Dario Prandi

Charge de recherche CNRS at Universite Paris-Saclay

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Professional	experience
I I C C C C C C C C C C C C C C C C C C	CAPCITCITOC

Chargé de Recherche CNRS, Université Paris-Saclay, CentraleSupélec, L2S Researcher in Section 07.	2016-now
Post-doc , CEREMADE, Université Paris-Dauphine, Paris Supervisors: G. Peyré and JM. Mirebeau.	2015-2016
Post-doc , LSIS, Université de Toulon, Toulon Grant of the LabEx Archimede (Aix-Marseille Université). Supervisor: JP. Gauthier.	2014-2015

Education Philosophiae Doctor (Ph.D.), École Polytechnique, Palaiseau Geometry and analysis of control-affine systems: motion planning, heat and Schrödinger evolut Supervisors: Ugo Boscain, Fréderic Jean, and Mario Sigalotti.	2010-2013 ion.
Master of Science (M.Sc.), Dep. of Mathematics, Univ. di Padova, Italy Final grade 110/110 cum laude. Specialised curriculum in mathematical analysis. Subject of the dissertation: Rearrangements in Metric Spaces. Supervisor: Roberto Monti.	2008 – 2010
Bachelor of Science (B.Sc.) , Dep. of Mathematics, Univ. di Modena e Reggio Emilia, Italy Final grade 110/110 <i>cum laude</i> . General curriculum in mathematics. Subject of the dissertation: Area and coarea formulae. Supervisor: Gian Paolo Leonardi.	2005 – 2008
Grants and awards	
80 prime , "A bio-inspired geometric model for speech sound reconstruction" Financing for 20k€ and a Ph.D thesis. In collaboration with U. Boscain and G. Turco.	2023-2024
ANR JCJC , "Redundancy-free neuro-biological design of visual and auditory sensing" Financing for 160k€. PI of the project.	2021-2024
Dispositif de Couties any Callaharations area l'Afrique Cubacharianna (DCCA) "Nouvel	0001 0000

Dispositif de Soutien aux Collaborations avec l'Afrique Subsaharienne (DSCA), "Neural dynamics via mean-field models" Financing for 17k€. Pl of the project.	2021-2022
Emergence en Recherche de Idex Université de Paris , "BioSpeech" Financing for 20k€. Principal investigator: Giuseppina Turco, in collaboration with U. Boscain	2019
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Financing from iCODE institut, "Control theoretical modelling of contrast perception"	2019
Financing for 12k€. "Porteur" of the project, in collaboration with V. Franceschi and L. Calatroni	

PEPS INS2I, "Lifting approaches for cortical inspired methods in imaging (LiftME)"	2018
Financing for 10k€. "Porteur" of the project, in collaboration with V. Franceschi and L. Calatroni	

PEPS INSZI, Cortical Inspired Non-holonomic Control for Imaging (CINCIN)	2017
Financing for 8k€. "Porteur" of the project, in collaboration with JP. Gauthier, V. Franceschi, L. Calatroni.	
ERC Proof of Concept, "An artificial visual cortex for image processing (ARTIV1)"	2016

ERC Proof of Concept, "An artificial visual cortex for image processing (ARTIV1)" Financing for 150k€. Principal investigator: Ugo Boscain. In collaboration with J.-P. Gauthier and M. Sigalotti.

Organization

Organization		
NFW 23: Neural fields equations, from Website: https://nfwparis2023.sciencesco	Vilson-Cowan to neural engineering , LJLL, Paris. conf.org/registration.	19-20 jun 2023
Geometry and Control in Cortona , Corton Website: https://indico.math.cnrs.fr/ever		27-31 mar 2023
Séminaire d'Automatique du Plateau de Website: https://icode-seminars.github.id	Saclay , L2S, CentraleSupélec, Gif-sur-Yvette. D. Co-organised with N. Amini.	oct 2016 - now
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Cortical models for visual perception and imaging applications, LJLL, 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.

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.

INDAM meeting on Geometric Control and sub-Riemannian Geometry, Cortona, Italy.

may 2012

Website: http://www.cmap.polytechnique.fr/geometric-control-srg/.

Teaching

Lecturer, Geometric Control Theory (CM, 12h). Master course, Université Paris-Sud Orsay / ENSTA. 2018 - now

Lecturer, Analyse et Topologie / Calcul Differentiel / Méthodes Mathématiques (~80h/y). Bachelor level courses (L2/L3). PSL Research University, Paris.

2015 - now

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.

Supervision

- · Post-doc supervisions:
 - Virginia Bolelli (2023-prés.). Subject: "Flicker-induced visual illusions".
 - Ilias Rentzeperis (2021-2022). Subject: "Sparse coding for V1 receptive fields".
- · Ongoing PhD thesis supervision:
 - Pierre-Jean Ménabé (2021-prés.).
 Co-supervised with Y. Chitour. Title: "Regularity of optimal trajectories for control-affine systems".
 - Roman Vanlaere (2022-prés.). Co-supervised with P. Lissy. Title: "Controllability of the heat equation on sub-Riemannian manifolds".
 - Adel Annabi (2022-prés.).
 Co-supervised with J.-B. Pomet and L. Sacchelli. Title: "Observability and observer synthesis for Wilson-Cowan equations".
 - Xiangyu Ma (2023-prés.).
 Thesis financed by the CNRS 80 prime interdisciplinary project.
 Co-supervised with U. Boscain and G. Turco. Title: "A bio-inspired geometric model for speech sound reconstruction".
- · Completed PhD thesis supervision:
 - Amine Bohi (2014–2017). Co-supervised with F. Bouchara, J.-P. Gauthier, V. Guis.
 Title: "Descripteurs de Fourier inspirès de la structure du cortex visuel primaire humain. Application à la reconnaissance de navires dans le cadre de la surveillance maritime"
 - Cyprien Tamekue (2020–2023). Thesis financed by the "Financement Jean-Pierre Aguilar".
 Co-supervised with Y. Chitour. Title: "Controllability, visual illusions and perception".
- Supervised 10 "stage de master" since 2018.
- Supervised a student in the "parcours recherche" of CentraleSupèlec (2017–2020)

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 (2018), Springer International Publishing, DOI: 10.1007/978-3-319-78482-3

Peer-reviewed journals

[1] Beyond ℓ_1 sparse coding in V1

Ilias Rentzeperis, Luca Calatroni, Laurent Perrinet, Dario Prandi *PLOS Computational biology* (to appear), arXiv: 2301.10002 [q-bio.NC]

[2] Weyl's law for singular Riemannian manifolds

Yacine Chitour, Dario Prandi, Luca Rizzi

Journal de Mathématiques Pures et Appliquées (to appear), arXiv: 1903.05639 [math.DG]

[3] Horizontal magnetic fields and improved Hardy inequalities in the Heisenberg group David Krejčiřík Biagio Cassano, Dario Prandi Communications in Partial Differential Equations 48.5 (2023), pp. 711–752, DOI: 10.1080/03605302.2023.2191326

[4] Worst Exponential Decay Rate for Degenerate Gradient Flows Subject to Persistent Excitation Paolo Mason, Yacine Chitour, Dario Prandi SIAM Journal on Control and Optimization 59.4 (2021), pp. 3040–3067, DOI: 10.1137/20M1343427

[5] A Cortical-Inspired Sub-Riemannian Model for Poggendorff-Type Visual Illusions Emre Baspinar, Luca Calatroni, Valentina Franceschi, Dario Prandi *Journal of Imaging* 7.3 (2021), DOI: 10.3390/jimaging7030041

[6] A bio-inspired geometric model for sound reconstruction

Ugo Boscain, Dario Prandi, Ludovic Sacchelli, Giuseppina Turco

The Journal of Mathematical Neurosciences 11 (2 2021), DOI: 10.1186/s13408-020-00099-4

[7] Point interactions for 3D sub-Laplacians

Riccardo Adami, Ugo Boscain, Valentina Franceschi, Dario Prandi

Annales de l'Institut Henri Poincaré C, Analyse non linéaire (2020), DOI: 10.1016/j.anihpc.2020.10.007

[8] Cortical-inspired Wilson-Cowan-type equations for orientation-dependent contrast perception modelling Marcelo Bertalmío, Luca Calatroni, Valentina Franceschi, Benedetta Franceschiello, Dario Prand i J. Math. Imaging Vision (2020), DOI: 10.1007/s10851-020-00960-x

- [9] 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: 10.1152/jn.00488.2019
- [10] 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

[11] On the regularity of abnormal minimizers for rank 2 sub-Riemannian structures
Davide Barilari, Yacine Chitour, Fréderic Jean, Dario Prandi, Mario Sigalotti

Journal de Mathématiques Pures et Appliquées (Apr. 2018), DOI: 10.1016/j.matpur.2019.04.008

[12] 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, Lehigh University, DOI: 10.4310/jdg/1549422105

[13] 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

[14] Quantum confinement on non-complete Riemannian manifolds

Dario Prandi, Luca Rizzi, Marcello Seri

J. Spectr. Theory (July 2018), DOI: 10.4171/JST/226

[15] 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

[16] Self-adjoint extensions and stochastic completeness of the Laplace-Beltrami operator on conic and anticonic surfaces

Ugo Boscain, Dario Prandi

J. Differential Equations 260.4 (2016), pp. 3234-3269, DOI: 10.1016/j.jde.2015.10.011

[17] 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

[18] 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

[19] Complexity of control-affine motion planning

F. Jean, D. Prandi

SIAM J. Control Optim. 53.2 (2015), pp. 816–844, DOI: 10.1137/130950793

[20] 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

Peer-reviewed conferences and workshops

[1] Cortical origins of MacKay-type visual illusions. A case for the non-linearity Cyprien Tamekue, Dario Prandi, Yacine Chitour 21st IFAC World Congress, 2023

, [2] Reproducing Sensory Induced Hallucinations via Neural Fields
Cyprien Tamekue, Dario Prandi, Yacine Chitour
2022 IEEE International Conference on Image Processing (ICIP), 2022, DOI: 10.1109/ICIP46576.2022.9898022

[3] An Auditory Cortex Model for Sound Processing
Rand Asswad, Ugo Boscain, Giuseppina Turco, Dario Prandi, Ludovic Sacchelli

Geometric Science of Information, 2021, Springer International Publishing, DOI: 10.1007/978-3-030-80209-7_7

[4] On the decay rate for degenerate gradient flows subject to persistent excitation Yacine Chitour, Paolo Mason, Dario Prandi

IFAC-PapersOnLine 53.2 (2020), pp. 1709–1714, DOI: 10.1016/j.ifacol.2020.12.2246

[5] A bio-inspired geometric model for sound reconstruction (Extended Abstract)
Ugo Boscain, Ludovic Sacchelli, Dario Prandi, Giuseppina Turco
20th IFAC World Congress, 2020

, [6] A Cortical-Inspired Model for Orientation-Dependent Contrast Perception: A Link with Wilson-Cowan Equa-

Marcelo Bertalmío, Luca Calatroni, Valentina Franceschi, Benedetta Franceschiello, Dario Prandi *Scale Space and Variational Methods in Computer Vision*, 2019, Springer International Publishing

, [7] 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

[8] 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

[9] 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

[10] Image processing in the semidiscrete group of rototranslations
Dario Prandi, Ugo Boscain, Jean-Paul Gauthier
Geometric science of information, 2015, Springer, Cham, DOI: 10.1007/978-3-319-25040-3_67

[11] Image reconstruction via non-isotropic diffusion in Dubins/Reed-Shepp-like control systems U. Boscain, J. P. Gauthier, D. Prandi, A. Remizov

Preprints

- [1] Reproducibility via neural fields of visual illusions induced by localized stimuli Cyprien Tamekue, Dario Prandi, Yacine Chitour arXiv: 2401.09108 [q-bio.NC]
- [2] On the mathematical replication of the MacKay effect from redundant stimulation Cyprien Tamekue, Dario Prandi, Yacine Chitour arXiv: 2311.07338 [math.OC]
- [3] Generalized Fourier-Bessel operator and almost-periodic interpolation and approximation J.-P. Gauthier, D. Prandi arXiv: 1612.00056 [math.NA]

Talks in international conferences

- [1] Reproducing sensory induced visual hallucinations via neural fields, a case for the non-linearity SIAM Conference on Control and Its Applications (CT23). Philadelphia, USA. 26 July 2023
- [2] Magnetic fields in the Heisenberg group
 Hypoelliptic Operators in Geometry. MFO, Oberwolfach. 25 May 2023
- [3] On the decay rate for degenerate gradient flows subject to persistent excitation

 Congrés SMAI 2021 10ième Biennale Française des Mathématiques Appliquées et Industrielles. La Grande Motte,

 France. 24 June 2021
- [4] On the essential self-adjointness of singular sub-Laplacians
 Mini-workshop "Self-adjoint extensions in new settings", MFO, Obserwolfach, Germany. 10 October 2019.
- [5] Weyl law for singular Laplace-Beltrami operators Asymptotic Analysis & Spectral Theory, University Paris-Sud, Orsay, France. 02 October 2019.
- [6] Weyl law for singular Riemannian manifolds EquaDiff2019, Leiden, The Netherlands. 08 July 2019.
- [7] Weyl law for singular Riemannian manifolds
 Journées sous-riemanniennes, Grenoble, France. 16 October 2018.
- [8] Weyl law for singular elliptic operators
 A sub-Riemannian day in Padova, Italy. 14 September 2018.
- [9] Cortical-inspired functional lifting for image inpainting SIAM conference on Imagining Science, Bologna, Italy. 5 June 2018.
- [10] Anthropomorphic image reconstruction via sub-Riemannian geometry and hypoelliptic diffusion Delays and constraints in distributed parameter systems, Gif-sur-Yvette, France. 24 November 2017.
- [11] Quantum confinement and spectral analysis of degenerate operators on Riemannian manifolds VII Partial differential equations, optimal design and numerics, Benasque, Spain. 22 August 2017.
- [12] 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.
- [13] Image processing in the semidiscrete group of rototranslations2nd Conference on Geometric Science of Information, École Polytechnique. 20 October 2015.
- [14] 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.
- [15] Self-adjointness of intrinsic diffusions in almost-Riemannian structures

 Thematic day on Analysis and geometry of almost-Riemannian manifolds, IHP, Paris. 03 December 2014.
- [16] Intrinsic hypoelliptic diffusions in sub-Riemannian and almost-Riemannian geometry Thematic day on Hypoelliptic diffusion: analysis and control, IHP, Paris. 06 November 2014.
- [17] Spectral properties and Aharonov-Bohm effect on Grushin-like structures First International Joint Meeting, Bilbao, Spain. 02 July 2014.

- [18] The Laplace-Beltrami operator on conic and anti-conic surfaces Geometry and Control, Steklov Institute, Moscow, Russia. 17 April 2014.
- [19] Heat and Schrödinger equation on conical and anticonical-type manifolds Control of PDEs, CNAM, Paris. 02 April 2014.
- [20] Complexity in control-affine systems

Mathematical Control in Trieste, SISSA, Trieste, Italy. 05 December 2013.

[21] Dynamics of a quantum particle on a conical-like surface Conical Intersections in Mathematical Physics, IHP, Paris. 31 May 2013.

[22] The Laplace-Beltrami operator on conic-type surfaces
Non Linear Control: Geometric Methods and Applications, Firenze, Italy. 19 April 2013

Other talks

- [1] Neural fields equations for visual illusions Séminaire d'automatique du plateau de Saclay, Université Paris-Saclay, Gif-sur-Yvette. 12 October 2023.
- [2] Reproducing sensory induced visual hallucinations via neural fields Imaging in Paris Seminar, IHP, Paris. 15 December 2022.
- [3] Reproducing sensory induced visual hallucinations via neural fields S'eminaire McTAO, INRIA Sophia-Antipolis. 25 May 2022.
- [4] A sub-Riemannian Santal o formula with applications to isoperimetric inequalities and Dirichlet spectral gap of hypoelliptic operators

Floris Takens Seminar, University of Groningen, Netherlands. 25 January 2022.

- [5] Cortical-inspired Wilson-Cowan-type equations for orientation-dependent contrast perception modellin Université de l'Artois, Lens. 16 Decembre 2021.
- [6] On the regularity of abnormal minimizers for rank 2 sub-Riemannian structures Moscow seminar on geometric theory of optimal control. 14 April 2021.
- [7] Point interactions for 3D sub-Laplacians
 Oberseminar Analysis/Numerik, Universität Oldenburg. 14 January 2021.
- [8] Point interactions for 3D sub-Laplacians Sub-riemannian international online seminar. 08 January 2021.
- [9] Self-adjointness e teoria spettrale per (sub-)laplaciani singolari Seminario FIM, Universitá di Modena e Reggio Emilia, Italy. 25 January 2018.
- [10] 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.
- [11] Sur le caractère auto-adjoint et la théorie spectrale des opérateurs de type Hörmander singuliers Séminaire d'Analyse, Université de Tours. 09 November 2017.
- [12] Quantum confinement and spectral theory of (sub-)Laplacians Séminaire de Géométrie sous-riemannienne, IHP, Paris. 04 October 2017.
- [13] Quantum confinement in non-complete Riemannian manifolds 25e colloque Jeunes Chercheurs Alain Bouyssy, Orsay, Paris. 02 March 2017.
- [14] Neuro-geometry of vision and applications to image processing Seminario FIM, Universitá di Modena e Reggio Emilia, Italy. 11 February 2016.
- [15] 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.
- [16] Reconstruction and pattern recognition via the Citti-Petitot-Sarti model Séminaire "Statistique et imagerie", Université Paris-Dauphine. 19 January 2015.
- [17] Complexity of control-affine motion planning
 Séminaire de Théorie du Contrôle de Toulon, Université de Toulon. 30 January 2014.
- [18] The heat and Schrödinger equations on conic and anticonic-type
 Gdt Problémes spectraux et physisque mathématique, Université Paris Sud-Orsay. 18 December 2013.

- [19] Complexity of control-affine motion planning Séminaire de Géométrie sous-riemannienne, IHP, Paris. 02 October 2013.
- [20] The heat and Schrödinger equations on conic and anticonic-type surfaces A geometry day in Bicocca, Milan, Italy. 27 September 2013.
- [21] Complexity in affine control systems
 Journée GECO, UPMC, Paris. 25 June 2012.
- [22] 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

Mothertongue: Italian, Fluent: English, French