Project Proposal

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1 Problem

The Travelling Salesman Problem (TSP) is known to be a NP-hard problem. Nevertheless, there are many algorithms that may provide solutions given sufficient amount of time but as the number of cities increases, the problem gets even more convoluted. The University of Waterloo in Canada has published a TSP instance with 100.000 cities that reflects a representation of Leonardo da Vinci's Mona Lisa when observed from the right angle [1]. The creator of the dataset, Robert Bosch, uses optimisation to create visual art work, the so-called TSP art [2]. Mathematicians would describe the TSP Mona Lisa instance as a simple closed curve that due to its complexity, the optimal solution has not yet been uncovered. The current best tour has a length of 5,757,191, even though theoretical evidence has been given that the optimal length should be 5,757,084. An optimal solution to the 100,000-city Mona Lisa instance would set a new world record for the TSP.

2 Methods

The Ant Colony Optimisation algorithm has been successfully used on TSP instances multiple times in the past. There are different variants to this algorithm available, such as Ant Colony [3], Ant Colony System [4] and Max-Min Ant Colony [5], each addressing different aspects of the algorithm's properties. Through this project we aim to investigate the performance of the mentioned variants of the Ant Colony Optimisation [6] in-depth, especially in terms of trade-off between exploitation and exploration, convergence, computational costs and their retrieved solutions. Undoubtedly, applying ACO on this instance of a problem will be an interesting experience for us and we hope to receive a good score, compared to other submissions.

References

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