RoboGen™

RoboGen Introduction

Evolutionary Robotics Course

Professor Dario Floreano

Assistants:

Euan Judd

Luca Zunino

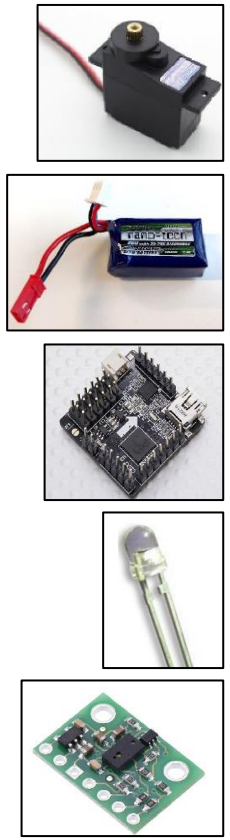
Shuhang Zhang

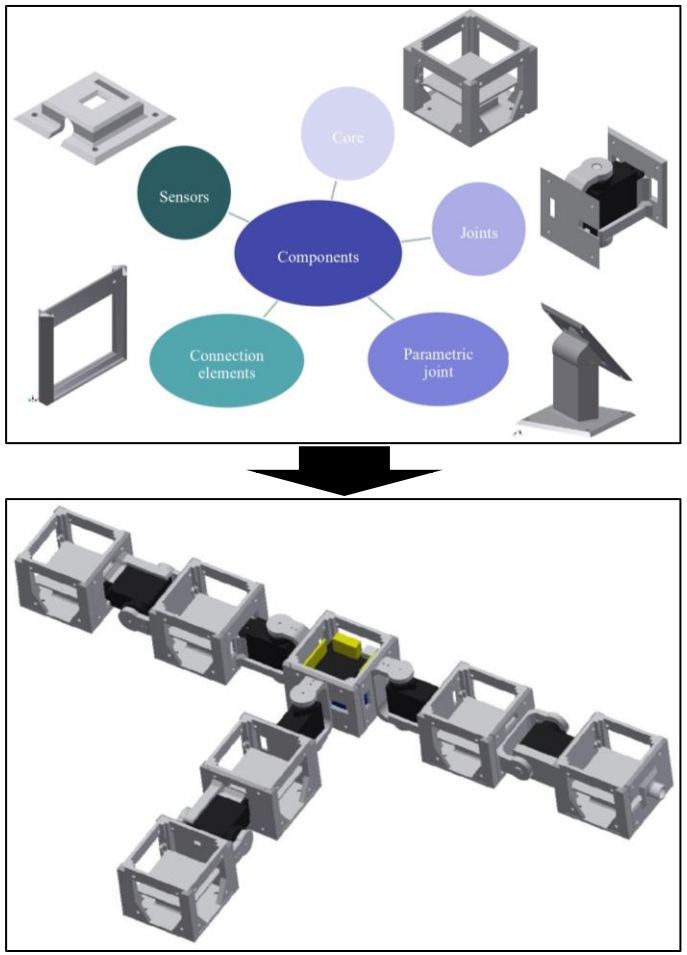
EPFL

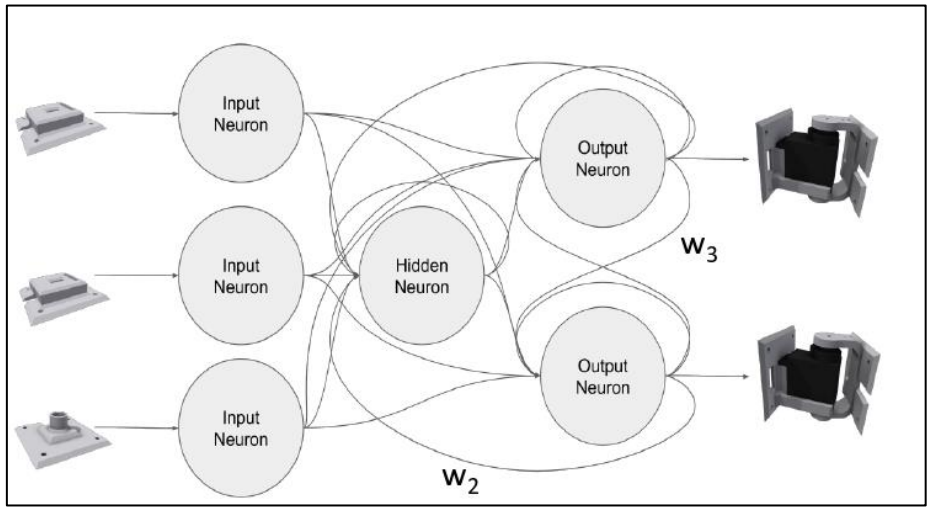
LIS

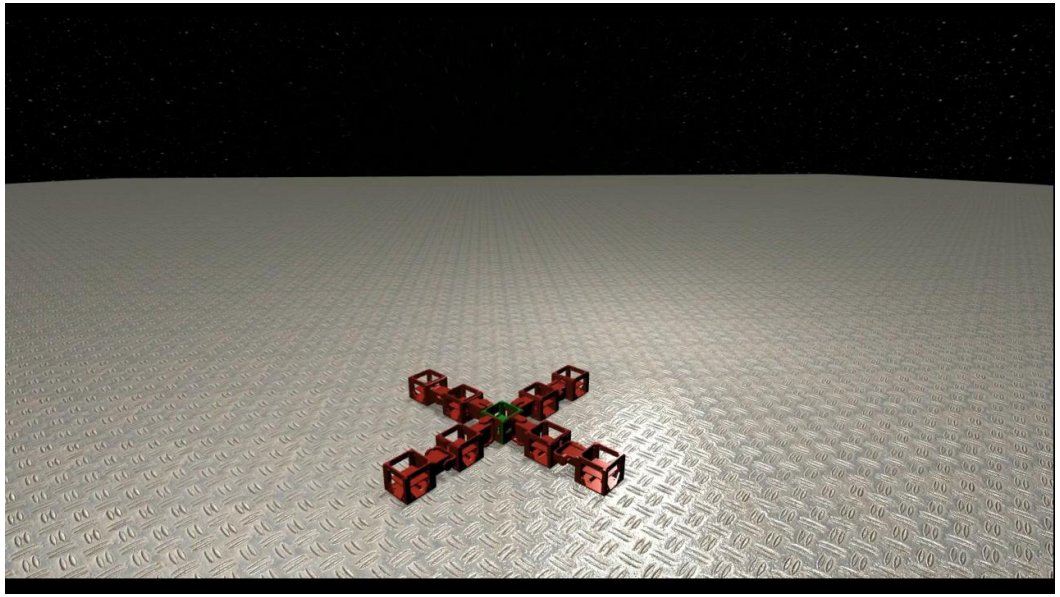
RoboGen for morphology and control co-evolution

RoboGen™





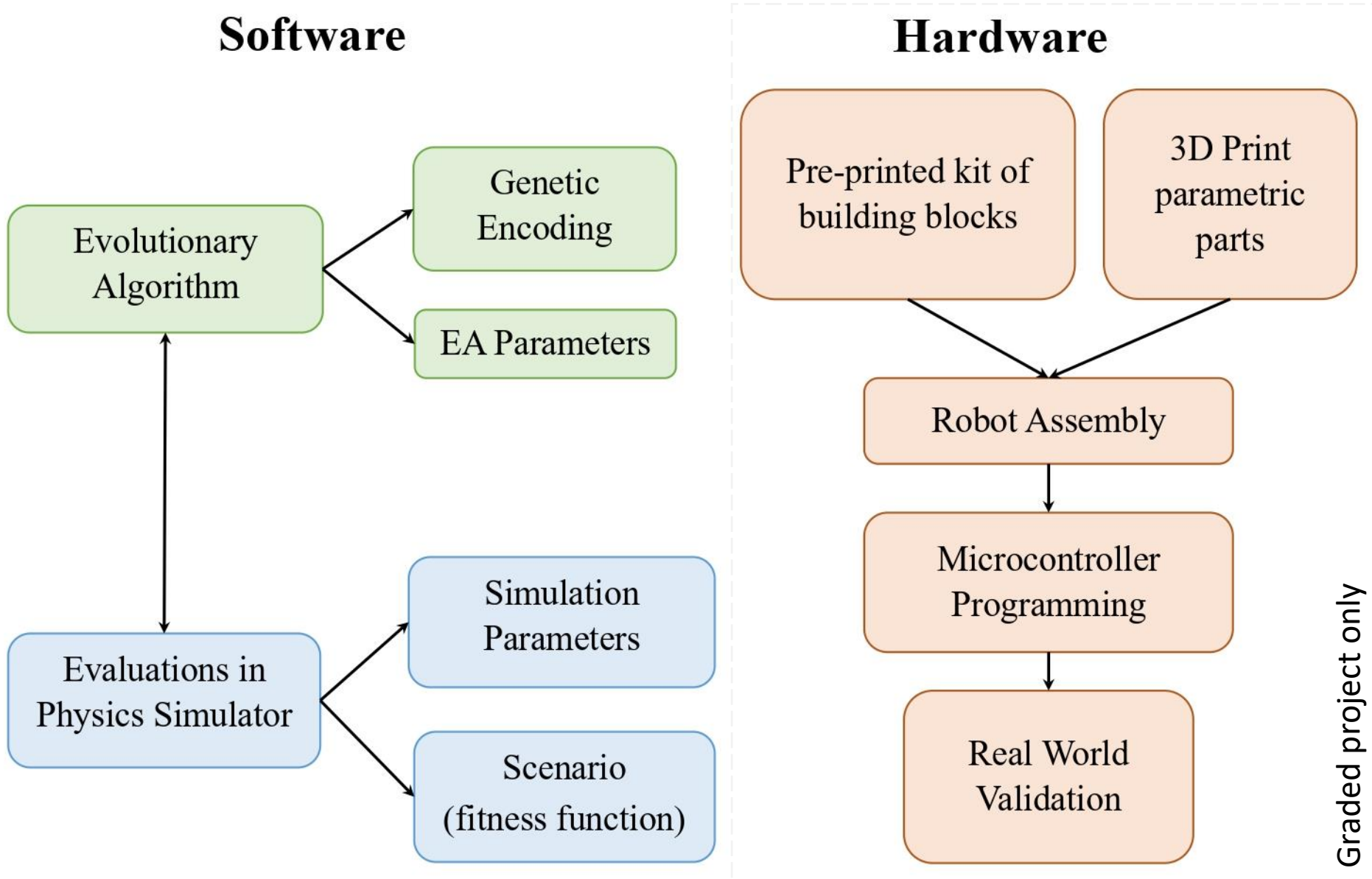




EPFL

LIS

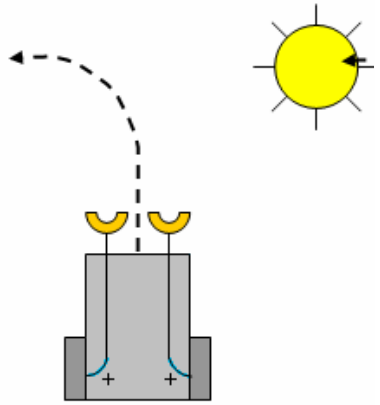
RoboGen™



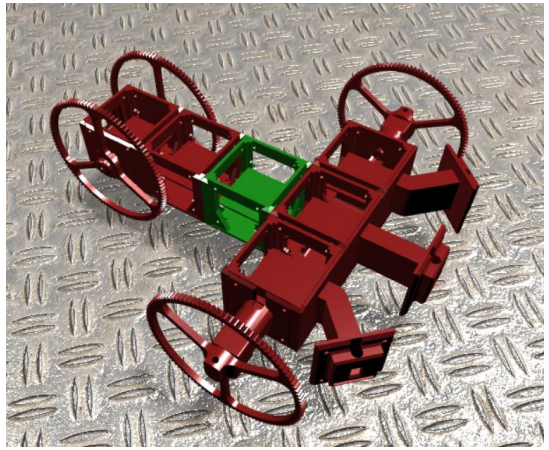
EPFL

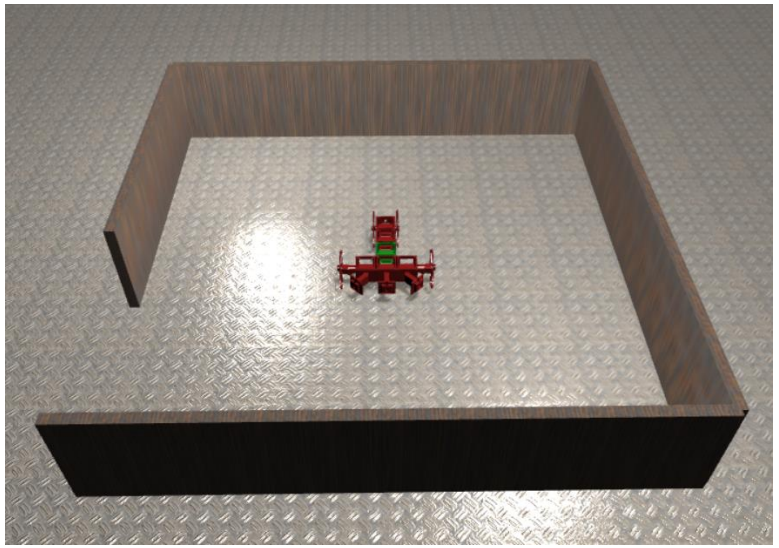
LIS

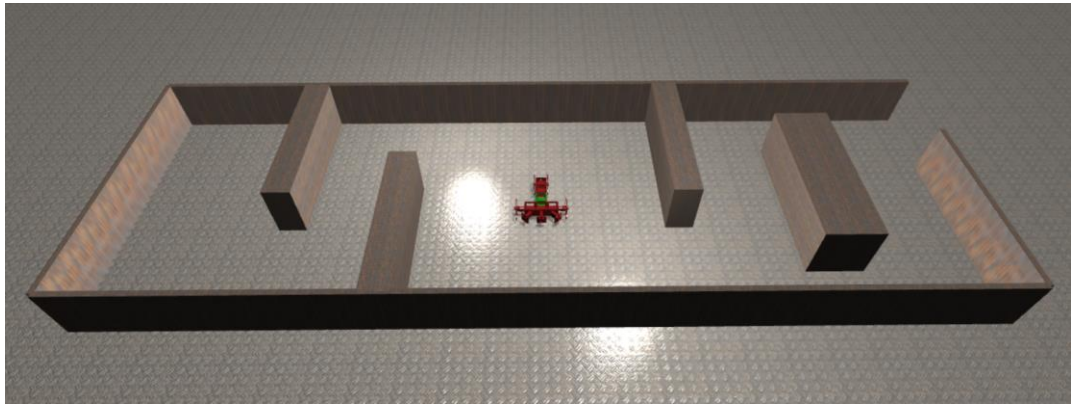
Morphological intelligence



Braitenberg vehicles

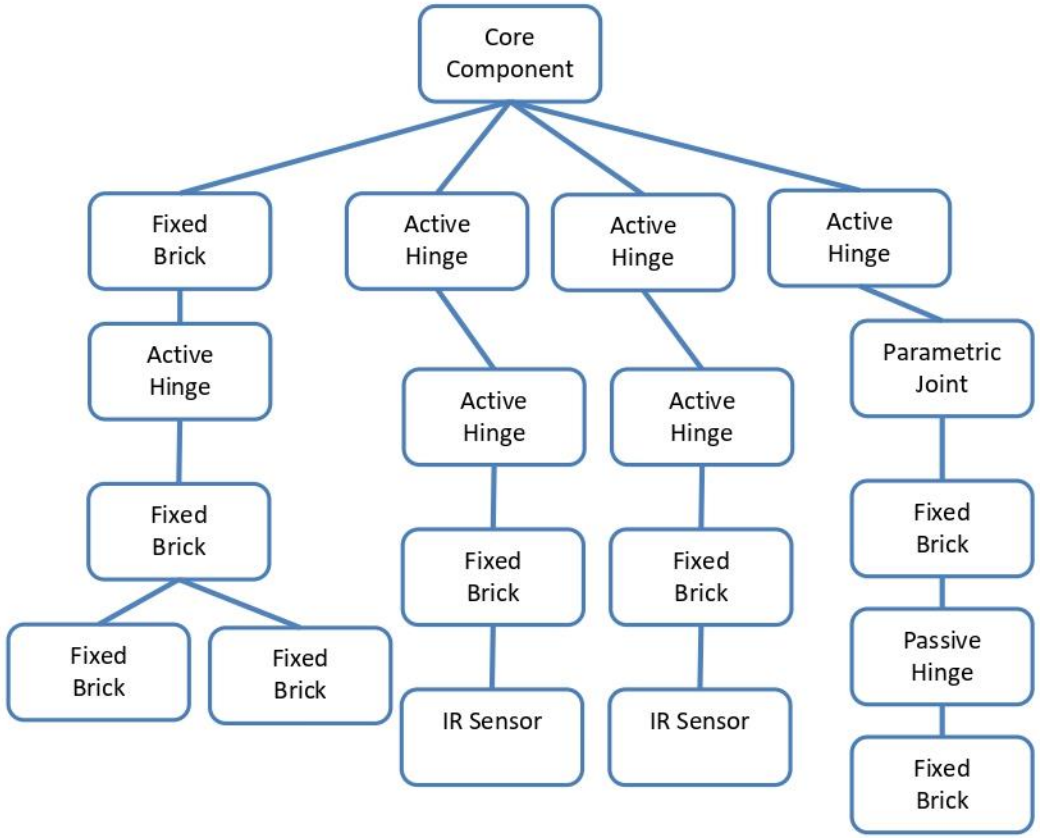




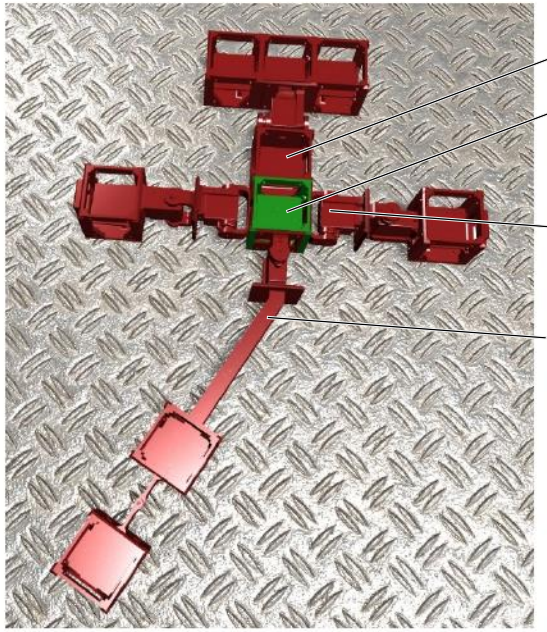


Software: Genetic Encoding

RoboGen™



Robot Body



https://robogen.org/docs/guidelines-for-writing-a-robot-text-file/

EPFL

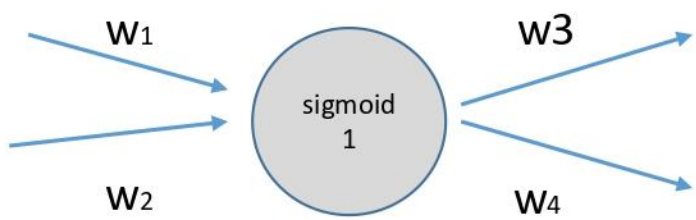
LIS

Software: Genetic Encoding

RoboGen™

Encoding - Weight

w_1	w_2	w_3	...	w_N



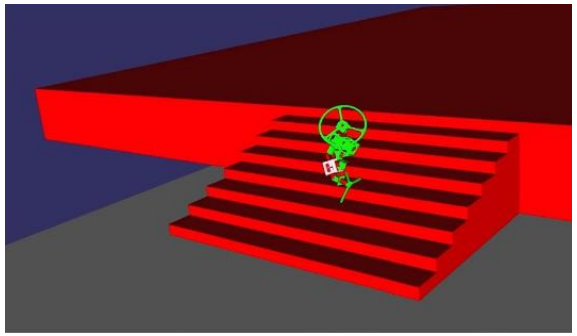
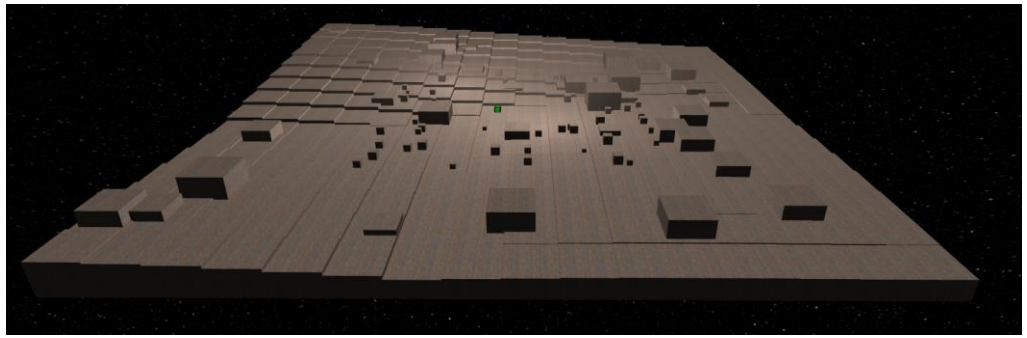
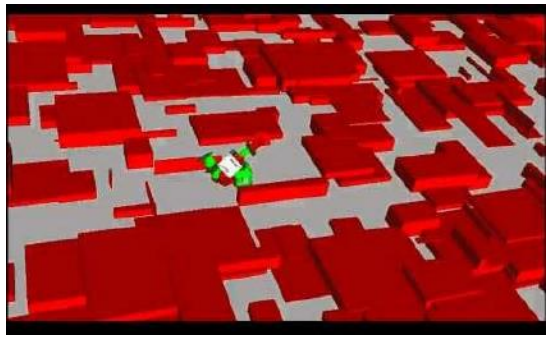
Encoding - Parameters

...	bias 1	...

EPFL

LIS

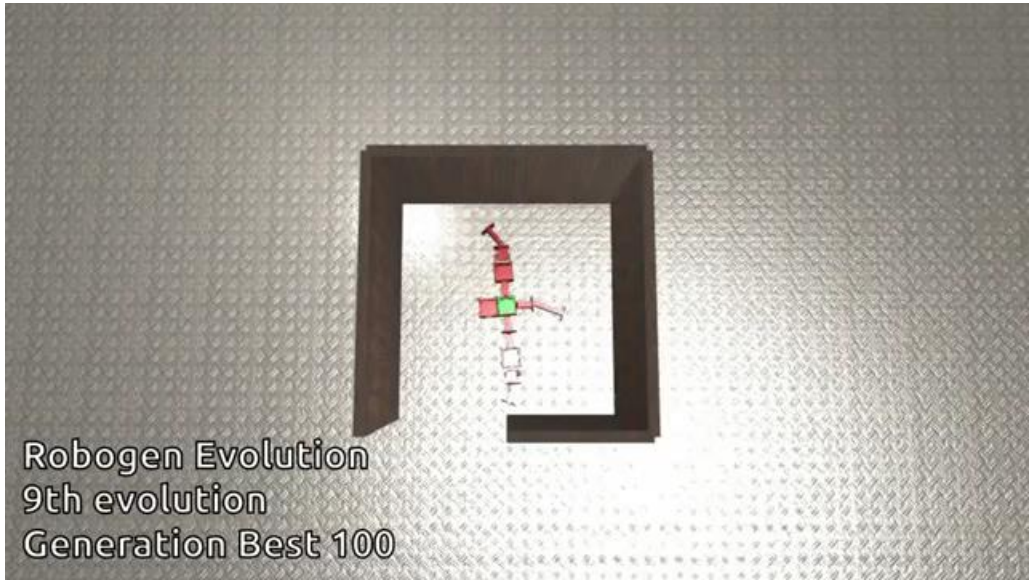
Setting up RoboGen

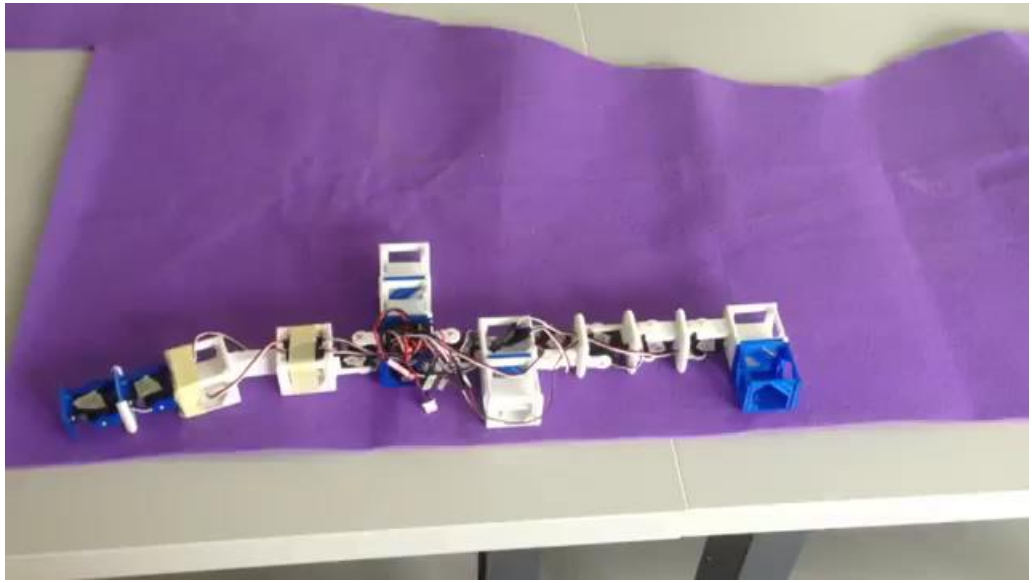




- Environment:
  - Arena: obstacles (https://robogen.org/docs/evolution-configuration/#Obstacles_configuration_file)
  - Properties: e.g. friction, etc. (https://robogen.org/docs/evolution-configuration/#Simulator_settings)
- Fitness function:
  - Inbuilt:
    1. Racing: https://github.com/lis-epfl/robogen/blob/8b710b93221882cdb9b970f55bf84d287dc2e4be/examples/racing_scenario.js
    2. Chasing: https://github.com/lis-epfl/robogen/blob/8b710b93221882cdb9b970f55bf84d287dc2e4be/examples/chasing_scenario.js
  - Write a custom one in JavaScript (https://robogen.org/docs/custom-scenarios/)
- Evolutionary algorithm parameters: e.g. mutation rate, number of generations, etc. (https://robogen.org/docs/evolution-configuration/#Evolution_client_settings)

RoboGen™

Previous examples





EPFL

LIS

What's next?

RoboGen™

3-4 students/group

This should not be the case.

Final presentation should state the contribution of each team member

EPFL

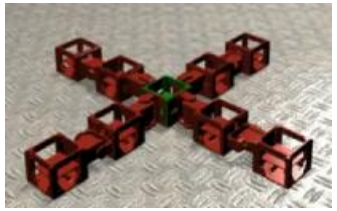
LIS

Schedule

RoboGen™

5th April
- Introduction to RoboGen
- Evolving the controller for a cart robot
- Project group formation

20th April
- Begin brain + body coevolution



11th May
- Information on robot fabrication
- Graded project coaching

1st June
- Final graded presentations

EPFL

LIS

Some guidance for the graded project

RoboGen™

You will need to evolve the body and brain of a robot for a given scenario. A (non-exhaustive) list of factors to consider during your project:

- **Fitness function**: You will need to design your own. How well you do this will be a significant factor in the success of your project.
  - See https://robogen.org/docs/custom-scenarios/ for details on writing a custom fitness function.
- **Environment** (e.g. obstacles, light source, terrain, etc.):
  - See https://robogen.org/docs/evolution-configuration/#Obstacles_configuration_file for writing a custom arena and
  - https://robogen.org/docs/evolution-configuration/#Simulator_settings for terrain, physics, obstacle, noise and constraint handling settings.
- **Evolutionary algorithm parameters**: A scientific approach to parameter selection should be used to give the best chance of convergence and to increase the convergence rate.
  - See https://robogen.org/docs/evolution-configuration for a list of evolution parameters.
- **Evaluation procedure** (length of evaluation, presence of noise, etc.): Your robot will likely perform worse when you build and test it in the real world due to the simulation to reality gap. The easiest way to get an idea of the generalisability of your solution is to first run it in the simulator using different environment parameters.

EPFL

LIS

Evaluation

RoboGen™

- Graded presentation on the 1st of June.
- A template will be provided.
- The presentation will document your work, your methods, your results and your analysis.
- Hint: performing repetitions of your experiments in order to conduct a statistical analysis is strongly encouraged!

Your grade will be influenced by
- Demonstration of rigorous scientific approach
- Creativity
- The results you obtain
- Task difficulty
- Clarity
- Completeness of presentations

EPFL

LIS

Learn more about robogen …

[RoboGen Website]

YouTube

[YouTube Channel]

[RoboGen App]