2022 IEEE 18th International Conference on Automation
Science and Engineering (CASE)
August 20-24, 2022. Mexico City, Mexico

Deterministic Path Optimization in 2D

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June 2022

1 Abstract

Path smoothing is an important operation in a number of path planning applications. While several approaches have been proposed in the literature, a lack of simple and effective methods with quality-based termination conditions can be observed. Among the many available methods, the traditional random shortcuts approach represents a popular and effective solution. However its random selection of shortcuts may miss tight areas difficult to be sampled. This may lead to sharp corners in tight areas making it difficult to achieve termination conditions based on path quality.

In this paper we propose a method that overcomes these limitations and is able to include user-specified termination conditions based on solution quality. At each iteration, our method first identifies a vertex on the path that has the most potential for smoothing, and then applies one of two possible shortcut-based smoothing operation. As a result, our prioritized shortcut selection and quality-based termination conditions result in a method that outperforms the random shortcuts approach both in path length and worst-case angle. We present several benchmarks demonstrating that, for the same amount of smoothing time, our method produces higher-quality paths when compared to the traditional random shortcuts approach.

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