Paolo Conti

Milano, Italy • Via Piccinni, 23 • paolo.conti@polimi.it • (+39)3406332219 • www.paolo-conti.com •

Education

Ph.D. in Scientific Machine Learning May 2021 – Ongoing (Expected Sept 2024)
Polytechnic University of Milan Milan, Italy

Conducted advanced research in scientific machine learning (ML), focusing on the conceptualization, design, and implementation of algorithms aimed at advancing data-driven modeling of physical systems in computational science and engineering. Key achievements include:

- Developed interpretable and uncertainty-aware ML frameworks for modeling and simulating complex dynamical systems using generative AI and reduced-order modeling techniques, with applications in fluid dynamics, microelectromechanical systems (MEMS), and computational biology.
- Created cutting-edge multi-fidelity and multi-modal techniques to accelerate and improve the accuracy of long-term forecasting for high-dimensional dynamical systems by leveraging multiple data sources.

Teaching Assistant for courses in Numerical Mathematics, Dynamical Systems, and Scientific Communication.

MSc in Mathematical Engineering Sept 2018 – Apr 2021
Polytechnic University of Milan – Score: 110/110 cum laude Milan, Italy

- MSc. Thesis: *"*Multi-fidelity regression with artificial neural networks: efficient approximation of output quantities for parametrized systems*"*. Advisor: Prof. A. Manzoni.
- **Relevant Coursework**: Algorithms and parallel computing; Advanced methods for scientific computing; Numerical methods for partial differential equations; Applied and Bayesian statistics; Model identification and data analysis; Biomathematical modeling.

BSc in Mathematical Engineering Sept 2015 – Sept 2018
Polytechnic University of Milan – Score: 110/110 Milan, Italy

- BSc. Thesis: "Stationary Schrödinger equation: existence of a fundamental state". Advisor: Prof. S. Salsa.

Experiences

Visiting Researcher Oct 2023 – Dec 2023
Imperial College London (Nov 2023 – Dec 2023) London, UK
SimTech Cluster of Excellence – University of Stuttgart (Oct 2023 – Nov 2023) Stuttgart, Germany

Led a research project to develop generative AI/ML frameworks for data-driven, reduced-order modeling under uncertainty.

- Conceptualized and implemented a data-driven framework based on variational reduced-order modeling with variational dynamics identification for scientific discovery in the presence of model and measurement uncertainties.
- Developed the Python package VINDy to perform data-driven modeling of dynamical systems with generative AI.

Research Intern Oct 2022 – May 2023
Artificial Intelligence Institute in Dynamic System – University of Washington Seattle (WA), USA

Advisors: Prof. J. Nathan Kutz, Prof. Steven L. Brunton.

- Designed and constructed data-driven methods to create physical models from time-series data of engineering devices. Applications and validation on MEMS micromirror and resonator devices from STMicroelectronics, as well as on fluid dynamics systems.
- Developed a multi-fidelity method to recover and predict high-quality solutions from multiple, low-fidelity data sources.

Study Exchange Sept 2019 – July 2020
Sorbonne University Paris, France

Study abroad coursework in the departments of Applied Mathematics of Sorbonne University and at Sorbonne Polytech.

Publications

github.com/ContiPaolo

- **Conti**, Kneifl, Frangi, Manzoni, Fehr, Brunton, Kutz, "VENI, VINDy, VICI: a variational reduced-order modeling framework with embedded uncertainty quantification", *arXiv,* 2024. VENI-VINDy-VICI.
- Rosafalco, **Conti**, Manzoni, Mariani, Frangi, "EKF-SINDy: Empowering the extended Kalman filter with sparse identification of nonlinear dynamics", *Computer methods in applied mechanics and engineering*, 2024. EKF-SINDy.
- **Conti**, Guo, Manzoni, Frangi, Brunton, Kutz, "Multi-fidelity reduced-order surrogate modelling*", Proceedings of Royal Society A*, 2024. MultiFidelity_POD.
- **Conti**, Gobat, Fresca, Manzoni, Frangi, "Reduced order modeling of parametrized systems through autoencoders and SINDy approach: continuation of periodic solutions", *Computer methods in applied mechanics and engineering*, 2023.
- **Conti**, Guo, Manzoni, Hesthaven, "Multi-fidelity surrogate modeling using long short-term memory networks", *Computer methods in applied mechanics and engineering*, 2023. MultiFidelity_NNs.
- Guo, Manzoni, Amendt, **Conti**, Hesthaven, "Multi-fidelity regression using artificial neural networks: efficient approximation of parameter-dependent output quantities", *Computer methods in applied mechanics and engineering*, 2022. MultiFidelity_NNs.

Software and scientific projects

github.com/ContiPaolo

- **VINDy package** Python – Developed a python package for dynamics identification based on generative AI.
- **EKF-SINDy digital twin** Python – Coupling data assimilation with system identification to build a digital twin.
- **Multi-fidelity tutorial** Python at the "Scientific ML and Dynamical Systems" Autumn School Amsterdam.
- **Applied Statistics** R *"What do you need to climb the charts?"* – Analysis of Spotify Dataset.
- **Model Identification** Python MATLAB "*Modeling from measurements"* – Implemented numerical and machine learning techniques for data-driven dynamics identification.
- **High performance computing** CUDA "*GPU Merge Path*": batch merge and merge path sorting algorithms**.**
- **C++ library implementation** C/C++ **"***Poisson differential equation solver"* – Implemented a library for the finite difference resolution of partial differential equations.

Achievements

Academic awards

- *Best Poster Award* at the 6th International Workshop on Model Order Reduction Techniques (MORTech).
- *Best Project Award* at Deep Learning School at the Machine Learning Genoa Center.
- *Academic & Athletic Merit scholarship,* awarded by Polytechnic Univ. of Milan. Four times recipient, 2015 – 2018.

Sport Career awards – Aerobic Gymnastics

- *Medal of Athletic Value for the sport career,* awarded by the Italian National Olympic Committee in 2023.
- *Oscar awards for Gymnastics,* awarded by the Italian National Olympic Committee in 2015.
- World Championship medalist in 2021, 2016 and European Champion in 2015.
- Italian National Champion in 2021 and Member of the National Team of Aerobic Gymnastics from 2010 to 2021.

Skills

Programming: Python (Tensorflow), C/C++, R, MATLAB, SQL, CUDA.

Languages: English (Fluent), Italian (Native Language), French (Intermediate), Spanish (Intermediate).

Activities

LGBTQIA+ right activist and volunteer in *Bergamo Pride*

- Organized and coordinated *Bergamo Pride* (2020 – 2024). Promoted and organized awareness and prevention events; fundraising and volunteering programs for the LGBTQIA+ community; educational and social activities.

International gymnastic coach and choreographer

- Coached and choreographed teams in Italy, France, Finland, Hungary, Lithuania and USA.

Selected conferences and workshops

Invited seminar

- *"Data-driven modeling of nonlinear dynamical system*" seminar talk at the Alan Turning Institute for data science and artificial intelligence – London, May 2024.
- "*Between the physical and digital worlds*" seminar talk – Milan, Jan 2024.
- *"Modeling from measurements*", seminar talk at the SimTech institute of University of Stuttgart – Stuttgart, Oct 2023.
- "*A day in artificial intelligence & dynamical systems*" at Politecnico di Milano – Milan, July 2023.

Oral presenter

- 9th European Congress on Computational Methods in Applied Sciences & Eng. (ECCOMAS24) – Lisbon, June 2024.
- SIAM conference on uncertainty quantification (SIAM UQ24) – Trieste, Feb 2024.
- Math 2 Product (M2P) Emerging Technologies in Computational Science – Taormina, May 2023.
- AAAI Symposium on computational approaches to scientific discovery – San Francisco, Mar 2023.
- SIAM conference on computational science and engineering (CSE23) – Amsterdam, Feb 2023.
- DICA PhD talk – Milan, July 2021.

Poster presenter

- 6^{th} International Workshop on Model Order Reduction Techniques (MORTech) – Paris, Nov 2023.
- Common Task Framework for AI in Science and Engineering – Seattle, Feb 2023.
- Mediterranean Machine Learning (M^2L) Summer School (organized by Google DeepMind) – Milan, Sept 2022.

Participant

- Neural Information Processing Systems (NeurIPS 2022) – New Orleans, Nov 2022.
- Mathematics of Machine Learning summer school (organized by MSRI) – Cortona, Aug 2022.