ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

Disal

Distributed Intelligent Systems
Lab 9 Tutorial

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Lab Structure

1. Multi-robot PSO for obstacle avoidance:
   - Same fitness function as single-robot PSO
   - Differences in performance and evaluation time

2. Budget allocation
   - Comparing standard PSO, PSO-pbest, PSO OCBA

3. Multi-robot PSO for collaborative tasks:
   - Coordinated motion: move as far as possible while staying together

Code Structure

Pso_sup.c

- Main()
  - Initialize world
  - Best = pso()
  - Evaluate best
- Calc_fitness()
  - Reposition robots randomly
  - Send candidate solutions to robots
  - store fitness value

Pso.c

Pso()

- Initialize swarm
- For each iteration
  - Move particles
  - Evaluate particles
- Return best particle

Obs_con.c

- Main()
  - Initialize robot
  - Receive weights from supervisor
  - Run controller with weights
  - Evaluate fitness and send to supervisor

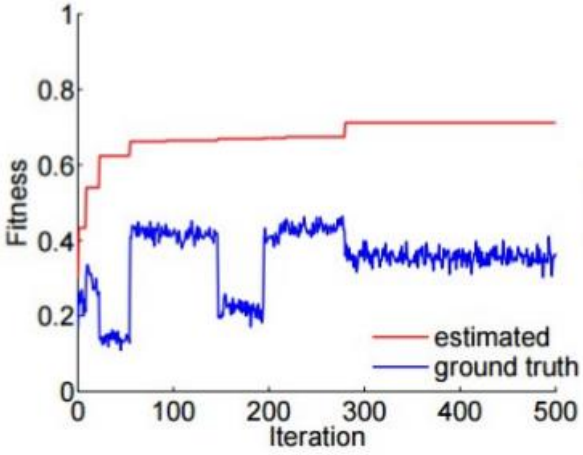
Noise-resistant PSO

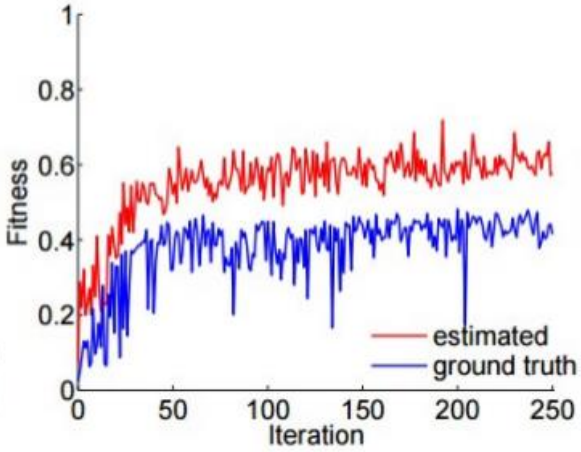
- Setting `NOISY=1` triggers two changes
  - Half the number of iterations
  - Revaluate performance for `lbest` (with flag `EVOLVE_AVG`)

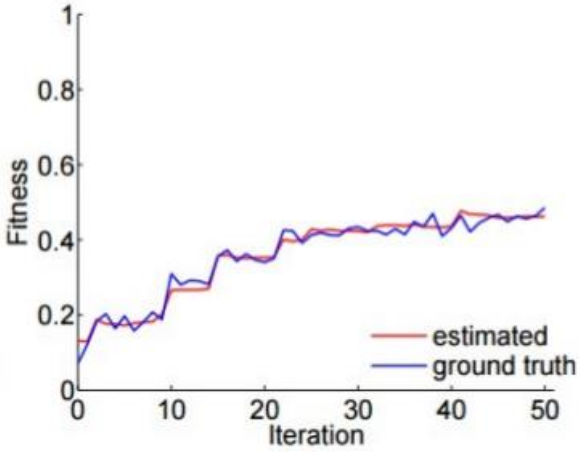
- You need to implement the behavior for `EVOLVE_AVG`
  - Modified moving average (MMA) with `age` as the number of periods.
  - Remember to increase `age`.

PSO-OCBA

- Optimal allocation of computation budget
- Very effective in the presence of noise







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PSO for a collaborative task

- Fitness value calculated in the supervisor
- Copy-paste the noise resistant PSO
- More difficult task than obstacle avoidance
- New sources of uncertainties

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Notes and Clarifications

- Simulations take longer with complex tasks, read ahead and answer questions while the simulation runs.
- Performance evaluations have a high variance, you may need additional runs to establish clear trends
- **Remember to fill the feedback form**