

Research

Main Research Topics

Swarm robotics for Firefighting

How to make resilient robots for operations in dangerous environments?

Current projects

- A throwable, jumping robot for firefighting applications

Programming robot swarms

What are the fundamental concepts that constitute a swarm behavior, and how to combine them?
How to identify and fix errors and bugs in a swarm behavior?

Current projects

- Buzz, a programming language for heterogeneous robot swarms
- Space- and time-dynamic distributed hash tables
- In-network computation of swarm functions
- Debugging infrastructure for robot swarms
- Machine-learning and bug detection
- Augmented-reality-based development and testing

Algorithms for coordination with contradicting goals

How to harmonize the individual needs of robots (e.g., battery limitations, completion of assigned tasks), with swarm-level coordination requirements (e.g., connectivity maintenance)?

Current projects

- Scalable network deployment and maintenance
- Energy-constrained coordination
- Spatially-aware task allocation

Algorithms for collective spatial perception

How can a robot swarm construct a shared representation of complex aspects of the environment, despite severe limitations in sensing and computational capabilities?

Current projects

- Decentralized pattern detection with noisy sensors and lying robots

Primitives for human-swarm interaction

Which behavioral traits can a swarm exhibit to interact with a human operator efficiently? Conversely, what kind of commands can a human operator give a swarm, for the swarm to execute them effectively?

Current projects

- Hybrid goal- and robot-oriented interfaces
- Tactile interfaces

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