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Decentralized coordination algorithms for Quadcopter-swarms for Search and Rescue (SAR) operations.

Research Proposal for PhD in Cooperation with BCS-Lab TU Darmstadt

Presented by



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AGENDA



1. Proposed Ideas



2. Abstraction of SAR



3. Research Points



4. Application Scenarios



5. Summary



1. Proposed Ideas

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- Decentralized surface scan and data aggregation for microcracks detection on
 - Solar panels
 - Wind turbines
- Events Monitoring in sport games and record continuous events rather than switching between multiple cameras for continuous motions
 - Soccer VAR
- Search and Rescue SAR
 - Assisting in reconnaissance missions
 - Rescue operations
 - Environmental monitoring



2. Abstraction of SAR

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- Target
 - In an objective environment, when agents find potential object/person, they'll send their sensor data to central-hub, which's used for computational offloading and communication base
 - The actual rescue and treatment operations are left as responsibility of the rescue-crew
- Quadcopters
 - Autonomous decentralized coordination of quadcopters (agents) to maximize area coverage
 - Formation control algorithms for reconfigure spatial distribution for a robust ad-hock communication, when a direct connection between agents isn't available
 - D-RL algorithms for ranking detected objects by their reliability and urgency



3. Research Points

3. Research Points

- Decentralized coordination algorithms
 - Starting formation
 - Formation maintenance (leader-follower, virtual-leader-follower)
- Algorithms for ranking detection and classification according to urgency
- Robust, optimized, and lightweight algorithms that can run on small embedded devices in-board of agents
 - Object/person detection and classification
 - Active vision and tracking techniques to analyze closer objects that has been found
 - Ranking detected objects to be classified with giving priority
- Situations' algorithm-oriented to enable efficient SAR in specific environments
- Algorithms for situation awareness in unknown environments



4. Application Scenarios

Usage of the Regular Master Slides.

4. Application Scenarios

- E.g. assisting firefighters for SAR by using swarm of agents
- Every agent will be equipped with a unique sensor (for economical & weight reduction reasons)
 - Hear-rate sensor
 - Oximeter
 - Consciousness Detection
- In case of person detection a decentralized algorithm will be applied to monitor the person and report his/her state to the central-hub



5. Summary

5. Summary

- Decentralized coordination algorithms
- Decentralized formation control e.g. optimal communication to central-hub and data transition
- Optimized multi-modal D-RL algorithms to run in small embedded devices on-board of quadcopter swarms
- Algorithms for situation awareness for unknown environments

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Thank you!

If you have any questions/suggestions
feel free to ask!



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