The Comparison and Application of Different Traveling Salesman Problem Algorithms
Miléna DeGuere, mdeguere@exeter.edu
Phillips Exeter Academy, 2018
USC Viterbi Department of Industrial & Systems Engineering, SHINE 2017

Introduction to Dr. Carlsson’s Lab

In Prof. Carlsson’s research of optimizing delivery times, the Traveling Salesman Problem presents a salesman who is given a list of locations to visit. He must visit each destination once. The goal of the problem is to find the optimal route that would take the least amount of time. TSP is classified as NP-Hard (Non-deterministic Polynomial acceptable problems) for its computational complexity.

Research Objective

The goal of Professor Carlsson’s research was to further the understanding of the effectiveness of different methods for solving TSP problems. This takes into account the efficiency of drone delivery (ex: Amazon Prime) versus man-operated delivery (ex: FedEx) and explored what happens when the two are combined in what is referred to as a horsefly scenario. (Horsefly delivery is when a person is driving a truck that has drones on it. The drones complete the actual delivery to the customer, and the driver minimizes time the drone would have to spend in air.)

Projects and Experiment

Within a 30x30ft area, we randomly placed 20, 30, and 40 flags. In three trial runs, we created individual TSP tours that we then measured the distance of. We ran the same experiment with clusters of five flags integrated with the randomly spread out flags. We then plotted these data points against the algorithms we previously learned and coded (Nearest Neighbor, Cheapest Insertion, Random Insertion, and the Optimal TSP).

Skills Learned

- MatLAB coding
- Graph Theory
- TSP problem formulation and algorithms
- Operation of DJI Spark Drone
- Operation of remote controlled car
- Logic and calculus strengthened through complex problems

Acknowledgements

Special thanks to Professor John Carlsson, my lab mentors Shichun Hu and Yang Cao, my SURE mentor Ramy Elbakari, Emanuel Marquez, and Dr. Katie Mills!