Optimisation techniques for monitoring a high-risk industrial area by a team of autonomous mobile robots

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Abstract
This thesis explores the development and implementation of optimisation algorithms for monitoring industrial areas using a team of autonomous mobile robots. The research focuses on Multi-Robot Task Allocation (MRTA), where a near-optimal mission plan must be generated. A novel model considering heterogeneous robots and tasks is proposed, using Genetic Algorithms (GA) and 2-Opt local search methods to solve the problem. The thesis also integrates collision avoidance strategies, which become necessary when there are many robots and tasks. A low-level local solution handles many conflict situations during the mission, which can cause delays. Therefore, a solution for this case was proposed using clustering. Furthermore, we evaluate the proposed solutions through real-world experiments including a navigation-based algorithm that addresses collision issues. The results demonstrate the value of these algorithms in optimising task allocation and path planning for autonomous mobile robots in industrial settings, paving the way for more efficient mission planning and enhanced safety in industrial environments