

SPECIES Scholarship Host Institute

Computational Intelligence Group, Vrije Universiteit Amsterdam, The Netherlands

1. CV of the advisor

Dr. Anil Yaman (<https://www.anilyaman.com/>) is a Tenure-track Assistant Professor in the Computational Intelligence Group (<https://cs.vu.nl/ci/>) at the Vrije Universiteit Amsterdam. He received his PhD in Computer Science from the Eindhoven University of Technology (TUE) in 2020. His main areas of research include: nature-inspired individual and social learning approaches, evolutionary computing, artificial neural networks, multi-agent systems, neuroevolution.

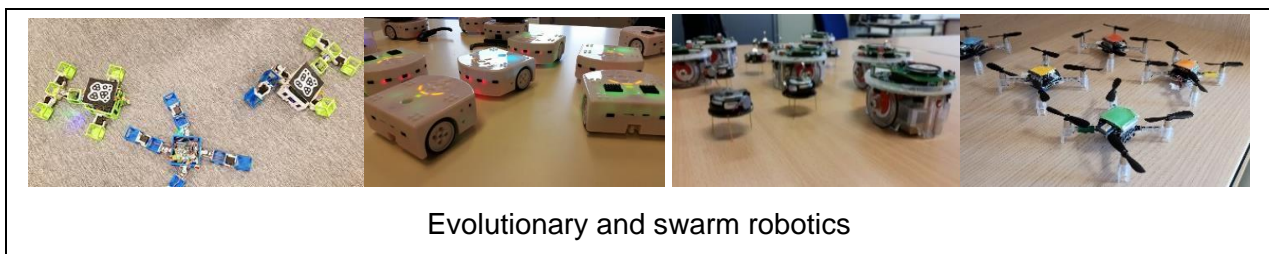
Experience

Assistant Professor, Vrije Universiteit Amsterdam, Amsterdam, The Netherlands	12.2021 – Present
Postdoctoral Researcher, KAIST, Daejeon, Republic of Korea	03.2020 – 11.2021
Researcher, Phoenix Project (H2020 EU), TUE, Eindhoven, the Netherlands	11.2015 – 11.2019
Researcher, Dep. of Biomedical Informatics, Columbia University, New York, USA	11.2013 – 09.2015

2. Research in the Computational Intelligence Group

The Computational Intelligence Group is specialized in the nature-inspired computational methods where fundamental research questions concern how to design, use, and understand intelligent systems consist of autonomous agents that can self-organise, evolve, and learn. In particular, we work in evolutionary computing, machine learning and complex systems for optimization, modeling, robotics and sensory data processing.

The group has developed Revolve2 (<https://github.com/ci-group/revolve2>) platform to conduct evolutionary robotics and artificial life research projects on simulation. In addition, we have a bio-inspired robotics lab (<https://cs.vu.nl/ci/index.php/robot-lab/>) where these projects are tested and validated in real world on hardware. Images below show some of the projects from evolvable modular robotics and swarm robotics projects. For instance, the robotics platforms we possess include Crazyflie, Thymio, Kilobot and Robobo.



Our group is led by Prof. Dr. Agoston E. (Gusz) Eiben (<https://www.cs.vu.nl/~gusz/>), an expert in evolutionary computing and evolutionary robotics with 30+ years of experience. He has involved as a contributing partner in many collaborative projects funded by the European Union.

The academic staff of our group include: Dr. Anil Yaman (evolutionary and collective intelligence), Dr. Eliseo Ferrante (swarm robotics), Dr. Karine Miras (evolutionary robotics).

In addition, our group hosts researchers (PhD and master's students) with diverse background, and is connected to a large collaborative network of researchers all around the world.

3. The work to be carried out by the student

Computational Intelligence group provides the opportunity work on the following topics (the research in some of the projects can be conducted in simulation and/or on real world hardware):

Social learning strategies and cultural evolution models:

Designing efficient and effective individual and social learning approaches in a population of lifetime-learning agents [1, 2], and spread and evolution of cultural knowledge. Some of the key questions include:

- How to identify reliable knowledge (i.e. when, what and who to learn from)?
- How to design meta-learning strategies that can effectively use individual and social learning to provide optimum learning as a collective of lifetime-learners?
- How can a group level collective knowledge emerge and evolve to benefit to the individuals in the collective system [3]?

Neuroscience-inspired AI:

Developing learning and decision-making models inspired by neuroscience. Some interesting topics include:

- Lifetime learning and synaptic plasticity: How neurons change their connectivity to learn to perform certain behaviors while interacting with the environment?
- How to learn spatial representations inspired by various types of cells in the brain?

Robot morphology and controller evolution/optimization:

Designing robot morphologies and controllers for solving various tasks in various environments under changing environmental conditions [4]. Some key questions involve:

- How does the environment and task (i.e. locomotion, foraging, ..) effect the evolution of morphologies and controllers?
- How to allow generalizability and lifetime-learning to cope with changing environmental conditions or wide range of environments [5]?

References:

- [1] Yaman, A., Bredeche, N., Çaylak, O., Leibo, J. Z., & Lee, S. W. (2022). Meta-control of social learning strategies. *PLoS computational biology*, 18(2), e1009882.
- [2] Yaman, A., & Iacca, G. (2021). Distributed embodied evolution over networks. *Applied Soft Computing*, 101, 106993.
- [3] Yaman, A., Leibo, J. Z., Iacca, G., & Lee, S. W. (2022). The emergence of division of labor through decentralized social sanctioning. *arXiv preprint arXiv:2208.05568*.
- [4] Eiben, A. E., & Smith, J. (2015). From evolutionary computation to the evolution of things. *Nature*, 521(7553), 476-482.
- [5] Yaman A, Iacca G, Mocanu DC, Coler M, Fletcher G, Pechenizkiy M. Evolving Plasticity for Autonomous Learning under Changing Environmental Conditions. *Evolutionary Computation*. 2020. DOI: 10.1162/evco_a_00286

4. Other relevant information

Amsterdam is one of the well-connected hubs in Europe with a population of 1.1 million. It is a vibrant city with diverse international community. It offers lots of interesting and historical places such as museums, exhibitions, restaurants and social life.

The Vrije Universiteit Amsterdam (VU, <https://vu.nl/en>) is a public research university in Amsterdam. It ranks among the top 150 universities in the world. Its campus is located in the south of Amsterdam next to the Zuidas business district. For virtual tour, see <https://www.youvisit.com/tour/vuamsterdam>.

Accommodation

The university can help with the accommodation by providing a place to stay close to the university for a relatively lower price. In addition, the international office helps with the administration and visa application.

(see <https://vu.nl/en/education/more-about/looking-for-accommodation-in-amsterdam>)