

Dario Prandi

Chargé de recherche CNRS at Université Paris-Saclay

📍 3, Rue Joliot-Curie, 91192 CentraleSupélec, Gif-sur-Yvette, France

✉ dario.prandi@centralesupelec.fr 🌐 darioprandi.com

Experience

- Chargé de Recherche CNRS**, Université Paris-Saclay, CentraleSupélec, L2S 2016–now
Researcher in Section 07.
- Post-doc**, CEREMADE, Université Paris-Dauphine, Paris 2015–2016
Supervisors: [G. Peyré](#) and [J.-M. Mirebeau](#).
- Post-doc**, LSIS, Université de Toulon, Toulon 2014–2015
Grant of the LabEx Archimède (Aix-Marseille Université). Supervisor: [J.-P. Gauthier](#).

Education

- Philosophiae Doctor (Ph.D.)**, École Polytechnique, Palaiseau 2010–2013
Subject of the dissertation: [Geometry and analysis of control-affine systems: motion planning, heat and Schrödinger evolution](#). Supervisors: [Ugo Boscain](#), [Frédéric Jean](#), and [Mario Sigalotti](#).
- Master of Science (M.Sc.)**, Dep. of Mathematics, Univ. di Padova, Italy 2008 – 2010
Final grade 110/110 *cum laude*. Specialised curriculum in mathematical analysis. Subject of the dissertation: Rearrangements in Metric Spaces. Supervisor: [Roberto Monti](#).
- Bachelor of Science (B.Sc.)**, Dep. of Mathematics, Univ. di Modena e Reggio Emilia, Italy 2005 – 2008
Final grade 110/110 *cum laude*. General curriculum in mathematics. Subject of the dissertation: Area and coarea formulae. Supervisor: [Gian Paolo Leonardi](#).

Teaching

- Lecturer**, Geometric Control Theory (CM, 12h). 2018
Master course, Université Paris-Sud Orsay.
- Lecturer**, Analyse et Topologie (CM and TD, 60h). 2015 – 2020
Bachelor course (L2). PSL Research University, Paris.
- Teaching assistant**, Contrôle Géométrique (TD, 10h). 2013 & 2016
Master course, Université Paris-Sud Orsay.
- Teaching assistant**, Outils Logiciels (TP, 50h). 2014
Bachelor course, IUT de Toulon.

Organization

- Cortical models for visual perception and imaging applications**, LJLL, UPMC, Paris. 22 nov 2018
Website: <https://liftme.sciencesconf.org/>. Co-organised with L. Calatroni, V. Franceschi, and B. Franceschiello.
- Cortical Inspired Non-holonomic Control for Imaging**, Institut Henri Poincaré, Paris. 28 nov 2017
Co-organised with L. Calatroni and V. Franceschi.
- Séminaire d'Automatique du Plateau de Saclay**, L2S, CentraleSupélec, Gif-sur-Yvette. oct 2016 – now
Website: <https://icode-seminars.github.io>. Co-organised with N. Amini.
- A day in control theory**, CMAP, École Polytechnique, Palaiseau. 2 may 2017
Thematic day in honour of A. Agrachev 65th birthday. Co-organised with F. Chittaro and R. Ghezzi.
- Spectral properties of hypoelliptic operators**, Institut Henri Poincaré, Paris. 9 dec 2015
Website: <http://webusers.imj-prg.fr/~davide.barilari/seminar.php>.
- INDAM meeting on Geometric Control and sub-Riemannian Geometry**, Cortona, Italy. may 2012
Website: <http://www.cmap.polytechnique.fr/geometric-control-srg/>.

Grants and awards

Emergence en Recherche de Idex Université de Paris , “BioSpeech” Principal investigator: Giuseppina Turco, in collaboration with U. Boscain	2019
Financing from iCODE institut , “Control theoretical modelling of contrast perception” “Porteur” of the project, in collaboration with V. Franceschi and L. Calatroni	2019
PEPS Blanc INS2I , “Lifting approaches for cortical inspired methods in imaging (LiftME)” “Porteur” of the project, in collaboration with V. Franceschi and L. Calatroni	2018
PEPS Blanc INS2I , “Cortical Inspired Non-holonomic Control for Imaging (CINCIN)” “Porteur” of the project, in collaboration with J.-P. Gauthier, V. Franceschi, L. Calatroni.	2017
ERC Proof of Concept , “An artificial visual cortex for image processing (ARTIV1)” Principal investigator: Ugo Boscain. In collaboration with J.-P. Gauthier and M. Sigalotti.	2016
BOUM SMAI Project , “Quantum confinement and spectral properties of singular operators” In collaboration with L. Rizzi and M. Seri.	2016
BOUM SMAI Project , “Formule de Santalò en géométrie sous-riemannienne et applications” In collaboration with L. Rizzi and M. Seri.	2016

Supervision

Nouamane Tazi , CentraleSupélec student. Supervised under the “parcours recherche” offering of CentraleSupélec.	2018–pres.
Hippolyte Charvin , Master student in Mathematics at Université de Paris. Supervised in collaboration with D. Barilari. Subject of the dissertation: “Geometric visual hallucinations, and the functional architecture of striate cortex”.	2020.
Cyprien Tamekue Woundja , Master student in Mathematics at IMSP, Porto-Novo, Benin. Supervised in collaboration with Y. Chitour. Subject of the dissertation: “Null controllability of Grushin-type operators”.	2019.
Louis Gradt , Master student in Mathematics at Université de Paris. Supervised in collaboration with R. Petrides. Subject of the dissertation: “Spectral theory of almost-Riemannian manifolds”.	2019.
Amine Bohi , Ph.D student in Computer Science, LSIS, Université de Toulon. Supervised in collaboration with F. Bouchara and J.-P. Gauthier. Subject of the dissertation: “Descripteurs de Fourier inspirés de la structure du cortex visuel primaire humain. Application à la reconnaissance de navires dans le cadre de la surveillance maritime”.	2017
Leonardo Suriano , INRIA Saclay engineer. Supervised in collaboration with M. Sigalotti.	2015

Publications

Books and edited proceedings

- [1] A semidiscrete version of the Petitot model as a plausible model for anthropomorphic image reconstruction and pattern recognition
Dario Prandi, Jean-Paul Gauthier
SpringerBriefs in Mathematics. Springer International Publishing. (2018). doi: [10.1007/978-3-319-78482-3](https://doi.org/10.1007/978-3-319-78482-3)

Peer-reviewed journals

- [1] Cortical-inspired Wilson-Cowan-type equations for orientation-dependent contrast perception modelling
Marcelo Bertalmío, Luca Calatroni, Valentina Franceschi, Benedetta Franceschiello, Dario Prandi
J. Math. Imaging Vision (to appear), arXiv:1910.06808
- [2] Visual illusions via neural dynamics: Wilson-Cowan-type models and the efficient representation principle
Marcelo Bertalmío, Luca Calatroni, Valentina Franceschi, Benedetta Franceschiello, Alexander Gomez-Villa, Dario Prandi
Journal of Neurophysiology (2020). doi: <https://doi.org/10.1152/jn.00488.2019>
- [3] Hardy-Type Inequalities for the Carnot–Carathéodory Distance in the Heisenberg Group
Valentina Franceschi, Dario Prandi
The Journal of Geometric Analysis (Jan. 2020). doi: [10.1007/s12220-020-00360-y](https://doi.org/10.1007/s12220-020-00360-y)

- [4] On the regularity of abnormal minimizers for rank 2 sub-Riemannian structures
Davide Barilari, Yacine Chitour, Frédéric Jean, Dario Prandi, Mario Sigalotti
Journal de Mathématiques Pures et Appliquées (Apr. 2018). doi: [10.1016/j.matpur.2019.04.008](https://doi.org/10.1016/j.matpur.2019.04.008)
- [5] A sub-Riemannian Santaló formula with applications to isoperimetric inequalities and first Dirichlet eigenvalue of hypoelliptic operators
Dario Prandi, Luca Rizzi, Marcello Seri
J. Differential Geom. 111.2 (Feb. 2019), pp. 339–379. doi: [10.4310/jdg/1549422105](https://doi.org/10.4310/jdg/1549422105)
- [6] On the Essential Self-Adjointness of Singular Sub-Laplacians
Valentina Franceschi, Dario Prandi, Luca Rizzi
Potential Analysis (Jan. 2019). doi: [10.1007/s11118-018-09760-w](https://doi.org/10.1007/s11118-018-09760-w)
- [7] Quantum confinement on non-complete Riemannian manifolds
Dario Prandi, Luca Rizzi, Marcello Seri
J. Spectr. Theory (July 2018). doi: [10.4171/JST/226](https://doi.org/10.4171/JST/226)
- [8] Highly Corrupted Image Inpainting Through Hypoelliptic Diffusion
Ugo V. Boscain, Roman Chertovskih, Jean-Paul Gauthier, Dario Prandi, Alexey Remizov
J. Math. Imaging Vision (Apr. 2018). doi: [10.1007/s10851-018-0810-4](https://doi.org/10.1007/s10851-018-0810-4)
- [9] Self-adjoint extensions and stochastic completeness of the Laplace-Beltrami operator on conic and anti-conic surfaces
Ugo Boscain, Dario Prandi
J. Differential Equations. 260.4 (2016), pp. 3234–3269. doi: [10.1016/j.jde.2015.10.011](https://doi.org/10.1016/j.jde.2015.10.011)
- [10] Spectral analysis and the Aharonov-Bohm effect on certain almost-Riemannian manifolds
U. Boscain, D. Prandi, M. Seri
Comm. Partial Differential Equations. 41.1 (2016), pp. 32–50. doi: [10.1080/03605302.2015.1095766](https://doi.org/10.1080/03605302.2015.1095766)
- [11] Fourier descriptors based on the structure of the human primary visual cortex with applications to object recognition
Amine Bohi, Dario Prandi, Vincente Guis, Frédéric Bouchara, Jean-Paul Gauthier
J. Math. Imaging Vision. 57.1 (2017), pp. 117–133. doi: [10.1007/s10851-016-0669-1](https://doi.org/10.1007/s10851-016-0669-1)
- [12] Complexity of control-affine motion planning
F. Jean, D. Prandi
SIAM J. Control Optim. 53.2 (2015), pp. 816–844. doi: [10.1137/130950793](https://doi.org/10.1137/130950793)
- [13] Hölder equivalence of the value function for control-affine systems
Dario Prandi
ESAIM: COCV. 20.4 (2014), pp. 1224–1248. doi: [10.1051/cocv/2014014](https://doi.org/10.1051/cocv/2014014)

Peer-reviewed conferences and workshops

- [1] A bio-inspired geometric model for sound reconstruction (Extended Abstract)
Ugo Boscain, Ludovic Sacchelli, Dario Prandi, Giuseppina Turco
20th IFAC World Congress. (to appear)
- [2] On the decay rate for degenerate gradient flows subject to persistent excitation
Dario Prandi, Yacine Chitour, Paolo Mason
20th IFAC World Congress. (to appear)
- [3] A Cortical-Inspired Model for Orientation-Dependent Contrast Perception: A Link with Wilson-Cowan Equations
Marcelo Bertalmío, Luca Calatroni, Valentina Franceschi, Benedetta Franceschiello, Dario Prandi
Scale Space and Variational Methods in Computer Vision. (2019). ISBN: 978-3-030-22368-7
- [4] Cortical-inspired image reconstruction via sub-Riemannian geometry and hypoelliptic diffusion
Boscain, Ugo, Chertovskih, Roman, Gauthier, Jean-Paul, Prandi, Dario, Remizov, Alexey
SMAI 2017 – ESAIM: ProcS. 64 (2018), pp. 37–53. doi: [10.1051/proc/201864037](https://doi.org/10.1051/proc/201864037)
- [5] Image inpainting via a control-theoretical model of human vision
Ugo V. Boscain, Jean-Paul Gauthier, Dario Prandi
2018 14th IEEE International Conference on Control Automation (ICCA). (2018). doi: [10.1109/ICCA.2018.8444289](https://doi.org/10.1109/ICCA.2018.8444289)
- [6] Recent results on the essential self-adjointness of sub-Laplacians, with some remarks on the presence of characteristic points
Dario Prandi, Valentina Franceschi, Luca Rizzi

Séminaire de Théorie spectrale et géométrie (Grenoble), 33. (2015-2016). DOI: [10.5802/tsg.311](https://doi.org/10.5802/tsg.311)

- [7] Image processing in the semidiscrete group of rototranslations
Dario Prandi, Ugo Boscain, Jean-Paul Gauthier
Geometric science of information. Lecture Notes in Comput. Sci. Vol. 9389. (2015). DOI: [10.1007/978-3-319-25040-3_67](https://doi.org/10.1007/978-3-319-25040-3_67)
- [8] Image reconstruction via non-isotropic diffusion in Dubins/Reed-Shepp-like control systems
U. Boscain, J. P. Gauthier, D. Prandi, A. Remizov
53rd IEEE Conference on Decision and Control. (Dec. 2014). DOI: [10.1109/CDC.2014.7040056](https://doi.org/10.1109/CDC.2014.7040056)

Preprints

- [1] A bio-inspired geometric model for sound reconstruction
Ugo Boscain, Dario Prandi, Ludovic Sacchelli, Giuseppina Turco
arXiv: [2004.02450](https://arxiv.org/abs/2004.02450) [eess.AS]
- [2] Weyl's law for singular Riemannian manifolds
Yacine Chitour, Dario Prandi, Luca Rizzi
arXiv: [1903.05639](https://arxiv.org/abs/1903.05639) [math.DG]
- [3] Point interactions for 3D sub-Laplacians
Riccardo Adami, Ugo Boscain, Valentina Franceschi, Dario Prandi
arXiv: [1902.05475](https://arxiv.org/abs/1902.05475) [math.AP]
- [4] Generalized Fourier-Bessel operator and almost-periodic interpolation and approximation
J.-P. Gauthier, D. Prandi
arXiv: [1612.00056](https://arxiv.org/abs/1612.00056) [math.NA]

Talks in international conferences

- [1] On the essential self-adjointness of singular sub-Laplacians
Mini-workshop "Self-adjoint extensions in new settings", MFO, Oberwolfach, Germany. 10 October 2019.
- [2] Weyl law for singular Laplace-Beltrami operators
Asymptotic Analysis & Spectral Theory, University Paris-Sud, Orsay, France. 02 October 2019.
- [3] Weyl law for singular Riemannian manifolds
EquaDiff2019, Leiden, The Netherlands. 08 July 2019.
- [4] Weyl law for singular Riemannian manifolds
Journées sous-riemanniennes, Grenoble, France. 16 October 2018.
- [5] Weyl law for singular elliptic operators
A sub-Riemannian day in Padova, Italy. 14 September 2018.
- [6] Cortical-inspired functional lifting for image inpainting
SIAM conference on Imaging Science, Bologna, Italy. 5 June 2018.
- [7] Anthropomorphic image reconstruction via sub-Riemannian geometry and hypoelliptic diffusion
Delays and constraints in distributed parameter systems, Gif-sur-Yvette, France. 24 November 2017.
- [8] Quantum confinement and spectral analysis of degenerate operators on Riemannian manifolds
VII Partial differential equations, optimal design and numerics, Benasque, Spain. 22 August 2017.
- [9] A variational formulation of the sub-Riemannian model of the primary visual cortex
Geometric Analysis in Control and Vision Theory, Voss, Norway. 11 May 2016.
- [10] Image processing in the semidiscrete group of rototranslations
2nd Conference on Geometric Science of Information, École Polytechnique. 20 October 2015.
- [11] A sub-Riemannian Santaló formula with applications to isoperimetric inequalities and Dirichlet spectral gap of hypoelliptic operators
PGMO Days 2015, ENSTA ParisTech, Palaiseau. 28 October 2015.
- [12] Self-adjointness of intrinsic diffusions in almost-Riemannian structures
Thematic day on Analysis and geometry of almost-Riemannian manifolds, IHP, Paris. 03 December 2014.
- [13] Intrinsic hypoelliptic diffusions in sub-Riemannian and almost-Riemannian geometry
Thematic day on Hypoelliptic diffusion: analysis and control, IHP, Paris. 06 November 2014.

- [14] Spectral properties and Aharonov-Bohm effect on Grushin-like structures
First International Joint Meeting, Bilbao, Spain. 02 July 2014.
- [15] The Laplace-Beltrami operator on conic and anti-conic surfaces
Geometry and Control, Steklov Institute, Moscow, Russia. 17 April 2014.
- [16] Heat and Schrödinger equation on conical and anticonical-type manifolds
Control of PDEs, CNAM, Paris. 02 April 2014.
- [17] Complexity in control-affine systems
Mathematical Control in Trieste, SISSA, Trieste, Italy. 05 December 2013.
- [18] Dynamics of a quantum particle on a conical-like surface
Conical Intersections in Mathematical Physics, IHP, Paris. 31 May 2013.
- [19] The Laplace-Beltrami operator on conic-type surfaces
Non Linear Control: Geometric Methods and Applications, Firenze, Italy. 19 April 2013

Other talks

- [1] Self-adjointness e teoria spettrale per (sub-)laplaciani singolari
Seminario FIM, Università di Modena e Reggio Emilia, Italy. 25 January 2018.
- [2] Loi de Weyl avec reste et estimés du noyau de la chaleur sur varietés riemanniennes non-completes
Séminaire de Théorie spectrale et géométrie, Institut Fourier, Grenoble. 30 November 2017.
- [3] Sur le caractère auto-adjoint et la théorie spectrale des opérateurs de type Hörmander singuliers
Séminaire d'Analyse, Université de Tours. 09 November 2017.
- [4] Quantum confinement and spectral theory of (sub-)Laplacians
Séminaire de Géométrie sous-riemannienne, IHP, Paris. 04 October 2017.
- [5] Quantum confinement in non-complete Riemannian manifolds
25e colloque Jeunes Chercheurs Alain Bouyssy, Orsay, Paris. 02 March 2017.
- [6] Neuro-geometry of vision and applications to image processing
Seminario FIM, Università di Modena e Reggio Emilia, Italy. 11 February 2016.
- [7] A variational formulation of the sub-Riemannian model for the primary visual cortex
Séminaire "Analyse numérique et EDP", Université Paris Sud-Orsay. 26 November 2015.
- [8] Reconstruction and pattern recognition via the Citti-Petitot-Sarti model
Séminaire "Statistique et imagerie", Université Paris-Dauphine. 19 January 2015.
- [9] Complexity of control-affine motion planning
Séminaire de Théorie du Contrôle de Toulon, Université de Toulon. 30 January 2014.
- [10] The heat and Schrödinger equations on conic and anticonic-type
Gdt Problèmes spectraux et physique mathématique, Université Paris Sud-Orsay. 18 December 2013.
- [11] Complexity of control-affine motion planning
Séminaire de Géométrie sous-riemannienne, IHP, Paris. 02 October 2013.
- [12] The heat and Schrödinger equations on conic and anticonic-type surfaces
A geometry day in Bicocca, Milan, Italy. 27 September 2013.
- [13] Complexity in affine control systems
Journée GECO, UPMC, Paris. 25 June 2012.
- [14] Complexity in affine control systems
Functional Analysis sector's seminar, SISSA, Trieste, Italy. 19 April 2012.

Posters

- [1] Hardy-type inequalities and spectral bounds for hypoelliptic operators of Hörmander type
Contrôle des EDP et applications, CIRM, Marseille. 10 November 2015
- [2] Highly corrupted image inpainting through hypoelliptic diffusion
Workshop on Geometrical Models in Vision, IHP, Paris. 23 October 2014.

Languages

Mother tongue
Other languages¹

Italian

English²

French

Understanding		Speaking				Writing	
		Listening	Reading	Interaction	Production		
C2	Fluent	C2	Fluent	C2	Fluent	C2	Fluent
C2	Fluent	C2	Fluent	C1	Fluent	C1	Fluent

¹Common European Framework of Reference for Languages (CEFR)

²TOEFL iBT Test. Score of 110/120.