

Rossana Capuani

Curriculum Vitae

University of Trento, Italy
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Education

- 2020 **Postgraduate Teaching Training Program**, *University of Rome Tor Vergata*.
24 ECTS (200 hours) training program on Teaching of Mathematics, Cultural Anthropology, Psychology Of Groups, Experimental Pedagogy and Educational Technologies (Italian law DM616/17)
- 1 November 2014 – 24 April 2018 **Ph.D. in Mathematics**, *Joint Ph.D. program between University of Roma Tor Vergata and Paris-Dauphine University*, Supervisors: Prof. Piermarco Cannarsa (*University of Rome Tor Vergata*) and Prof. Pierre Cardaliaguet (*Paris-Dauphine University*).
Ph.D.'s Thesis: *Mean Field Games with state constraints*
- 1 October 2011 – 20 June 2014 **Master's Degree in Pure and Applied Mathematics**, *Federico II University, Naples*, Grade – 110/110 *cum laude*.
Master's Degree Thesis: *De Giorgi regularity theorem and nonlinear potential theory*.
- 1 October 2007 – 26 May 2011 **Bachelor's Degree in Mathematics**, *Federico II University, Naples*, Grade – 110/110 *cum laude*.
Bachelor's Degree Thesis: *Linear stability for the linear methods multistep*.

Internship

- 2009-2010 **Internship in High School Teaching**. 4 ECTS (60 hours) teaching at High School Liceo Scientifico Statale A. Nobel, Torre del Greco, Italy

Employment

- 1 August 2021 – present **Postdoctoral Fellow**, *Department of Mathematics, University of Trento, Italy*.
Supervisor: Prof. Fabio Bagagiolo
- 1 August 2020 – 31 July 2021 **Postdoctoral Fellow**, *Department of Computer Sciences, University of Verona, Italy*.
Supervisor: Prof. Antonio Marigonda
- 1 January 2019 – 31 December 2019 **Postdoctoral Fellow**, *Department of Mathematics, North Carolina State University, USA*.
Supervisor: Dr. Khai T. Nguyen
- 1 September 2018 – 31 December 2018 **Research Assistant**, *Department of Computer Sciences, University of Verona, Italy*, Supervisor: Prof. Riccardo Muradore.

Research Interests

- Multiagent systems
- Mean field games and control
- PDEs in connection with mean field game theory
- Optimal Transportation
- Heterogeneous agent models
- Economic models of real-world systems
- Traffic problems in operations research

Fellowships and Awards

- 2014-2018 **Scholarship for Doctoral Studies**, approx. 45,000 euros, *University of Rome Tor Vergata, Rome, Italy*.
- 2014-2018 **Member of the Doctoral Program of CEREMADE-Centre de Recherches en Mathématiques de la Decision**, *Paris-Dauphine University, Paris, France*.

2007-2013 **Best Performance Award 2007-2008, 2008-2009, 2010-2011, 2011-2012, 2012-2013**, Department of Mathematics, Federico II University, Naples Italy .

2015 **Call's Vinci 2015 for joint PhD program between Italian-France Universities, approx. 5,000 euros .**

Publications

Publications in Journals

- 2021 Cannarsa, P., Capuani, R. & Cardaliaguet, P. Mean field games with state constraints: from mild to pointwise solutions of the PDE system. *Calc. Var.* 60, 108, <https://doi.org/10.1007/s00526-021-01936-4>, 33 pages
- 2021 Capuani, R., Dutta, P., Nguyen, K. T., Metric entropy for functions of bounded total generalized variation, *SIAM J. Math. Anal.*, 53(1), DOI: 10.1137/20M1310953, 22 pages.
- 2020 Capuani, R., Gilmore, S., Nguyen, K. T., A model of debt with bankruptcy risk and currency devaluation, *Minimax Theory and its Applications* , 5, no. 2, 23 pages.
- 2018 Cannarsa, P., Capuani, R., and Cardaliaguet, P., $C^{1,1}$ -smoothness of constrained solutions in the calculus of variations with application to mean field games, *Mathematics in Engineering*, 1(1), doi:10.3934/Mine.2018.1.174, 29 pages.
- 2018 Cannarsa, P., Capuani, R., Existence and uniqueness for Mean Field Games with state constraints, "PDE models for multi-agent phenomena", P. Cardaliaguet, A. Porretta, F. Salvarani editors, Springer INdAM Series, 22 pages

Conference Proceedings

- 2021 Capuani, R., Marigonda, A., Mogentale, M., Random lifting of set-valued maps, **accepted** to appear In *Large-scale scientific computing*, Springer.

Submitted Paper

- 2021 Capuani, R., Di Persio, L., Kondratiev, Y., Ricciardi, M., da Silva, J.L., Random time dynamical system, **submitted**.

Work in Progress

- with A. Marigonda, *A model for multi-agent system with visibility constraints*.
- with A. Marigonda and A. Briggi (MSc student), *Methods of mean field control in S.A.R. operations*
- with A. Marigonda, M. Ricciardi, *Random Lift Of Set-Valued Maps And Applications*.
- with F. Bagagiolo and L. Marzifero, *Analysis of some models for pursuit-evasion game between two populations*.

Teaching Experience

- 2021 **Teaching at University of Verona**
- Spring 2021 **Instructor**, *Precalculus*.
- 2020 **Adjunct Lecturer** Department of Architecture, University of Reggio Calabria, Italy
- 2019 **Teaching at NCSU**
- Fall 2019 **Instructor**, *MA 141-Calculus I*.
- Spring 2019 **Instructor**, *MA 108-Precalculus II*.
- 2015-2017 **Teaching at Univeristy of Rome Tor Vergata**
- Fall 2017 **Teaching assistant**, *Analysis I*.
- Fall 2015 **Teaching assistant**, *Calculus II*.
- Spring 2015 **Teaching assistant**, *Ordinary Differential Equations*.
- Spring 2015 **Teaching assistant**, *Fourier Analysis*.

In addition, I have also taught a few sessions of the following courses and events:

April 2017-May 2017 **Sobolev Spaces and weak solutions**, Univerity of Rome Tor Vergata

July 2015-August 2015 **Instructor for "Test the Test"** Department of Civil Engineering and Architecture, University of Rome Tor Vergata, Italy

July **Instructor for "Test the Test"** Department of Medicine, University of Rome Tor Vergata, Italy
2015-August
2015

Student Supervision

- April 2021 – **Co-supervisor of the MSc thesis of A. Briggi**, *co-supervised with Prof. A. Marigonda*, University of
October 2021 Verona. **Title Thesis:** Methods of mean field control in S.A.R. operations, Grade: 110/110 cum laude.
- January **Co-supervisor of the PhD candidate Prerona Dutta**, co-supervised with Prof. Tien Khai Nguyen, North
2019–March Carolina State University, Raleigh, North Carolina, USA.
2020
- January **Co-supervisor of the PhD candidate Steven Gilmore**, co-supervised with Prof. Tien Khai Nguyen, North
2019–March Carolina State University, Raleigh, North Carolina, USA.
2020

Organization of Conferences and Seminars

- 2020 **"Online seminars in Analysis, Control and Inverse Problems for PDEs"**, organizers: Piermarco Cannarsa,
Rossana Capuani, Giuseppe Florida.
- January **Young Researcher Seminars, Maths Applications & Models**, organizers: Giacomo Albi,
2021-present Rossana Capuani, Antonio Marigonda, Michele Ricciardi, Nicola Sansonetto, Chiara Segala,
<https://mathseminarsverona.wordpress.com/>.

Research Visits

- December 2021 **Institute for Mathematical & Statistical Innovation**, *University of Chicago, Chicago, USA*, Invited as
a Research Member and as a participant in Long Program Distributed Solutions to Complex Societal
Problems..
- Jan. -Mar. 2020 **Prof. K. T. Nguyen**, *Department of Mathematics*, North Carolina State University, Raleigh, NC, USA.
- June 2019 **Prof. A. Marigonda**, *Department of Computer Science*, University of Verona, Verona, Italy.
- November 2018 **Prof. K. T. Nguyen**, *Department of Mathematics*, North Carolina State University, Raleigh, NC, USA.

Peer-Review Experience

Referee for SIAM J. Math. Anal, and Journal of Dynamical and Control Systems.

Selected Presentations in Conferences, Workshops and Seminars

- March 2022 **SIAM Conference on Analysis of Partial Differential Equations (PD22)**, 14-18 March 2022, Technical
University Berlin (Berlin - Germany). Invited talk for the minisymposium "Mean field games and applications"
organized by Jameson Graber and Alpar Meszaros. Invited talk's title: Mean Field Games with state
constraints: from mild to pointwise solutions of the PDE system.
- November 2021 **Seminar of Analysis**, with a **talk** entitled "*Random Lift Of Set-Valued Maps And Applications*", Department
of Mathematics, University of Trento(invited)
- June 2021 **13th International Conference on "Large-Scale Scientific Computations"**, with a **talk** entitled "*First
order Mean Field Games with state constraints*", Institute of Information and Communication Technologies,
Bulgarian Academy of Sciences, Sozopol, Bulgaria, (invited)
- April 2021 **Seminar of online Young Researcher Seminars, Maths Applications & Models**, with a **talk** entitled
"*First order Mean Field Games with state constraints*" Department of Computer Sciences, University of
Verona, (invited)
- September 2020 **XLV Summer School on Mathematical Physics**, with a **talk** entitled "*Metric entropy for functions of
bounded total generalized variation*" Ravello, Italy
- March 2020 **Seminar of Differential Equations and Nonlinear Analysis**, with a **talk** entitled "*Metric entropy for
functions of bounded total generalized variation*", Department of Mathematics, NCSU (invited)
- October 2019 **39th Southeastern-Atlantic Regional Conference on Differential Equations**, with a **talk** entitled
"*Introduction to Mean Field Games with state constraints*", Daytona Beach (Florida), USA
- August 2019 **The V AMMCS International Conference** with a **talk** entitled "*First order Mean Field Games systems
with state constraints*", Waterloo (Ontario), Canada

- June 2019 **Seminar of Analysis**, "*Mean Field Games with state constraints: from mild to pointwise solutions of the PDE system*", Department of Computer Sciences, University of Verona (invited)
- May 2019 **Indam intensive period-2019: Shape optimization, control and inverse problems for PDEs with a talk** entitled "*Mean Field Games with state constraints: from mild to pointwise solutions of the PDE system*", Naples, Italy(invited)
- February 2019 **Seminar of Differential Equations and Nonlinear Analysis**, with a **talk** entitled "*First order Mean Field Games with state constraints*" Department of Mathematics, NCSU (invited)
- November 2018 **Seminar of Analysis**, with a **talk** entitled "*Mean Field Games with state constraints*", Department of Mathematics, University of Trento, (invited)
- October 2018 **Seminar of Analysis**, with a **talk** entitled "*Fractional semiconcavity and some applications to state constrained problems*", Department of Mathematics, University of Padova, Italy (invited)
- September 2018 **Optimal Control and Mean Field Games** with a **talk** entitled "*First order Mean Field Games with state constraints*", Pavia, Italy (invited)
- August 2017 **Summer-school: VII Partial differential equations, optimal design and numerics** with a **talk** entitled "*Mean Field games with state constraints*", Benasque, Spain

Selected conferences and schools

- December 2021 **Mathematical Advances in Mean Field Games**, Institute for Mathematical & Statistical Innovation, Chicago, Illinois, USA
- December 2021 **Applications to Financial Engineering**, Institute for Mathematical & Statistical Innovation, Chicago, Illinois, USA
- November 2021 **Applications of Mean Field Games: from Models to Practice**, online
- November 2021 **Mean-Field Models for interacting agents**, online
- October 2021 **Aggregate Dynamics in Models with Heterogeneous Agents**, online
- October 2021 **Short Courses on the Mean Field Approach in Machine Learning and Statistics**, online
- September 2021 **Analysis, Control, and Numerics for PDE Models of Interest to Physical and Life Sciences**, online
- September 2021 **New Trends in Nonlinear Diffusion: a Bridge between PDEs, Analysis and Geometry**, online
- July 2021 **INdAM workshop Analysis and Numerics of Design, Control and Inverse Problems**, online
- June 2021 **Summer School: Model Order Reduction and Applications**, Cetraro, Italy
- May 2021 **Workshop on Control Theory and Partial Differential Equations**, online
- September 2020 **Variational methods in nonlinear phenomena**, online
- September 2020 **XLV Summer School on Mathematical Physics**, Ravello, Italy
- November 2020 **15th Young Researchers Workshop in Geometry, Mechanics, and Control**, online
- June 2019 **Singular Nonlinear Problems in Calculus of Variations and PDEs**, Naples, Italy
- June 2019 **Summer-school: Mean Field Games**, Cetraro, Italy.
- November 2018 **Optimal Transportation and Applications**, Pisa, Italy
- June 2018 **METE: Mathematics and Economics: Trends and Explorations**, Zurich, Switzerland.
- December 2017 **First meeting of the French-German-Italian LIA on applied analysis**, Paris, France.
- July 2017 **INdAM Workshop-New trends in control theory and PDEs**, Rome, Italy.
- June 2017 **Variational analysis and equilibrium models in physical and socio-economic phenomena**, Naples, Italy.
- June 2017 **Mean field games and related topics-4**, Rome, Italy.
- March 2017 **Mathematical Approach to climate change Impacts-MAC²I**, Rome, Italy.
- December 2016 **PDE Models for Multi-agent phenomena**, Rome, Italy.
- February 2016 **Nonlinear PDEs: Optimal Control, Asymptotic Problems and Mean Field Games**, Padua, Italy.
- June 2015 **The Hamiltonian-Jacobi equation : at the crossroads of PDE, Dynamical Systems and Geometry**, Cortona, Italy.
- June 2015 **MFG and Related Topics-3**, Paris, France.
- April 2015 **Workshop on Control of PDEs**, L'Aquila, Italy.
- July 2014 **Summer-school: ERC School on Free Discontinuity Problems**, Pisa, Italy.

Research Groups

- 2020–present time Member of research group Contemporary Applied Mathematics, University of Verona, Verona, Italy
- 2020–present time Member of research group AI&ML&MAT-Mathematics for Artificial Intelligence & Machine Learning of UMI (Italian Mathematical Union)
- 2020–present time Member of research group PRISMA-PRobability In Statistics, Mathematics and Applications of UMI (Italian Mathematical Union)
- 2019-2020 Member of Nonlinear Analysis thematic group, North Carolina State University, Raleigh, NC, USA
- 2018– present time Member of UMI - Unione matematica Italiana
- 2015–present time Member of GNAMPA (research group in mathematical analysis, probability theory and applications) of INdAM (Italian National Institute of High Mathematics)

Research Projects

- 2018 Analytical aspects of mean field optimal control for multi-agent systems project. Funded by University of Verona. Role in the project: Participant. Value: 4.500 euros
- 2015-2018 LEARN.NET project. Funded by ECOS-SUD, Chile-France collaboration. Role in the project: Participant. Value: 50.000 euros.
- 2015 GNAMPA 2015 "Processi di diffusione degeneri o singolari legati al controllo di dinamiche stocastiche" (Degenerate or singular diffusion processes related to the control of stochastic dynamics). Funded by INdAM (Italian National Institute of High Mathematics). Role in the project: Participant. Value: 2.600 euros

Diversity and Inclusion projects

- 2020-2021 **Co-organizer** of 'Name them to stop them' campaign to tackle harassment, mobbing, sexism, racism, and any other form of discrimination and cyberbullying. Department of Computer Science, University of Verona, Italy.
- 2020-2021 **Next Future Challenges for the University Internalization** project. Main aim: Project in which testimonials and opinions of international students are collected to improve their experience at the host university. Role in the project: Principal Investigator. Department of Computer Science, University of Verona, Italy.

Software Languages

Matlab, C, Julia and Fortran 95

Personal Development

- December 2021 **Job Talks & Stage Presence**, Workshop offered by Institute for Mathematical and Statistical Innovation, University of Chicago, Illinois, United Stated, 2 days.
- November 2021 **Writing a press release**, Workshop offered by Institute for Mathematical and Statistical Innovation, University of Chicago, Illinois, United Stated, 2 days.
- November 2020 **Julia Coursework**, Course offered by AI2S-Artificial Intelligence Student Society, Trieste, Italy, 3 days.

Language skills

Italian

Native speaker

English

Fluent in listening, reading, writing and speaking

French

Basic

Spanish

Basic