Extending Simultaneous Localization and Mapping to Swarms of Resource Limited Micro-Aerial Vehicles

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ABSTRACT

Achieving autonomy for robots involves building algorithms for the robots to localize themselves as well as map the environment around them. This problem, called Simultaneous Localization and Mapping (SLAM), has received significant attention in robotics literature. Traditionally, SLAM algorithms represent maps as gigantic matrices (occupancy grids) [3]. They also make use of expensive and energy-intensive sensors and heavy computing power for operation.

The RoboBees project [2] is involved in building a large-scale MAV swarm. The swarm must work around individual resource constraints, but complete large tasks as a group [1]. This involves performing SLAM in a distributed manner, with each robobee working on a small portion of the world and coordinating between these resources by efficient sharing of relevant information between RoboBees. Therefore, we need to rethink SLAM algorithms to scale them to such swarms of resource-constrained robots. Key to this is the representation of the map that has to move away from a flat data structure (like a grid) to hierarchical data structures that can be constructed, manipulated, and shared in a distributed manner.

BODY

Designing hierarchical data structures for map representation key to scaling SLAM algorithms to large swarms of resource-constrained robots

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