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Distributed task allocation for multi-robot systems in search and rescue scenario

Multi-robot systems are increasingly employed in various fields such as search and rescue, space and underwater exploration, surveillance and target tracking and logistics. Distributed task allocation is one of the key topics in such multi-robot systems. This presentation will introduce our recent work on developing novel algorithms for distributed task allocation under different constraints from real applications, in particular in search and rescue scenario. The objectives of the problem are analyzed, including maximizing the number of assignments (people rescued) and minimizing the average start times of tasks with deadlines. Then its mathematical formulation is developed considering only the local communication for connected robots. A novel task swapping mechanism is proposed to exchange tasks between vehicles through local networked communication in order to optimize the performance of the whole team. This mechanism is further supported by the concept of task performance impact which is measured by the contribution to the local cost generated by a vehicle. Two performance impacts are considered, Removal Performance Impact (RPI) and Inclusion Performance Impact (IPI) of a task assignment. Different communication topologies for multi-robot systems have been considered to investigate the proposed distributed task allocation algorithms. Experimental results demonstrate that the proposed algorithms can achieve better performance in comparison with other algorithms in this area.

Recent Publications

1. Whitbrook A, Meng Q, Chung P W H (2017) Reliable, Distributed Scheduling and Rescheduling for Time-Critical, Multiagent Systems, IEEE Transactions on Automation Science and Engineering, vol. PP, no. 99, pp. 1-16.

2. Zhao W, Meng Q, Chung P W H (2016) A Heuristic Distributed Task Allocation Method for Multivehicle Multitask Problems and Its Application to Search and Rescue Scenario, IEEE Transactions on Cybernetics, 46(4): 902-915.

Biography

Qinggang Meng is a Reader in Robotics and Autonomous Systems with the Department of Computer Science, Loughborough University, UK. His current research interests include biologically and psychologically inspired learning algorithms and developmental robotics, robot learning and adaptation, autonomous vehicles/systems, multi-UAV/UGV cooperation, service and assistive robotics, situation awareness and decision making for driverless vehicles, verification and validation of autonomous systems, driver's distraction detection, human motion analysis and activity recognition, activity pattern detection, pattern recognition, artificial intelligence, machine learning, deep learning and computer vision.

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Page 12