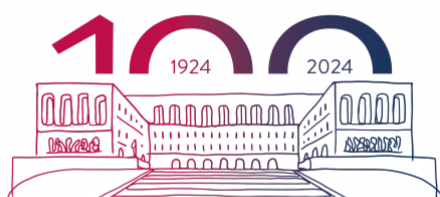


University of Trieste

Species Scholarship host candidate



**UNIVERSITÀ
DEGLI STUDI
DI TRIESTE**

PIs at the host institution

Eric Medvet (<https://medvet.inginf.units.it/>) is an Associate Professor in Computer Engineering at the Department of Engineering and Architecture of University of Trieste, Italy. He founded and leads the **Evolutionary Robotics and Artificial Life lab** (ERAllab, <https://erallab.inginf.units.it/>); he is the co-founder and co-head of the Machine Learning Lab. His research activities include evolutionary computation, artificial life, embodied intelligence, and the application of machine learning techniques to engineering and computer security problems (e.g., mobile malware analysis and detection). He serves as reviewers for many international journals closely related to his research interests; he is a member of the scientific/program committee of the most important conferences on evolutionary computation. He authored and co-authored more than 150 peer-reviewed articles on international journals or conferences, with more than 20 coauthors. He was a recipient of the Google Faculty Research Award 2020.

Luca Manzoni (<https://naturalcomputinglab.github.io/people/lmanzoni>) is an Associate Professor in Computer Science at the Department of Mathematics and Geosciences of the University of Trieste and an affiliate member of the National Institute of Oceanography and Applied Geophysics (OGS). He is currently the head of the **Natural Computing Laboratory** (NaCL, <https://naturalcomputinglab.github.io/>). He works in the areas of Evolutionary Computation, Artificial Intelligence, and Natural Computing. He published more than 130 articles in international conferences and journals with more than 80 co-authors. He received multiple awards for his research work, among them two best paper awards at the Conference on Membrane Computing (in 2018 and 2014), the best paper award at the EuroGP 2013 conference, and he was among the recipients of the 2022 SIGEVO Impact Award.

Research group

The research group is based on two highly interacting labs:

- Evolutionary Robotics and Artificial Life lab (ERALLab, <https://erallab.inginf.units.it/>)
- Natural Computing Laboratory (NaCL, <https://naturalcomputinglab.github.io/>)
- Machine Learning lab (MaLeLab, <https://machinelearning.inginf.units.it/>)



Jointly, the group is currently composed of academic staff:

- Eric Medvet (associate professor, head of ERALLab)
- Luca Manzoni (associate professor, head of NaCL)
- Sylvio Barbon Junior (associate professor, head of MaLeLab)
- Alberto Bartoli (associate professor)
- Andrea De Lorenzo (assistant professor)
- Laura Nenzi (assistant professor)
- Martino Trevisan (assistant professor)

PhD students:

- Federico Pigozzi, PhD student ERALLab
- Giorgia Nadizar, PhD student ERALLab
- Gloria Pietropolli, PhD student NaCL
- Giuliamaria Menara, PhD student NaCL
- Rocco Ascone, PhD student NaCL
- Umberto di Laudo, PhD student NaCL
- Kenza Benjelloun, PhD student NaCL
- Michele Rispoli, PhD student NaCL
- Lorenzo Bonin, PhD student NaCL
- Matheus Camilo da Silva, PhD student MaLeLab
- Leonardo Arrighi, PhD student MaLeLab
- Luigi Rovito, PhD student MaLeLab
- Lorenzo Bonin, PhD student MaLeLab
- Giovanni Pinna, PhD student MaLeLab

And many master students.

Students and staff interact daily, with the goal of mutual enrichment resulting eventually, when possible, in research output.

Work to be carried out by the student

We propose three research topics in two labs. The visiting student will be able to select the topic based on her/his personal expertise and knowledge about evolutionary computation. She/he will exploit the advisor's and other students' (both PhD and master) experience on the topic; she/he will be able to use software tools ready to be used for the research and will hence have the opportunity to focus on algorithms and experiment design rather than in software development.

Research projects @ ERALLab

One of the main research topics of interest of the ERALLab staff is **simulated evolutionary robotics**, i.e., the application of evolutionary optimization techniques for designing the shape or the behavior of (often simulated) robotic agents. Two peculiarities of evolutionary robotics are that (a) the fitness evaluation is in general rather computationally expensive and (b) there is no clear objective in terms of behavior, but rather a broad idea of how to measure if a behavior is more or less successful for performing a task—preserving diversity is hence often beneficial. These peculiarities motivate the two research activities that may be carried out by the student.

First, design a general purpose **adaptive mechanism for fitness a fitness surrogate**: during the evolutionary optimization and depending on its current outcome, the a fitness surrogate increases or decreases its fidelity (i.e., the quality of approximation of the real fitness). The evolution of voxel-based soft robots may be a case study, but the technique could be much more general.

Second, extend a **quality-diversity algorithm** (the main candidate being MAP-Elites) in order to be a form of **co-evolution**. Parts of the solution could be combined from different population sub-structures (as the cells in MAP-Elites) in order to find an overall well performing solution. The co-evolution of the body and the brain of voxel-based soft robots may be a case study, but the technique could be much more general.

Research project @ NaCL

In gist, the objective of this project is to add **genetic programming** (GP) in the growing field of **scientific Machine Learning**. In particular, the goal of the visiting student will be to work on the integration of domain knowledge expressed as systems of differential equations (or difference equations) with genetic programming. The idea is that the dynamics of a real complex system can be approximated by a low-fidelity system of equations but, being low fidelity, there are some “missing dynamics” that are not modeled by equations. Can GP learn the missing part of the dynamics only from data?

Other information

City of Trieste

Trieste is a mid-sized Italian city placed on the northernmost part of the Mediterranean sea. It is known for its high quality of life (6th in Italy according to Sole 24 Ore ranking) and its lively multiculturalism, deriving from its being a border town. Trieste has for decades been a research and science city: it hosts 2 universities (University of Trieste and SISSA) and many world-level research institutions. It has been the City of Science 2020 and hosted the Euroscience Open Forum (ESOF2020) in early July 2020

(<https://www.esof.eu/en/home.html>)

Trieste is a researcher-friendly city: with its 37 researchers on 1000 inhabitants it is one of the most science-dense regions of the world. As a result, Trieste offers many facilities and accommodations for researchers and students (e.g., Welcome Office:

<http://www.welcomeoffice.fvg.it/>).

Trieste will host evostar in 2025!

Accommodation

University of Trieste offers many student services, including accommodation and use of the canteen, to its students: see

<http://www.welcomeoffice.fvg.it/practical-info/accommodation/students-and-researchers-hall/>.

Depending on the status of the visiting student, these services may be accessed at a discounted rate.