Dynamic Ad-hoc Topologies for Mobile Robot Navigation Based on Non-Uniform Grid Maps

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Abstract : To avoid obstacles in the surrounding environment and to navigate to a given target belong to the most important tasks for mobile robots. According to these tasks different data structures are suitable. To avoid near obstacles, occupancy grid maps are an ideal representation of the surroundings. For less fine grained tasks, such as navigating from one room to another in an apartment, pure grid maps are inappropriate. Grid maps are very detailed, calculating paths to navigate between rooms based on grid maps would take too long. Instead, graph-based data structures, so-called topologies, turn out to be a proper choice for such tasks. In this paper we present two methods to dynamically create topologies from grid maps. Both methods are based on non-uniform grid maps. The topologies are generated on-the-fly and can easily be modified to represent changes in the environment. This allows a hybrid approach to control mobile robots, where, depending on the situation and the current task, either the grid map or the generated topology may be used.