# MICRO-515: Evolutionary Robotics
# **Introduction to the course**

**EPFL**

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Teaching Assistant

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Teaching Assistant

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Student Assistant

## Lectures

Introduction to theories, methods, and technologies for designing robots and artificial systems inspired by evolution.

**Assessment:** MCQ

## Exercises

Implementation of Genetic algorithm, Evolution Strategies and Multi-objective Optimization from the lecture.

**Assessment:** -

## Group Project

Evolution of a neural controller and the morphology of a robot in simulation. Deployment and testing of a self-printed and assembled physical robot.

**Assessment:** Presentation + Demo

# EPFL

## LIS Laboratory of Intelligent Systems

| Date | Week | Program | Lecturer |
|---|---|---|---|
| 22.02.24 | 1 | Organization of Lecture, Introduction to Evolutionary Computation, How to build an evolutionary algorithm? | Floreano |
| 29.02.24 | 2 | Evolutionary Strategies, Exercise Genetic Algorithm (Python), Exercise Evolutionary Strategies (Python) | Floreano, Dittrich, Hars |
| 07.03.24 | 3 | Multi-objective Optimization (NSGA-II), Exercise NSGA-II | Floreano, Dittrich, Hars |
| 14.03.24 | 4 | Foundations of Neural Networks, Unsupervised Learning | Floreano |
| 21.03.24 | 5 | Supervised Learning, Reinforcement Learning | Floreano |
| 28.03.24 | 6 | Evolution of Neural Controllers, Evolution and Learning | Floreano |
| 04.04.24 | 7 | *Easter Holiday* | |
| 11.04.24 | 8 | Introduction to Group Project, Brain Evolution for pre-defined body in RoboGen | Petrs, Dittrich, Hars |
| 18.04.24 | 9 | Evolution of body morphologies, Co-evolution of Brains and Bodies, Body Encoding and Evolutionary Parameters in RoboGen | Floreano, Petrs, Dittrich, Hars |
| 25.04.24 | 10 | Body Encoding and Evolutionary Parameters in RoboGen, Brain and Body Co-Evolution in RoboGen | Petrs, Dittrich, Hars |
| 02.05.24 | 11 | Cooperative Co-Evolution, Body-Brain Co-evolution in RoboGen | Floreano, Petrs, Dittrich, Hars |
| 09.05.24 | 12 | *Ascension Day* | |
| 16.05.24 | 13 | Introduction to RoboGen Hardware, Handout of Robotic Kits and Accessories | Petrs, Dittrich, Hars |
| 23.05.24 | 14 | Towards Self-Reproducing Robots, Group Project Coaching | Floreano, Petrs, Dittrich, Hars |
| 30.05.24 | 15 | Group Project Demonstrations and Final Presentation | Floreano, Petrs, Dittrich, Hars |

**Legend:**
- Lecture
- Exercise
- Project

MICRO-515 Evolutionary Robotics

Spring Semester 2024

# Course Requirements:

- Presentation with demo and submission of group project
- Final written exam

| | Grading | Deadline |
|---|---|---|
| 3 Programming exercises (GA, ES, NSGA-II) | - | - |
| 3 RoboGen exercises | - | - |
| RoboGen group challenge | mandatory, graded | 30.05.24 at 23:59 |
| MCQ written exam | mandatory, graded | *tba* |

# Grading:

- 50% written exam (Multiple Choice Questions)
- 50% group project presentation with robot demo

# Final exam information:

- Date and time to be announced
- No support material (books, notes, devices) allowed
- Student with special arrangements from SAC, please e-mail dario.floreano@epfl.ch before the exam