Algorithms for the Moving Target Travelling Salesmen Problem

[Bachelor thesis]

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ABSTRACT

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1. INTRODUCTION

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2. DEFINITIONS

In MT-TSP we consider an amount of targets $T = \{t_1, ..., t_n\}$ and a set of velocities $V = \{v_1, ..., v_n\}$ so that each moving with a constant movement speed $\overrightarrow{v_i}$. A pursuer starts at the origin O (a defined position), moving with a velocity of v_p. His target is to visit all targets once and return to the origin at the end.

Therefore, we can model this problem as a graph $G = (T, V, O, v_p)$.

3. INSTANCES OF MOVING-TARGET TSP

It was proved that MT-TSP is NP-hard. Some instances can result in an unbounded error, whenever the pursuer choses a non-optimal tour. Therefore, the condition $v_p > |\overrightarrow{v_i}|$ must apply to avoid those errors. The authors of [1] proved this, since the goal is the most fast optimal tour. Thus, instead of directly calculating the tour of the pursuer, it is necessary to determine the solvability of the input. Whenever it is not possible we gain a 'No'-instance, otherwise we go ahead and calculate the tour.

This paper presents two concrete cases:

1) 1D-case: Each target's movement is limited to a single line

2) 2D-case: The movement direction of a target consists of a two-dimensional vector

Each case is investigated for the shortest tour length and the fastest tour. We will consider different instances and try to approximate and analyse each one.

3.1 One-dimensional-case

3.2 Two-dimensional-case

4. SUMMARY AND OUTLOOK

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5. REFERENCES

[1] Christopher S Helvig, Gabriel Robins, and Alex Zelikovsky. The moving-target traveling salesman problem. *Journal of Algorithms*, 49(1):153–174, 2003.