Motivation / Background

Background:
- Global parcel delivery market valued at $82 bn and expected to double in next decade (McKinsey, 2016).
- Last mile makes up greater than 50 percent of market costs.

Immediate benefits with drones:
1. Significantly cut variable costs by cutting fuel and labor.
2. Faster delivery of products due to higher travel speeds.

Key Question / Hypothesis

Under what conditions will the integration of drones into last-mile delivery make sense?

Relevant Literature


The Problem

Physical Limitations
- Drones have a max payload of 5 lbs and limited range of 10 mi.

Operational Strategy
- A complete solution defining drone delivery execution has not been fully developed.

Government Regulation
- Current laws in US require line of sight and 400 ft ceiling.

Methodology

- Vehicle Routing Problem
- Mixed Integer Linear Programming
- Approximate Solutions with Heuristics

Initial Results

Objective Function:

Min Cost = \sum_{i} \sum_{j} x_{ij} c_{ij} + \sum_{i} \sum_{j} \sum_{k} y_{ijk\alpha} c_{d}(t_{ij}^{d} + t_{jk}^{d}) + \sum_{n} c_{n} x_{n}

Variables:
- \( x_{ij}, y_{ijk\alpha}, x_{n} \) = Binary Decision Variables
- \( t_{ij}^{d}, t_{ij}^{d}, t_{jk}^{d} \) = Travel Time
- \( c_{d}, c_{n} \) = Variable Cost
- \( c_{n} \) = Fixed Cost per Drone Dispatch

Expected Contribution

Develop algorithms to:
1. Model and optimize drone operations as a function of cost.
3. Solve problems more efficiently with heuristic.

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