Danilo Pezzi

Email: danilo.pezzi@unimore.it
Address: Via Campi 213/b, 41125, Modena (MO), Italy.

Current Position

- **Postdoctoral Researcher** — Modena, Italy
  Università di Modena e Reggio Emilia — *Dec 2023 - Present*

Education

- **Università degli Studi di Parma** — Modena, Italy
  PhD in Mathematics — *2020 - 2024*
  Supervisor: *Prof. Silvia Bonettini*

- **Università degli Studi di Modena e Reggio Emilia** — Modena, Italy
  Master's Degree in Mathematics — *2018-2020*
  Thesis: *Convex Analysis and Optimization: Splitting Methods.*

- **Università degli Studi di Modena e Reggio Emilia** — Modena, Italy
  Bachelor's Degree in Mathematics - Summa Cum Laude — *2015-2018*
  Thesis: *Reed-Solomon Codes in CDs.*

Research Interests

My research focuses on numerical optimization for inverse problems, with a particular interest on imaging applications combined with modern machine and deep learning techniques. Currently, I am working on:

- Bilevel optimization schemes to learn variational models as well as the lower level solvers.

- First-order forward-backwards schemes to solve composite optimization problems where the objective terms may be non-differentiable and/or non-convex.

Publications

- S. Bonettini, L. Calatroni, D. Pezzi, M. Prato, "Algorithmic unfolding for image reconstruction and localization problems in single-molecule fluorescence microscopy", in *IMA Journal of Applied Mathematics*, 2026. doi:10.1093/imamat/hxaf025
- S. Bonettini, G. Franchini, D. Pezzi, M. Prato, "Linesearch-enhanced forward–backward methods for inexact nonconvex scenarios", in *SIAM Journal on Imaging Sciences*, 2025. doi:https://doi.org/10.1137/24M1675977
- C. Scribano, D. Pezzi, G. Franchini, M. Prato, "Denoising Diffusion Models on Model-Based Latent Space", in *Algorithms*, 2023. doi:10.3390/a16110501
- S. Bonettini, D. Pezzi, M. Prato, S. Rebegoldi, "On an Iteratively Reweighted Linesearch Based Algorithm for Nonconvex Composite Optimization", in *Inverse Problems*, 2023. doi:10.1088/1361-6420/acca43
- S. Bonettini, G. Franchini, D. Pezzi, M. Prato, "Explainable Bilevel Optimization: an Application to the Helsinki Deblur Challenge", in *Inverse Problems and Imaging*, 2023. doi:10.3934/ipi.2022055
- S. Bonettini, G. Franchini, D. Pezzi, M. Prato, "Learning the Image Prior by Unrolling an Optimization Method", in *2022 30th European Signal Processing Conference (EUSIPCO)* doi:10.23919/EUSIPCO55093.2022.9909852

Talks at Conferences and Workshops:

- **Applied Inverse Problems (AIP 2025), Rio de Janeiro, Brazil, 28 July - 1 August 2025:** speaker at the minisymposium "Recent trends and advances in imaging: models, methods, and applications" organized by G. Franchini, A. Sebastiani and S. Tozza.
- **Math to Product (M2P 2025), Valencia, Spain, 4–6 June 2025:** speaker at the minisymposium "Challenges And Innovative Solutions In Optimization And Data-Driven Approaches For Industrial And Real-World Problems" organized by P. Cascarano, E. Govi and F. Mezzadri.
- **UMI Workshop - Mathematics For Artificial Intelligence And Machine Learning (M4AIML 2025), Bari, Italy, 29–31 January 2025**
- **6th Dolomites Workshop on Constructive Approximation and Applications, Alba di Canazei, Italy, 9–13 September 2024:** speaker for the session "Approximation, AI and inverse problems: A physics-driven perspectives" organized by S. Guastavino and E. Perracchione.

- **GIMC SIMAI Young, Naples, Italy, 10–12 July 2024:** speaker at the minisymposium "Advances in optimization methods with applications to real-world challenges" organized by D. Carbonaro, N. Ferro and F. Mezzadri.
- **Siam Conference on Imaging Science (IS24), Atlanta, USA, 27 May - 1 June 2024:** speaker at the minisymposium "Deep Unrolled Optimisation Methods for Inverse Imaging Problems" organized by E. Papoutsellis, K. Papafitsoros and A. Kofler.
- **Siam Conference on Uncertainty Quantification (UQ24), Trieste, Italy, 27 February - 1 March 2024:** speaker at the minisymposium "Handling Uncertainties in Industry" organized by G. Franchini and D. Bigoni.
- **Numerical Computations: Theory and Algorithms (NUMTA23), Pizzo Calabro, Italy 14–20 June 2023:** speaker for the special session "Optimization for Data Driven Methods" organized by G. Franchini, F. Porta and S. Rebegoldi.
- **Workshop "Matematica per l'Intelligenza Artificiale e il Machine Learning: Giovani ricercatori", Turin, Italy, 24–26 November 2022.**
- **1st French-Italian workshop on the Mathematics of Imaging, Vision and their Applications, Sophia-Antipolis, France, 12–14 September 2022.**
- **30th European Signal Processing Conference (EUSIPCO 2022) - Belgrade, Serbia 29 August - 2 September 2022:** speaker for the special session "Advanced Optimization Methods for Learning in Image Processing" organized by I. Ben Ayed, J.-C. Pesquet and by A. Repetti.
- **Siam Conference on Imaging Science (IS22) - Berlin (virtual), 21–25 March 2022:** speaker at the minisymposium "Novel perspectives in optimization and machine learning for imaging" organized by Dr. S. Crisci and G. Franchini

Organization:

- **SIMAI, Trieste, Italy, 1-5 September 2025:** organized the two minisymposia "From Classical to Data-Driven: Modern Trends in Optimization and Regularization (Part 1)" and "From Classical to Data-Driven: Modern Trends in Optimization and Regularization (Part 2)" in collaboration with G. Franchini and S. Rebegoldi.

Teaching

- **Lecturer (adjunct)** 2024-2025
  Geometry course, Bachelor's Degree in Computer Engineering:
  - 20 hours of in-person lectures.
  - Final oral examination.
- **Tutor** 2023
  Practical exercises sessions for the students of the following courses at Unimore:
  - **Mathematics I:** for the Bachelor degree in Chemistry.
  - **Fundamentals of Calculus** for the Bachelor degree in Computer Engineering.
- **Tutor** 2022
  Mathematics pre-enrollment class for degree course in Computer Science
- **Tutor** 2021-2022
  Practical exercises sessions for the students of the following courses at Unimore:
  - **Calculus A:** for the Bachelor degree in Computer Science.
  - **Linear Algebra** for the Bachelor degree in Computer Science.
  - **Fundamentals of Calculus:** for the Bachelor of Computer Engineering.
- **Tutor** 2020-2021
  Practical exercises sessions for the students of the following courses at Unimore:
  - **Calculus A** for the Bachelor degree in Mathematics.
  - **Algebra A** for the Bachelor degree in Mathematics.
  - **Fundamentals of Calculus** for the Bachelor degree in Computer Engineering.

Public Engagement

- **European Researchers' Night - Modena, 26 September 2025** Member of the team organizing the exhibition "Neuroni artificiali, errori reali. Anche l'IA sbaglia, ma con rigore matematico".
- **Play: Festival del gioco - Bologna, 4 April 2025** Member of the team organizing the exhibition "Sei più bravo dell'intelligenza artificiale?".
- **European Researchers' Night - Modena, 27 September 2024** Member of the team organizing the exhibition "Paperelle, gatti ed Orietta Berti: l'incredibile mondo dell'Intelligenza Artificiale!".
- **Play: Festival del gioco - Modena, 17-18 May 2024** Member of the team organizing the exhibition "Sei più bravo dell'intelligenza artificiale?".
- **Notte dell'Intelligenza Artificiale - Modena, 24 January 2024** Member of the team organizing the exhibition "Fantavip".
- **European Researchers' Night - Modena, 29 September 2023** Member of the team organizing the exhibition "Anche la matematica ha emozioni".
- **European Researchers' Night - Modena, 30 Septmeber 2022** Member of the team organizing the exhibition "Intelligenza artificiale: la matematica è l'unica cosa di cui avrai bisogno".

Visiting

- **Laboratoire i3S / Université Côte d'Azur** On invitation by Luca Calatroni. February 2024.
- **Laboratoire i3S / Université Côte d'Azur** On invitation by Luca Calatroni. October - November 2023.

Funding

I have participated in the following Italian national research projects

- **GNCS Project, 2025** "Problemi di elaborazione di immagini descritti da modelli con incertezza".
- **GNCS Project, 2024** "Deep Variational Learning: un approccio combinato per la ricostruzione di immagini".
- **GNCS Project, 2023** "Modelli e metodi avanzati in Computer Vision".
- **PRIN Project, 2022** "Sustainable Tomographic Imaging with Learning and rEgularization (STILE)".
- **PRIN Project, 2022** "Inverse Problems in the Imaging Sciences (IPIS)".
- **GNCS Project, 2022** "Ottimizzazione Adattiva per il Machine Learning".