Multi-Robot Coordination: Applications in Orchard Bin Management and Informative Path Planning

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Abstract

Efficient coordination is desired for multi-robot systems in many scenarios. In this research, we first provide a multi-robot system to help human workers during tree fruit harvest. We present an auction-based method to coordinate a team of self-propelled bin carriers to retrieve fruit bins. Second, we propose a more general information gathering problem in a dynamic environment. In this problem, locations of points of interest change over time. Further, the amount of meaningful information or reward that can be obtained from each point is limited. We propose to use a distributed sampling algorithm for task allocation, and receding horizon strategy for path planning in this problem. To evaluate its performance, the proposed algorithm is compared to a baseline algorithm that implements sequential auction for task allocation with greedy path planning. Experimental results suggest that the proposed algorithm is more suitable for solving the aforementioned information gathering problem. Finally we present an effective approach to coordinating a team of UAVs (unmanned aerial vehicles) to simultaneously exploring, map, and search in unknown environments. The UAVs can perform a weighted tradeoff between the three sub-tasks. Moreover, human controllers can limit the time allowed for each UAV to remain without a valid communication link to the control base station. We compare results to a market-based baseline algorithm.

Wednesday, September 16, 2015
8:00 AM, Rogers 226

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