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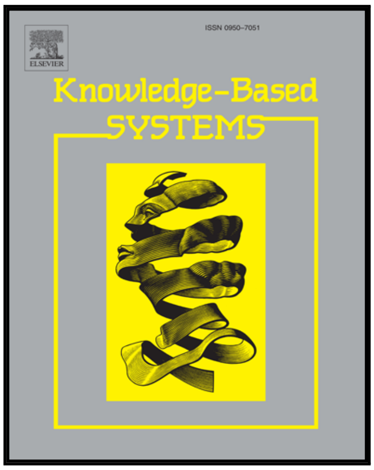

The More Obstacle Information Sharing, The More Effective Real-time Path Planning?

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More Threat Information Sharing, More Effective UAV Real-time Path Planning?

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Abstract

With the requirements of improving the intelligence of unmanned aerial vehicles (UAVs), real-time path planning for heterogeneous UAVs has attracted substantial attention. Sharing the detected threat information of a UAV (Unmanned Aerial Vehicle) with other UAVs is expected to help them improve the path quality of cooperative path planning. However, it does not always come up to the expectation due to the diversity of the owned information and the shared information. Motivated by this, in this work we investigate the impacts of sharing threat information on UAV path planning by figuring out the characteristics of threat environments with information sharing. Furthermore, a new path planning approach based on three adaptive strategies are proposed to adapt to the diversity. The effectiveness and efficiency of the approach are verified by implementing it on a real-time Rapidly-exploring Random Tree (RRT) algorithm and plenty of test scenarios.

Keywords- Path planning; Real-time path planning; Multi-UAVs; Information sharing; Threat information

1 Introduction

Real-time path planning for unmanned aerial vehicles (UAVs) has been considered as a fundamental and necessary mission in diverse civil applications, such as surveillance, rescue, navigation and guidance of air [5][25][26][27][30]. A wide variety of path planning methods for UAVs have been proposed for these missions, for example, graph search based Voronoi diagram methods [2], evolutionary computation based methods [34], optimal control approaches [4][29], sampling based methods such as probabilistic roadmaps methods (PRMs) [1][6] and rapidly exploring random trees (RRTs) methods [13][17][20][31], mixed-integer linear programming (MILP) based methods [15][28], bouncing based algorithms [16], behavior based algorithms [33][36], bi-level programming based algorithms [12][21][24][35], etc. Due to the enhancement of detection ability of UAVs, more and more researchers observe that the way of detecting obstacle