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“A Comparative Analysis of Meta-heuristic Optimisation Algorithms for Vehicle Routing“

Today's popular "shared-economy" concept has accelerated the progress towards prioritising the implementation of cost-efficient strategies and promoting sustainable solutions, especially in the logistics and transportation sectors. This has directed more attention towards the last-mile delivery logistics and the prohibitively expensive costs associated with it. Hence, numerous approaches tackle this challenge by utilising urban transportation resources in the supply chain. This is achieved by incorporating parcel delivery into ride-sharing services by integrating parcel delivery requests with passenger transportation route plans. Lying at the core of route planning is the travelling salesman problem, which is a typical unresolved challenge in the field of combinatorial optimisation, owing to the exponential time complexity and expensive resources required by traditional algorithmic methods to compute the optimal route. Meanwhile, several heuristic and meta-heuristic optimisation techniques such as evolutionary algorithms, swarm intelligence-based algorithms or physics-based algorithms have been developed in recent years in an attempt to effectively solve optimisation problems. This thesis aims to compare the performance of three different types of meta-heuristic algorithms (Genetic Algorithm, Ant Colony Optimisation and Simulated Annealing) for the vehicle routing problem represented as travelling salesman problem, based on two datasets: NYC Green Taxi dataset and Porto City Taxi dataset. The performance of the three algorithms was evaluated on the basis of computation efficiency in terms of time needed to find the solution and on the basis of accuracy as well as reliability of the obtained solutions. The simulation results obtained from both datasets show that simulated annealing provided the most accurate and most reliable results, where ant colony optimisation came in second. On the other hand, the genetic algorithm demonstrated the highest efficiency in terms of algorithm runtime yet the quality of its results fell short in terms of accuracy and reliability.

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