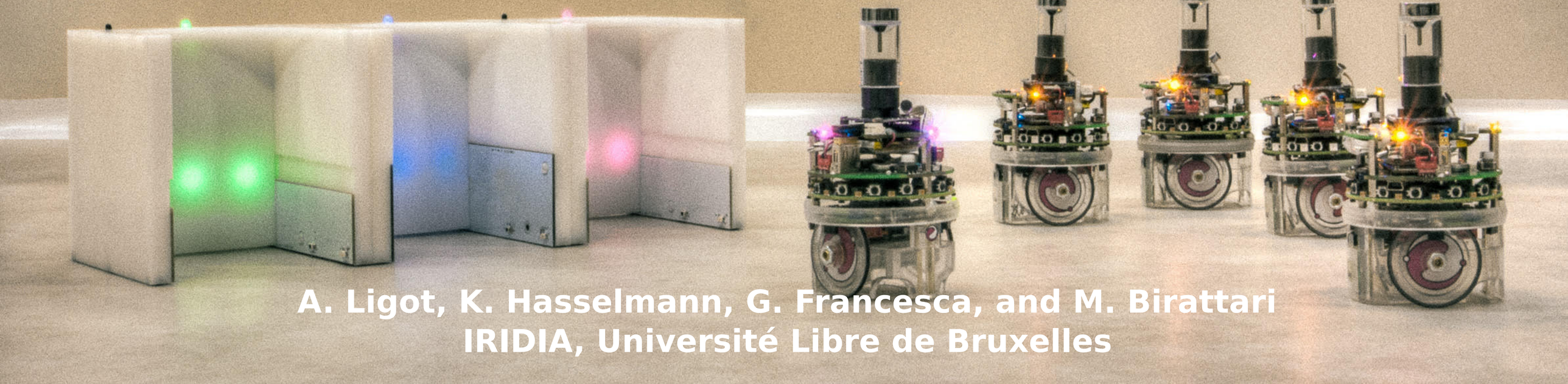
Automatic design of robot swarms:
towards a free-software implementation



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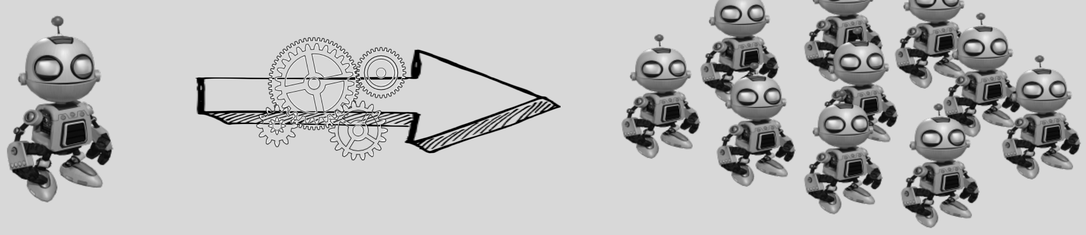
Challenge



Individual rules

Collective behaviour

Offline automatic design

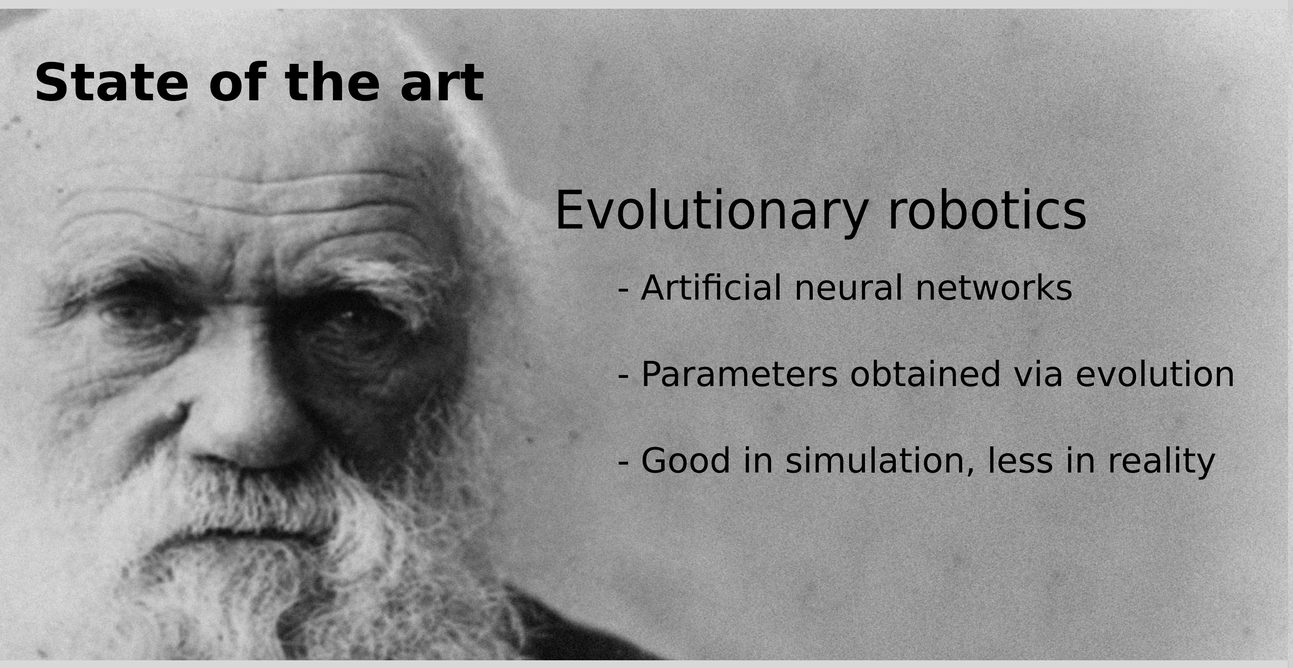
Mission specifications → Objective function

Objective function → Design via optimization in simulation

Design via optimization in simulation → Control software

Control software → Mission specifications

State of the art



Evolutionary robotics

- Artificial neural networks
- Parameters obtained via evolution
- Good in simulation, less in reality

Idea

Automatic design Machine learning

Simulation

Reality gap

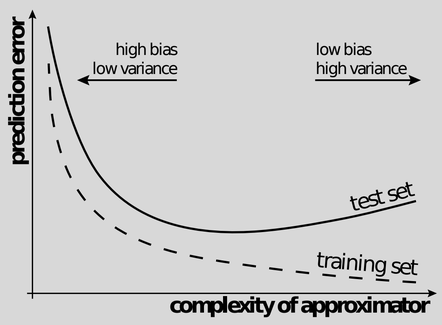
Real world

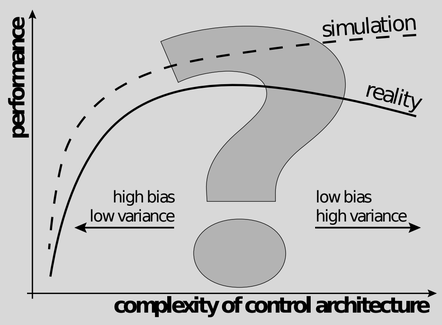
Training set

Generalization

Testing set

Hypothesis





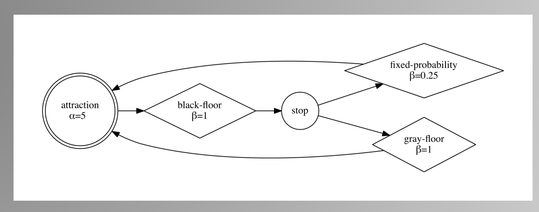
- ANN could be too prowerfull: low bias / high variance
- They could overfit particularities of simulator

AutoMoDe

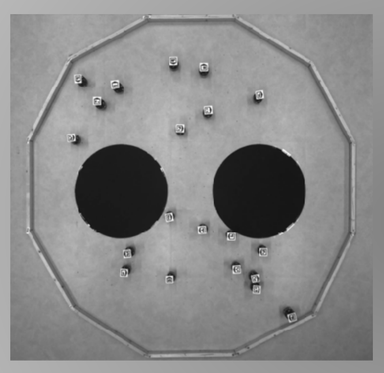
12 Parametric Modules

Prob. Finite State Machine

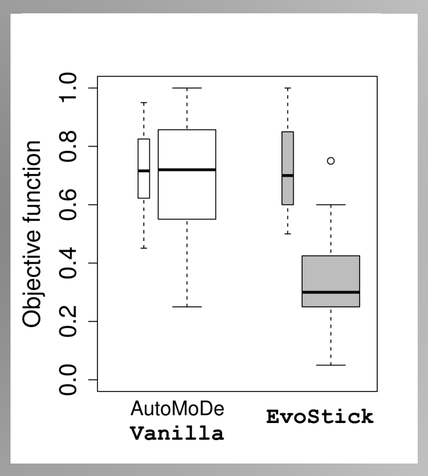
Behaviors	Conditions
- exploration	- neighbor-count
- stop	- inv.-neighbor-count
- phototaxis	- black-floor
- anti-phototaxis	- gray-floor
- attraction	- white-floor
- repulsion	- fixed-probability



Results



$F = \max(N_a, N_b)/N$



Towards the Demiurge

Demiurge: an intelligent system that designs robot swarms in an integrated and automatic way.

Public release of software, raw data and videos of real-robot experiments.
- ARGoS3-AutoMoDe
- ARGoS3-NEAT

Postdoctoral open positions

European Research Council
Established by the European Commission

DEMIURGE
Automatic Design of Robot Swarms

European Commission
Horizon 2020
European Union funding
for Research & Innovation