[[1]](#footnote-1)

Vehicle Routing Problem: Using Wisdom of Crowds and Genetic Algorithms

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*Abstract*—This paper presents a novel approach to solving the vehicle routing problem, a generalization of the Traveling Salesman Problem, using wisdom of crowds and genetic algorithms. It provides evidence showing improvements in route estimations over standard genetic algorithms at the cost of runtime. Furthermore, a method to parallelize the approximation of multiple vehicle routes from multiple depots is presented.

*Index Terms*—Shortest path problem, Genetic algorithms, NP-hard, Routing

# INTRODUCTION

The Vehicle Routing Problem (VRP) is a generalization of the well-known non-deterministic polynomial-time hard problem, the Traveling Salesman Problem. The VRP has been a topic of scientific publication since 1959 [1]. The context of the problem is that there are one or more depots each with one or more vehicles that must deliver goods to one or more customers with preference to traveling a shorter distance. Advancements in the problem have been proven to be valuable for vital industries such as agriculture [2].

[1]

[2] <https://www.sciencedirect.com/science/article/pii/S1537511014000968>

# Prior Work

## Traveling Salesman Problem

The Vehicle Routing Problem is a generalization of the Traveling Salesman Problem (TSP). The Traveling Salesman Problem was first defined by Thomas Kirkman and W. R. Hamilton in the 1800s. It is considered a non-deterministic polynomial-time hard problem due to its factorial complexity. There have been many attempts at developing algorithms to approximate solutions to this problem including genetic algorithms [3] as well as wisdom of crowds [4].

[3]

[4]

## Vehicle Routing Problem

The Vehicle Routing Problem was first introduced by George Dantzig and John Ramser in 1959. Route optimization is of interest to many industries including agricultural, transportation, deliver, and more [5].

[5] <https://www.sciencedirect.com/science/article/abs/pii/S0377221707001233>

## Genetic Algorithms

Genetic Algorithms were first introduced by John Holland in 1960 based on principles from Darwinian evolution.

## Wisdom of Crowds

# Proposed Approach

## Genetic Algorithm

The genetic algorithm implemented is inspired by sexual reproduction of gametes in biology. This algorithm retains a constant population of “chromosomes” which are representations of possible solutions for the given problem. These chromosomes are a set of alleles that describe its performance. The algorithm makes use of two methods, crossover and mutation, to evolve the population overtime while weeding out the poor performers and mating the good performers through crossover.

# Experimental Results

## Data

## Results

# Conclusions

# Acknowledgements

References

1. [↑](#footnote-ref-1)