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Algorithm to Optimize Drone Delivery

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Sponsor: MIT Megacity Logistics Lab (MLL)

MIT GLOBAL SCALE NETWORK

January 2019 Poster Session

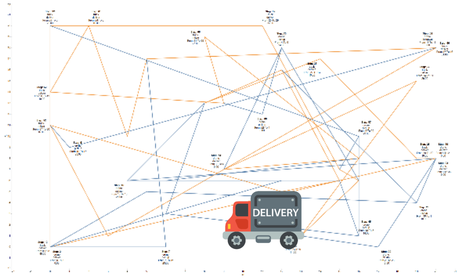
Motivation / Background

- Truck-and-drones synchronized delivery is a promising solution for last-mile delivery in some urban centers
- Quick and accurate network cost optimization is necessary to guide development/implementation decision-making

Small problem – 6 customers

Where truck go first?
Where to send drones?
Where to pick up drones?

Real world – 37 customers, 1 DC



Key Question / Hypothesis

How much can truck-and-drone delivery system save over traditional trucks? What factors most determine this?

Relevant Literature

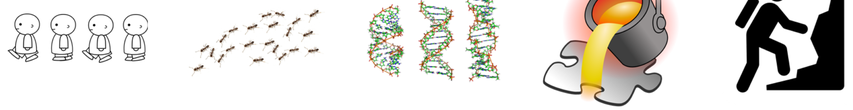
1. Murray, Chase C., and Amanda G. Chu. "The Flying Sidekick Traveling Salesman Problem: Optimization of Drone-Assisted Parcel Delivery." Transportation Research Part C: Emerging Technologies 54 (May 2015): 86–109. https://doi.org/10.1016/j.trc.2015.03.005.
2. Yoon, Justin J. "The Traveling Salesman Problem with Multiple Drones : An Optimization Model for Last-Mile Delivery." Thesis, Massachusetts Institute of Technology, 2018. http://dspace.mit.edu/handle/1721.1/117930.

Truck-and-drone System

Methodology

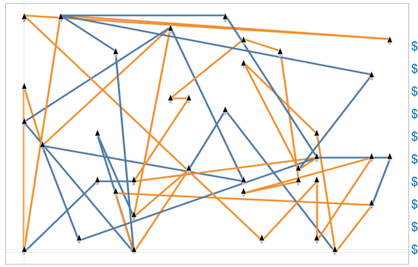
Not Greedy — *Most Greedy*

Random walk	Ant Colony	Genetic Algorithm	Simulated Annealing	Hill-climbing



Initial Results

Solution 3004 ≈ 40% improvement

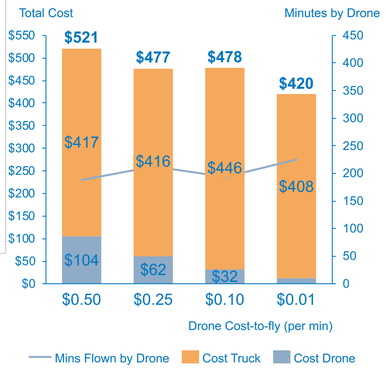


*** Solution Example – 38 nodes, GA, 100 gens**

Solution 1
Cost: $764
Time: 728 mins

Solution 3004
Cost: $478
Time: 446 mins

Sensitivity to drone cost-to-fly



Expected Contribution

- Develop efficient algorithm to evaluate truck-and-drone synchronized delivery optimality
- Justify or dispel the value of this specific truck-and-drone paired delivery implementation to real-world sized problems
- Sensitivity analysis around dynamics of market and technological constraints

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