PI 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); 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 130 peer-reviewed articles on international journals or conferences, with more than 20 coauthors. He was a recipient of the Google Faculty Research Award 2020.

Research group

The research group is based on two contiguous and highly interacting labs:
- Evolutionary Robotics and Artificial Life lab (ERALLab, https://erallab.inginf.units.it/)
- Machine Learning lab (MaLeLab, https://machinelearning.inginf.units.it/)

Moreover, we tightly collaborate with dr. Luca Manzoni (https://dssc.units.it/people/luca-manzoni), affiliated with another department at the University of Trieste.

Jointly, the group is currently composed of academic staff:
- Eric Medvet (associate professor, head of ERALLab)
- Sylvio Barbon Junior (associate professor, head of MaLeLab)
- Alberto Bartoli (associate professor)
- Andrea De Lorenzo (assistant professor)
- Luca Manzoni (assistant professor)
- Laura Nenzi (assistant professor)

PhD students:
- Federico Pigozzi, PhD student ERALLab
- Giorgia Nadizar, PhD student ERALLab
- Gloria Pietropolli, PhD student supervised by dr. Manzoni

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

The student will work with Voxel-based Soft Robots (VSRs), which constitute the main line of research of the ERAL lab. The interest in VSRs was initially instantiated in the ReMoSo project, for which the advisor was recently assigned the **Google Faculty Research Award** 2020.

Main option

In particular the goal of the visiting student will be to apply **cooperative evolution** for the concurrent **optimization of the body and brain** of VSRs. Using an improved version of a well established scheme for cooperative evolution, we'll try to evolve **robust** VSRs, i.e., VSRs whose brain is somehow robust to small changes in the body, the body is robust to small changes in the brain, and the brain-body pair is in general robust to environmental changes.

Other possible side projects

Several research topics are to be investigated within this framework (see https://erallab.inginf.units.it/student-opportunities). The ones that are more suitable for a few months collaboration fitting the requirements and objectives of the SPECIES scholarships are likely:
- Resolution-agnostic representation for evolution of closed-loop controllers of VSRs
- Grammar-based generative encoding for developing (phenotypically plastic) modular robots

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 (primarily [1]) and will hence have the opportunity to focus on algorithms and experiment design rather than in software development.

References

1. Medvet, Bartoli, De Lorenzo, Seriani, Design, Validation, and Case Studies of 2D-VSR-Sim, an Optimization-friendly Simulator of 2-D Voxel-based Soft Robots, arXiv, 2020 (https://github.com/ericmedvet/2dhmsr)

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 is since decades 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/).

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.