Alternative Pathfinding in Game Maps and Indoor Venues

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Background

Alternative routes in road networks have gained a lot of attention [4]. However, no existing work focuses on finding alternative routes in game maps and indoor venues.

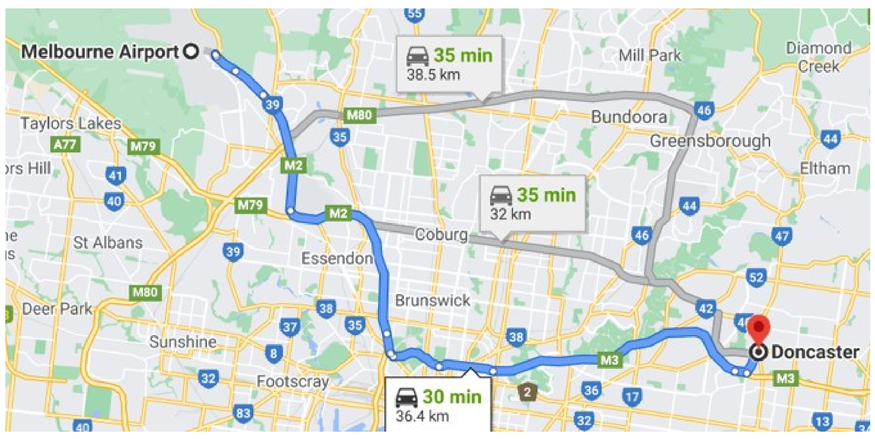

Figure 1: Three alternatives reported by Google Maps.

Aims and Contributions

Given a start s and a goal t in a game map or indoor venue, the aim is to return a set of k paths significantly different and short. Firstly, we introduce a parameter $\alpha > 1$ and only report the alternative paths that have length at most $L \times \alpha$ where L is the length of the shortest path. Meanwhile, we implement state-of-the-art road network techniques for game maps and indoor venues and visualise the routes generated by them. This system will help evaluate these techniques and identify potential limitations that must be addressed for better alternative pathfinding in game maps and indoor venues.

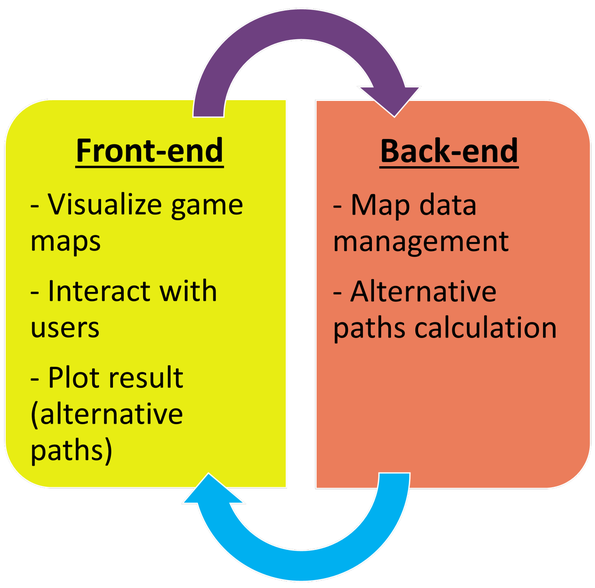

Figure 2: System architecture.

System Description

Our web-based system is mainly implemented in JavaScript and running on the Node.js server.

Algorithms and Implementation Details

Penalty [1]

- Iteratively compute shortest paths from start to goal.
- After each iteration, apply a penalty on each edge of the shortest path found in the previous iteration by increasing its edge weight by a specific factor.

Plateaus [3]

- Create two shortest path trees: T_s, rooted at the start s; T_t, rooted at the goal t.
- T_s and T_t are *joined* to obtain the common branches (equiv. plateaus).
- Generate the alternative paths from the plateaus.

Dissimilarity [2]

- Dissimilarity function $dis(p, p)$, e.g., Jaccard distance.
- Iteratively add candidate path p to the current result set P if $dis(p, p') \geq \theta$ for every $p' \in P$.

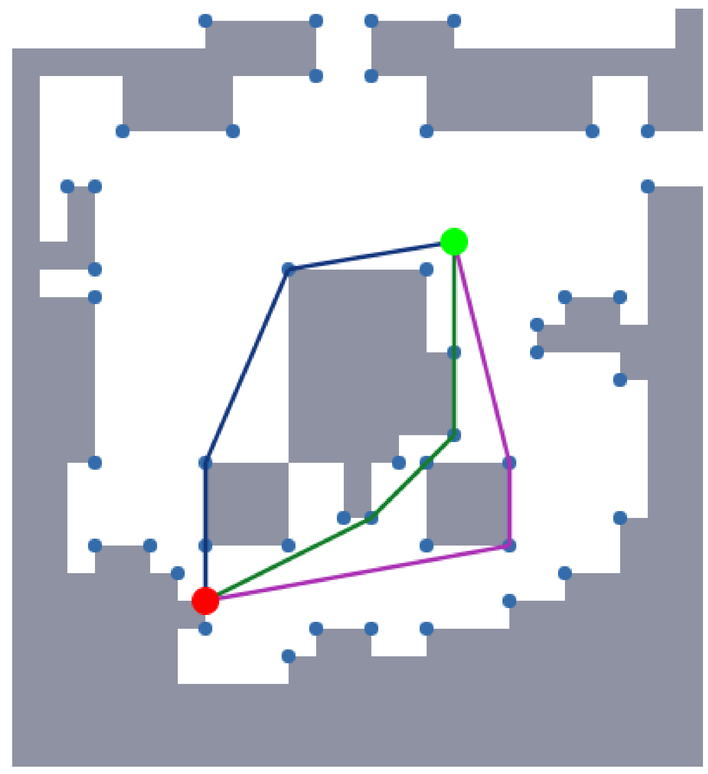

Figure 3: Three alternative paths reported by plateaus.

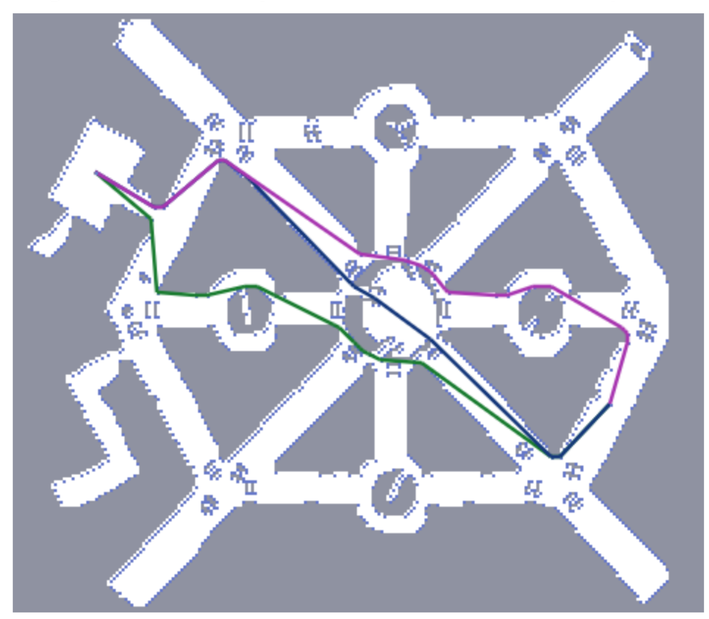

Figure 4: Three alternative paths reported by plateaus.

References

[1] Vedat Akgün, Erhan Erkut, and Rajan Batta. On finding dissimilar paths. *European Journal of Operational Research*, 121(2):232–246, 2000.

[2] Theodoros Chondrogiannis, Panagiotis Bouros, Johann Gamper, Ulf Leser, and David B Blumenthal. Finding k-shortest paths with limited overlap. *The VLDB Journal*, pages 1–25, 2020.

[3] Alan Henry Jones. Method of and apparatus for generating routes, August 21 2012. US Patent 8,249,810.

[4] Lingxiao Li, Muhammad Aamir Cheema, Hua Lu, Mohammed Eunus Ali, and Adel N Toosi. Comparing alternative route planning techniques: A comparative user study on melbourne, dhaka and copenhagen road networks. *IEEE TKDE*, 2021.