Gloria Pietropolli

Gloria **Pietropolli**

PostDoc

University of Trieste, Italy

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Research Backgorund

During my PhD in Computer Science at the University of Trieste, I focused and centered my research in the field of evolutionary computation. My work has spanned different methods, including (but not limited to) evolutionary algorithms, genetic programming, and grammatical evolution, with a focus on developing new algorithms and on practical problem-solving applications – primarily using Python, Java, and Julia. My collaborative research experiences, including work with international institutes (Massachusetts Institute of Technology (MIT), the NOVA Institute in Lisbon, the University of Milano-Bicocca, and the University of Strathclyde), have refined my capabilities. During my PhD I also have been actively involved in developing deep learning algorithms and applying these methods to various scientific domains, including ocean biogeochemical modeling and AI-based medical research.

Education

University of Trieste & National Institute of Oceanography and Applied Geophysics *Trieste*

PhD Earth Science, Fluid-Dynamics, and Mathematics. Interactions and Methods *01/10/2020 - 21/03/2024*

- Thesis Title: Machine Learning Applications to Data Reconstruction in Marine Biogeochemistry.
- Advisors: Luca Manzoni, Gianpiero Cossarini

University of Padua *Padua*

MS Mathematics *01/10/2018 - 18/07/2020*

- Thesis Title: "Stabilized formulation using the Material Point Method". *Advisor: Antonia Larese.*
- Grade: 110/110

University of Padua *Padua*

Bachelor Mathematics *01/10/2015 - 20/07/2018*

- Thesis Title: "Studio di un modello di genetica spaziale". *Advisor: Marco Favretti.*
- Grade: 95/110

Appointments

2024-present **Postdoctoral Fellowship**, *University of Trieste*.

2023 **Independent Research Contract (1 months)**, Conducting experimental campaign evaluations of optimization algorithms based on the computational paradigm of cellular automata. *University of Trieste*.

2023 **Independent Research Contract (2 months)**, Integrated pathways of diagnosis, therapy, and assisted care management for multimorbid individuals at risk of atrial fibrillation. *University of Trieste*.

Teaching

2023	**Lecturer: Introduction to Computing**, BSc Artificial Intelligence and Data Analytics - University of Trieste
2022	**Teaching Assistant: Computer Architecture** , BSc Artificial Intelligence and Data Analytics - University of Trieste
2021-2022	**Teaching Assistant: Algorithms and Data Structures** , BSc Artificial Intelligence and Data Analytics - University of Trieste
2021	**Teaching Assistant: Computer Programming** , BSc Mathematics - University of Trieste
2020	**Teaching Assistant: Linear Algebra and Geometry** , BSc Environmental and Spatial Engineering - University of Padua
2019	**Teaching Assistant: Numerical Calculation** , BSc Energy Engineering - University of Padua
2018-2019	**Teaching Assistant: Analysis 1**, BSc Physics, Astronomy - University of Padua

International Visit

2024	**Research Visit**, NOVA University of Lisbon. **Leonardo Vanneschi, Mauro Castelli**; April-June 2024 (3 months).	*Lisbon*
2024	**Research Visit**, Massachusetts Institute of Technology. **Una-May O'Reilly**; Jan 2024 (1 month).	*Cambridge*
2022	**Guest**, University Cote d'Azur. **Enrico Formenti**; 25 Sep-1 Oct 2022 (1 week).	*Nice*

Peer-Reviewed Journal Publications

Marchetti, F., **Pietropolli, G.**, Verdù, F. J. C., Castelli, M., Minisci, E. (2024).
Automatic design of interpretable control laws through parametrized Genetic Programming with adjoint state method gradient evaluation. *Applied Soft Computing*.

Amadio, C., Teruzzi, A., **Pietropolli, G.**, Manzoni, L., Coidessa, G., Cossarini, G. (2024).
Combining neural networks and data assimilation to enhance the spatial impact of Argo floats in the Copernicus Mediterranean biogeochemical model. *Ocean Science*.

Leporati, A., Manzoni, L., Mauri, G., **Pietropolli, G.**, Zandron, C. (2023).
Inferring P systems from their computing steps: An evolutionary approach. *Swarm and Evolutionary Computation*.

Pietropolli, G., Manzoni, L., Cossarini, G. (2023).
Multivariate Relationship in Big Data Collection of Ocean Observing System. *Applied Sciences*.

Nadizar, G., **Pietropolli, G.** (2023).
A grammatical evolution approach to the automatic inference of P systems. *Journal of Membrane Computing*.

Pietropolli, G., Menara, G., Castelli, M. (2023).
A Genetic Programming Based Heuristic to Simplify Rugged Landscapes Exploration. *Emerging Science Journal*

Pietropolli, G., Manzoni, L., Paoletti, A., Castelli, M. (2023).
On the hybridization of geometric semantic GP with gradient-based optimizers. *Genetic Programming and Evolvable Machines*

Castelli, M., Manzoni, L., Mariot, L., Menara, G., **Pietropolli, G.** (2022).
The Effect of Multi-Generational Selection in Geometric Semantic Genetic Programming. *Applied Sciences*.

Peer-Reviewed Conference Publications

Tonelli, T., **Pietropolli, G.**, Sbaiz, G., Manzoni, L. (2024, July).
Genetic Programming for the Reconstruction of Delay Differential Equations in Economics.
In Proceedings of the Genetic and Evolutionary Computation Conference Companion (**GECCO 2024**).

Jorgensen, S., Nadizar, G., **Pietropolli, G.**, Manzoni, L., Medvet, E., O'Reilly, U. M., Hemberg, E. (2024, July).
Large Language Model-based Test Case Generation for GP Agents.
In Proceedings of the Genetic and Evolutionary Computation Conference Companion (**GECCO 2024**).

Pietropolli, G., Nichele, S., Medvet, E. (2024, July).
The Role of the Substrate in CA-based Evolutionary Algorithms.
In Proceedings of the Genetic and Evolutionary Computation Conference Companion (**GECCO 2024**).

Ferreira, J., Castelli, M., Manzoni, L., **Pietropolli, G.** (2023, March).
A Self-Adaptive Approach to Exploit Topological Properties of Different GAs' Crossover Operators.
In Genetic Programming: 26th European Conference, Held as Part of EvoStar 2023 (**EuroGP 2023**).

Pietropolli, G., Camerota Verdù, F. J., Manzoni, L., Castelli, M. (2023, July).
Parametrizing GP Trees for Better Symbolic Regression Performance through Gradient Descent.
In Proceedings of the Companion Conference on Genetic and Evolutionary Computation (**GECCO 2023**).

Pietropolli, G., Manzoni, L., Paoletti, A., Castelli, M. (2022, April).
Combining geometric semantic gp with gradient-descent optimization.
Genetic Programming: 25th European Conference, Held as Part of EvoStar 2022 (**EuroGP 2022**).

Pietropolli, G., Cossarini, G., Manzoni, L. (2022, September).
GANs for Integration of Deterministic Model and Observations in Marine Ecosystem.
In Progress in Artificial Intelligence: 21st EPIA Conference on Artificial Intelligence (**EPIA 2022**).

Abstracts and Local Proceedings

Pietropolli, G., Manzoni L., Cossarini G. (2023, May).
A convolutional deep learning approach for the reconstruction of nutrient and carbonate system variable profiles.
54th International Liege Colloquium On Ocean Dynamics.

Amadio C., Teruzzi A., **Pietropolli G.**, Manzoni L., Coidessa G., Cossarini G. (2023, May).
Combining Neural Networks and Data Assimilation to enhance the spatial impact of Argo floats in the Copernicus Mediterranean biogeochemical model.
54th International Liege Colloquium On Ocean Dynamics.

Fabri, M.E., **Pietropolli, G.**, Manzoni L. (2022, September).
Construction of semi-uniform membrane structures in a uniform way.
23rd Conference on Membrane Computing - Local Proceedings (**CMC 2022**).

Nadizar, G., **Pietropolli, G.** (2022, September).
P Systems inference via Grammatical Evolution.
23rd Conference on Membrane Computing - Local Proceedings (**CMC 2022**).

Under Review

Pietropolli, G., Manzoni L., Cossarini G.
PPCon 1.0: Predict Profiles Convolutional, a Novel Deep Learning approach for Smooth Nutrient Profile Predictions.

Talks Given at Conferences and Workshops

4th workshop HPC-TRES.
Contributed Talk: *Multivariate relationship in big data collection of Ocean Observing System*.
December 2021, online.

EuroGP 2022 - European Conference on Genetic Programming (Part of EvoStar).
Contributed Talk: *Combining geometric semantic gp with gradient-descent optimization*.
April 2022, Madrid (Spain).

Epia 2022 - 21st EPIA Conference on Artificial Intelligence.
Contributed Talk: *GANs for Integration of Deterministic Model and Observations in Marine Ecosystem*.
September 2022, Lisbon (Portugal).

CMC 2022 - 23rd Conference on Membrane Computing.
Contributed Talk: *P Systems inference via Grammatical Evolution*.
September 2022, Trieste (Italy).

5th workshop HPC-TRES.
Contributed Talk: *GANs for integration of deterministic model and observations in marine ecosystem*.
January 2023, Trieste (Italy).

EuroGP 2023 - European Conference on Genetic Programming (Part of EvoStar).
Contributed Talk: *A Self-Adaptive Approach to Exploit Topological Properties of Different GAs' Crossover Operators*.

April 2023, Brno (Czech Republic).

54th International Liege Colloquium On Ocean Dynamics.
Contributed Talk: *A convolutional deep learning approach for the reconstruction of nutrient and carbonate system variable profiles*.
May 2023, Liegi (Belgium).

Attended Conferences, Workshops and Schools

Workshop: *3th workshop HPC-TRES*. December 2020, online.

Summer School: *4th Advanced Course on Data Science and Machine Learning ACDL2021.* July 2021, online.

Summer School: *Deep Learning.* July 2022, Gran Canaria.

Research Project

2023 **ISCRA class C project IsCa8-MEDConTr**, 80000 core processor hours awarded by CINECA through ISCRA (Italian SuperComputing Resource Allocation) on the supercomputer LEONARDO.

Thesis Mentoring

2020-2021	**Jury Paglierani**, BSc student; *"Approcci alla simulazione di sistemi fisici mediante l'utilizzo di reti neurali"*.	*Trieste*
2022	**Marie-Eva Fabbri**, Master student; *"Construction of semi-uniform membrane structures in a uniform way"*.	*Lyon*
2023	**Teresa Tonelli**, Master student; *"Genetic programming to reconstruct alkalinity distribution in Mediterranean Sea"*	*Trieste*
2023	**Ines Ferreria**, Master student; *"Unleashing the Power of Convolutional Transformers for Advanced Environmental Analysis"*	*Lisbon*

Refereeing Duties

Journals: Genetic Programming and Evolvable Machines (GPEM), AI Communications (AIC), IEEE Transactions on Artificial Intelligence (TAI), Journal of Cellular Automata (JCA), Natural Computing, Data Mining and Knowledge Discovery.

Conferences: International Conference on WORDS (WORDS 2023), European Symposium on Algorithms (ESA 2023), European Conference On Artificial Intelligence (ECAI 2024), The Conference on Artificial Life (ALIFE 2024).

Committee Memberships

2024	**Local Chair**, The Leading European Event on Bio-Inspired AI (**EvoStar 2024**)	*Trieste*
2024	**Program committee**, European Conference On Artificial Intelligence (**ECAI 2024**)	*Santiago de Compostela*
2024	**Program committee**, The Conference on Artificial Life (**ALIFE 2024**)	*Copenhagen*
2023	**Student activities committe**, European Conference on Genetic Programming (**EuroGP 2023**)	*Brno*
2023	**Organizing committee**, The 29th International Workshop on Cellular Automata and Discrete Complex Systems (**Automata 2023**)	*Trieste*

Personal Skills

Languages

Italian (native) **- English** (proficiency)

Programming

Python (PyTorch, Tensorflow, Pandas, NetCDF, gplearn) **- Julia - Matlab**

Software

LaTeX - Excel