

Title: Collective decision making and swarm robotics

Given by: Giulia De Masi

Duration:12h

CFU: 3

Target audience: PhD students and Master students

Dates: 12, 19, 21, 26 June, 3, 10 July

Time: 9:30-11:30am

Description: This course is giving a self-contained introduction to collective decision-making with applications to swarm robotics, from theoretical aspects, to simulation, modeling and principles for experimental applications. At the end of this course, the student will be able to recognize in the real life the scenarios where collective decision making is playing a role, will be able to design a swarm of robots for a proper predefined task, model the system and analyze the results.

Prerequisites: Python, Calculus

1. Introduction to swarm robotics (2h)
 - a. What is and what is not swarm robotics
 - b. Biological inspiration
 - c. From social systems to robotics
 - d. Applications
 - e. Pros and cons of swarm robotics
2. Scenarios of swarm robotics (2h)
 - a. Collective decision mechanisms
 - b. Aggregation
 - c. Task allocation
 - d. Pattern formation
 - e. Collective motion and flocking
3. Collective decision making (2h)
 - a. Single vs group decision making
 - b. Collective decision mechanisms in animals
 - c. From micro to macro
 - d. Models for collective decision-making processes
4. Simulations and statistical analyses (1h+2h)
 - a. Design of experiment
 - b. Code implementation
 - c. Post-simulation statistical analyses for swarm robotics
 - d. Practical session
5. Simulations and statistical analyses (2h)
 - a. Multi-agents reinforcement learning
 - b. Practical session
6. Discussion and comparison of results from different methodologies (1h)