Robotics and Autonomous Systems Thesis Defense

Multi-Robot Task Allocation with Inter-Agent Distance Constraints

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Abstract

This thesis considers the problem of multi-robot task allocation with inter-agent distance constraints, e.g., due to the presence of physical tethers or communication requirements, that must be satisfied at all times. Specifically, three optimization-based formulations are explored: (i) a ``Naive Method" that leverages the classical multiple traveling salesman (mTSP) formulation to find solutions that are then filtered out when the inter-agent distance constraints are violated, (ii) a ``Timed Method" that constructs a new formulation that explicitly accounts for robot timings, including the inter-agent distance constraints, and (iii) an ``Improved Naive Method" that reformulates the Naive Method with a novel graph-traversal algorithm to produce tours that, unlike the Naive Method, allow backtracking and also introduces a more systematic approach to filter out solutions that violate inter-agent distance constraints. The effectiveness of the approaches to return task allocations that satisfy the constraints are demonstrated and compared in simulation experiments.

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