolution with congestion October 2018
MFO, Oberwolfach (Oberwolfach seminar)

Harmonic mappings valued in the Wasserstein space June 2018
Cardiff University, Cardiff (Workshop An analyst, a probabilist and a geometer walk into a bar*)*

Harmonic mappings valued in the Wasserstein space May 2018
Université Paris-Sud, Orsay (AN&EDP seminar)

Harmonic mappings valued in the Wasserstein space April 2018
UCLA, Los Angeles (Analysis and PDE seminar)

Harmonic mappings valued in the Wasserstein space March 2018
NYU, New York (MIC seminar)

L^∞ bounds in optimal density evolution May 2017
INRIA, Paris (Mokameeting)

Courbes de mesures May 2017
Université Pierre et Marie-Curie, Paris (PhD student's seminar)

Courbes de mesures May 2017
Université Paris-Sud, Orsay (PhD student's seminar)

Incompressible Euler equations and the least action principle February 2017
Université Pierre et Marie-Curie, Paris (Physics PhD student's seminar)

SKILLS

Software Python (advanced), C++ and Matlab (notions)

PUBLICATIONS

UNDERGRADUATE WORK

[1] Hugo Lavenant, Vladimir Naletov, Olivier Klein, Grégoire De Loubens, Laura Casado, and José María De Teresa (2014). Mechanical magnetometry of Cobalt nanospheres deposited by focused electron beam at the tip of ultra-soft cantilevers. *Nanofabrication*, 1(1).

ACCEPTED PAPERS

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

[3] Hugo Lavenant and Filippo Santambrogio (2018). Optimal density evolution with congestion: L^∞ bounds via flow interchange techniques and applications to variational Mean Field Games. *Published paper: Communications in Partial Differential Equations*, vol. 43, issue 12, p. 1761–1802.

[4] Hugo Lavenant, Sebastian Claici, Edward Chien, and Justin Solomon (2018). Dynamical optimal transport on discrete surfaces. *Published paper: ACM Trans. Graph.* 37, 6, Article 250. *Presented at SIGGRAPH Asia 2018*.

[5] Hugo Lavenant (2019). Harmonic mappings valued in the Wasserstein space. *Published paper: Journal of Functional Analysis*, vol. 277, issue 3, p. 688–785.

[6] Hugo Lavenant and Filippo Santambrogio (2019). New estimates on the pressure in density-constrained Mean Field Games. *Accepted paper: Journal of the London Mathematical Society*.

[7] Daryl Deford, Hugo Lavenant, Zachary Schutzman and Justin Solomon (2019). Total Variation Isoperimetric Profiles. *Accepted paper: SIAM Journal on Applied Algebra and Geometry*.

PREPRINT

[8] Hugo Lavenant (2019). Unconditional convergence for discretizations of dynamical optimal transport. *Preprint available: http://cvgmt.sns.it/media/doc/paper/4415/convergence_BB.pdf*.