Online adaptation of robots controlled by nanowire networks

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Motivations and goals

- size;
- costs;
- autonomy;
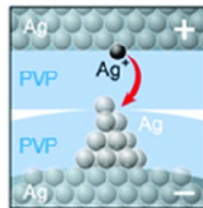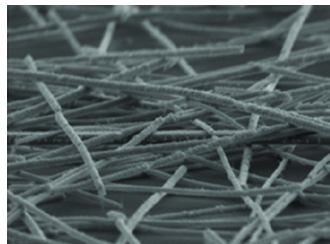- computing power;
- learning techniques.

Motivations and goals

- training methodologies;
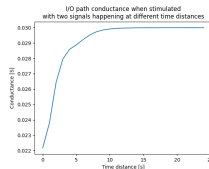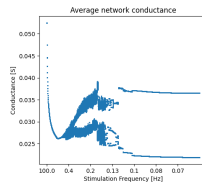- use of nanowire networks;
- adaptability.

Nanowire networks

- nanoscale electrical circuit;
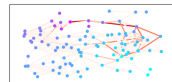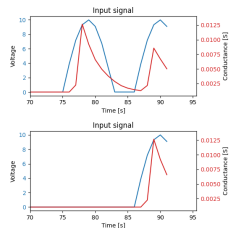- non-linear dynamic;
- neuromorphic behaviour.

Analysis

- system criticality;
- separation property;
- fading memory;
- stimulation distribution;
- signal type influence;
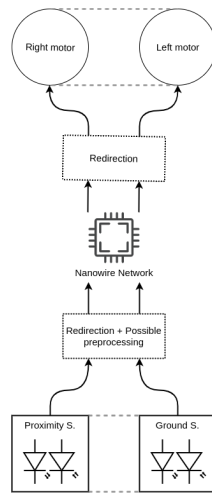- influence of connected loads;
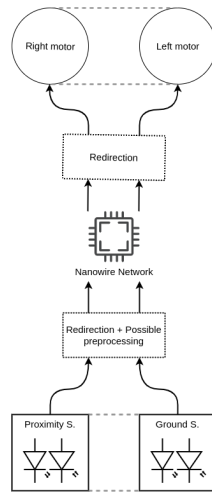- network density.

Architecture

- controller;
- sensory connections;
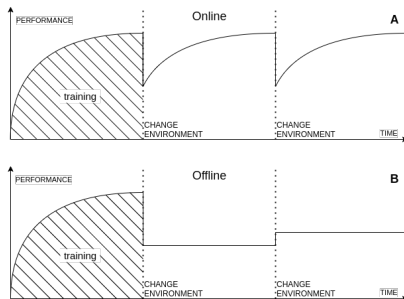- control connections;
- sensors;
- motors.

Adaptation

- connections re-wiring;
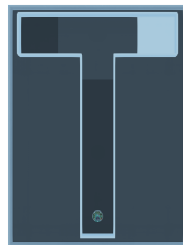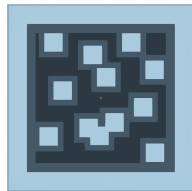- inputs re-weighting.

Adaptation

- online approach;
    - no reset of robot state.
- epoch based;
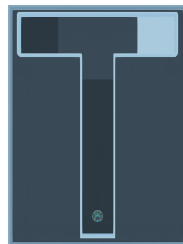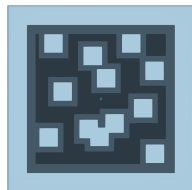- according to an evaluating function.

Experiments

- Collision avoidance;
- Area avoidance;
- T-maze.

Experiments: Goals

- Collision avoidance;
    - preliminary test of a simple task.
- Area avoidance;
    - show phenotypical plasticity.
- T-maze.
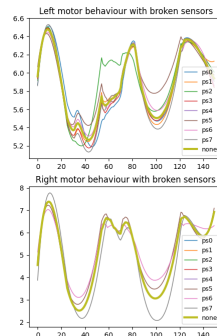   - exploit endogenic memory.

Results

Successful behaviour in all the tasks

	collision avoidance	area avoidance	tmaze
success rate	84.44%	75.56%	73.33%

*percentage of successful results of the best runs

Results

- **fault tolerance;**
- phenotypical plasticity;
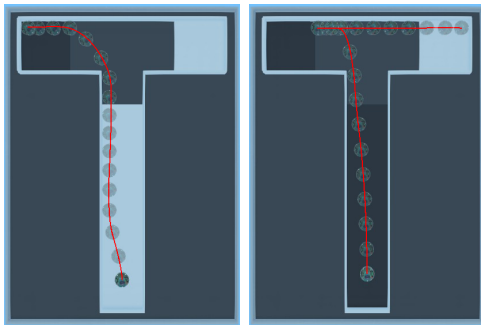- memory;
- density influence;
- load influence.
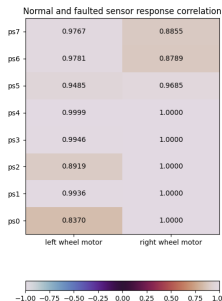
Results

- fault tolerance;
- **phenotypical plasticity;**
- memory;
- density influence;
- load influence.

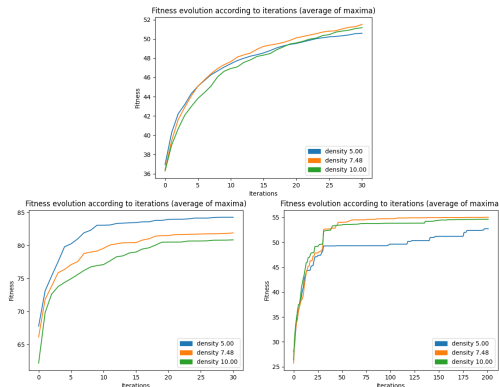|	success rate
collision a.	78.89%
area a.	75.56%

Results

- fault tolerance;
- phenotypical plasticity;
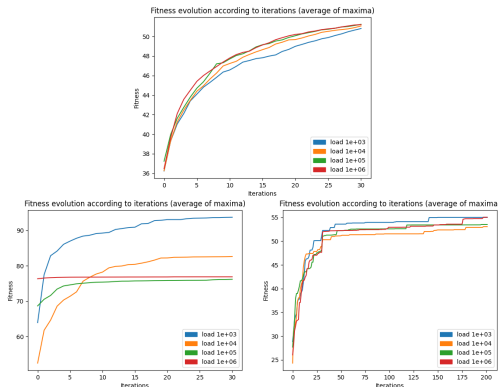- **memory;**
- density influence;
- load influence.

Results

- fault tolerance;
- phenotypical plasticity;
- memory;
- **density influence;**
- load influence.

Results

- fault tolerance;
- phenotypical plasticity;
- memory;
- density influence;
- **load influence.**

Future works

- comparison with other computational systems;
- automatic modulation of the adaptation;
- nano and microbots development;
- evaluation of memory usage in complex mazes;
- others...