

Student: Didi Dai, SCM 2022

Student: Aravindan Jayantha, SCM 2022

Advisor: David Correll, Mehdi Farahani

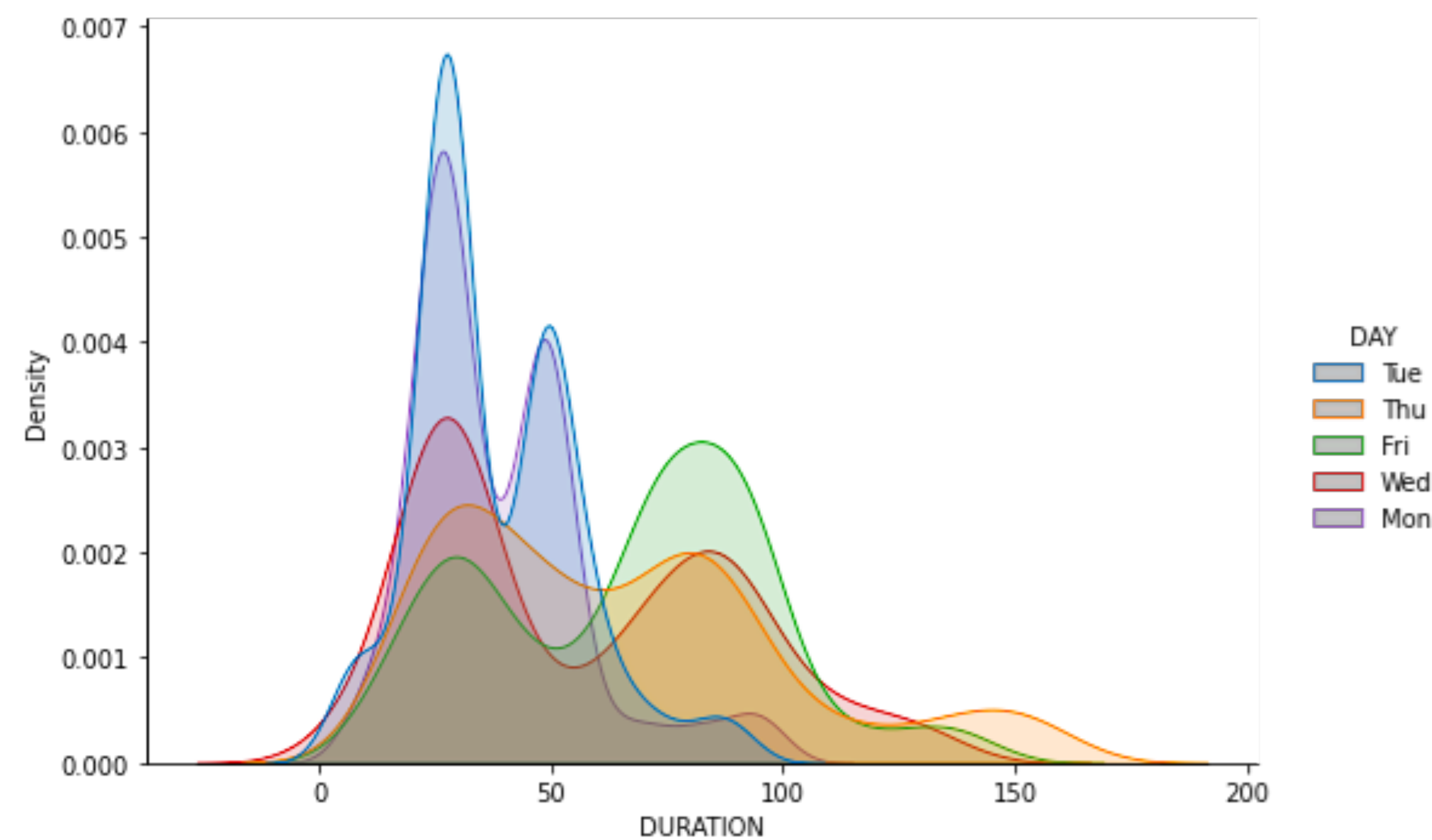
Sponsor: project44

Is your Transit Timetable "Normal" ?

Motivation

Companies make inventory decisions based on a keystone assumption that transit times are normally distributed. Although previous studies have shown a non-normality in transit time distributions in ocean freight, it is still unclear how transit time distribute in land freight and how much less inventories could a company hold if the transit time estimate is more accurate.

The inputs used in safety stock equation are often sourced from static and unsophisticated transit timetables. To address this limitation, this project examined geolocation data captured by project44.

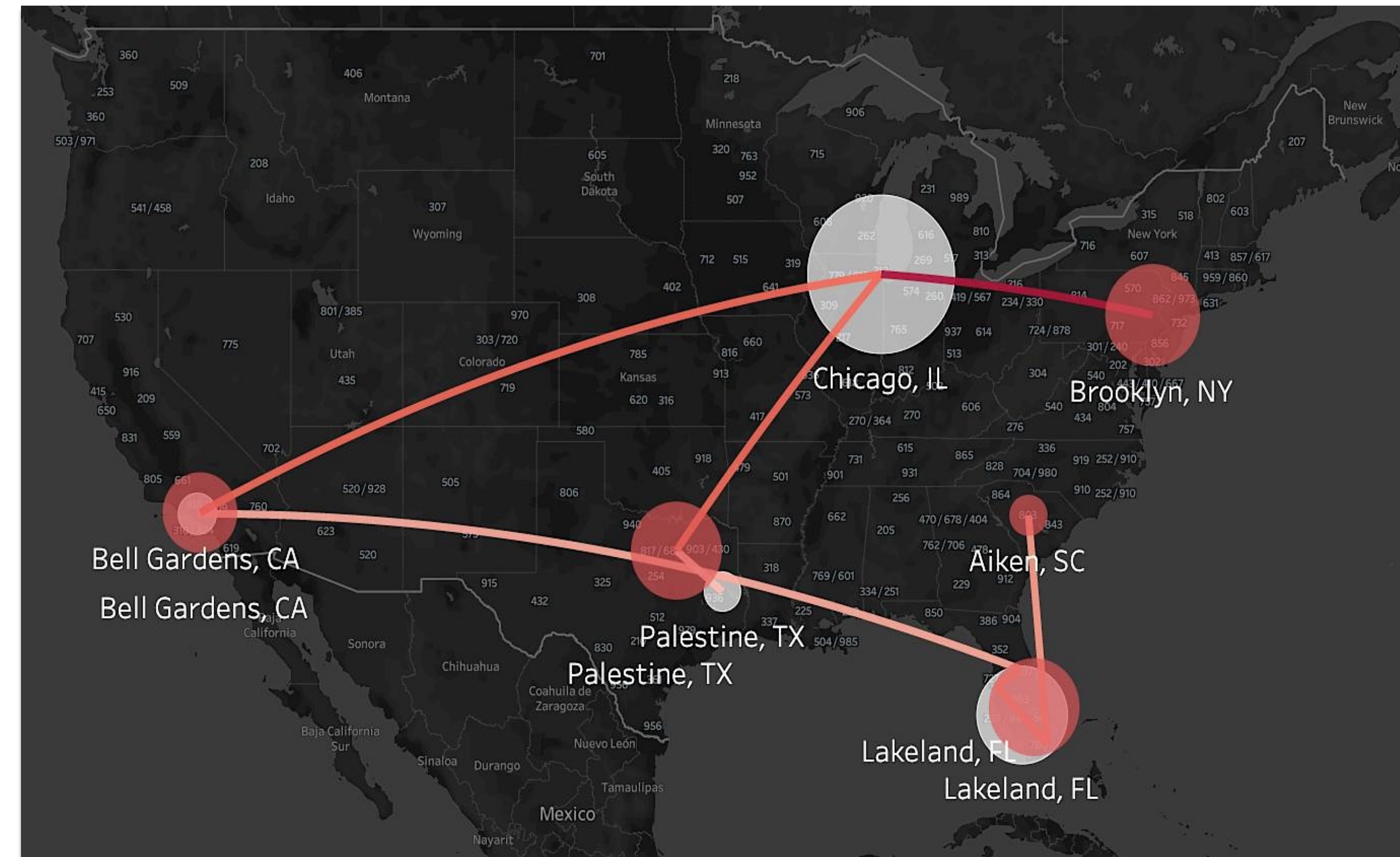


Key Questions

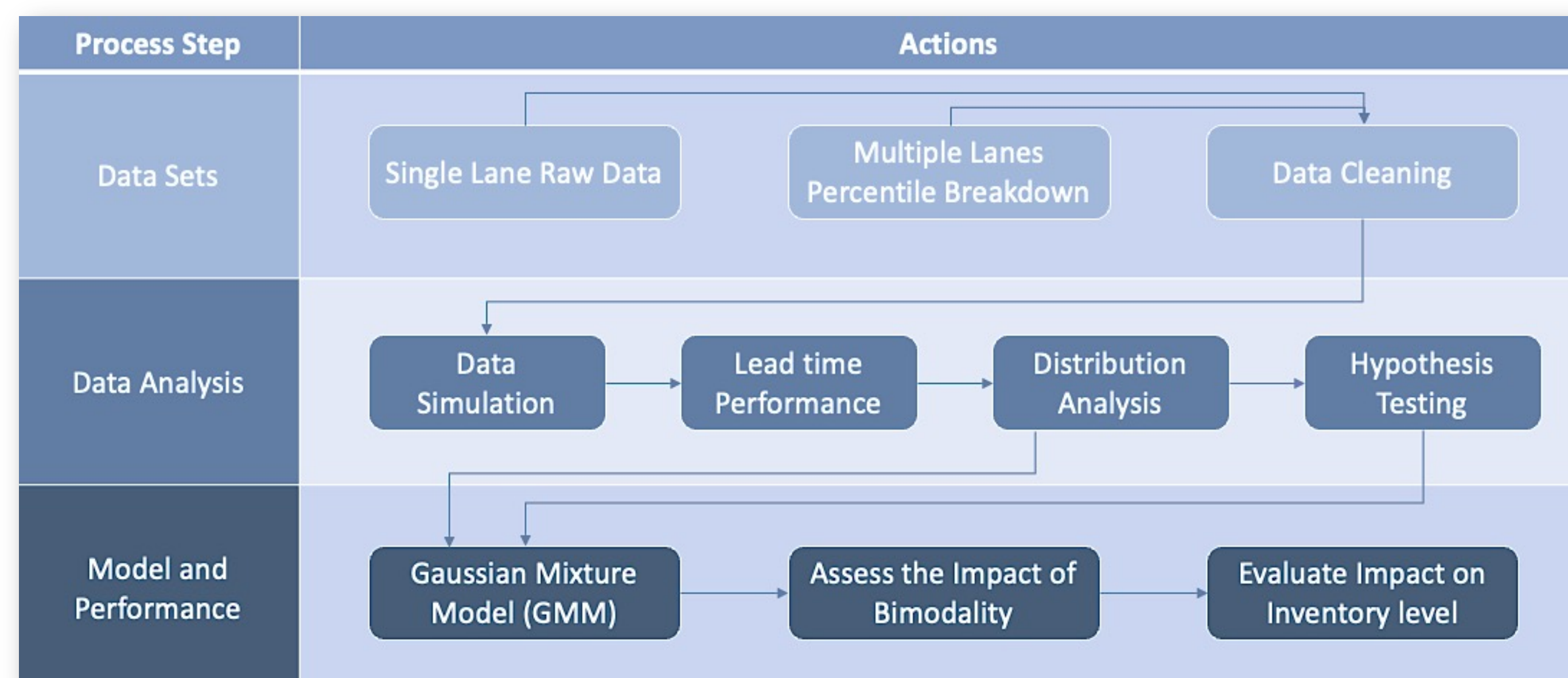
1. Investigate if transit times are different across days of the week
2. Measure the levels of transit time bimodality across various transport lanes
3. Evaluate the benefit of accounting for bimodality in safety stock reduction

Relevant Literature

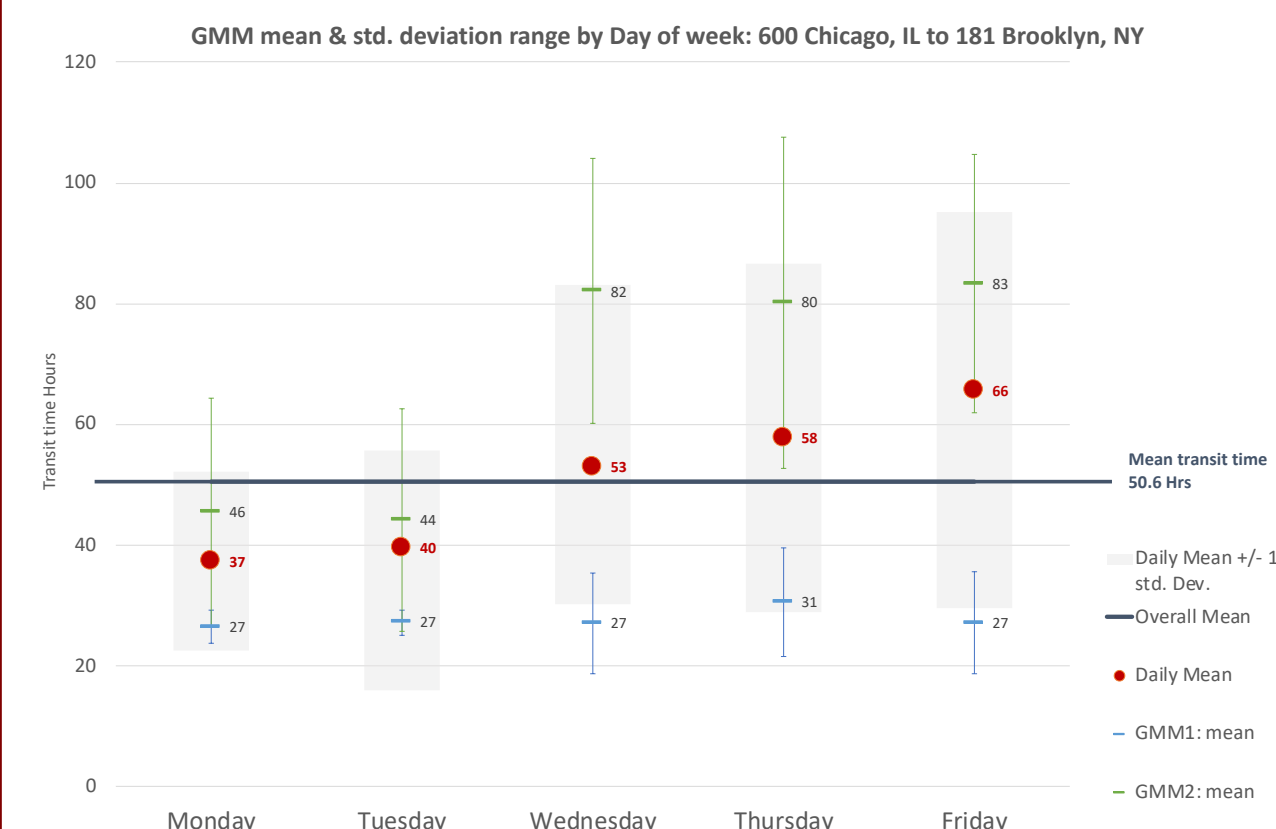
- Das, L., Kalkanci, B., & Caplice, C. (2014). Impact of Bimodal and Lognormal Distributions in Ocean Transportation Transit Time on Logistics Costs.
- Hadley, G., & Whitin, T. M. (1963). Analysis of inventory systems [by] G. Hadley [and] T.M. Whitin



Methodology



Results



Hypothesis testing proved that Mean Transit times for each day of the week pairing is not equivalent across many lanes and days.

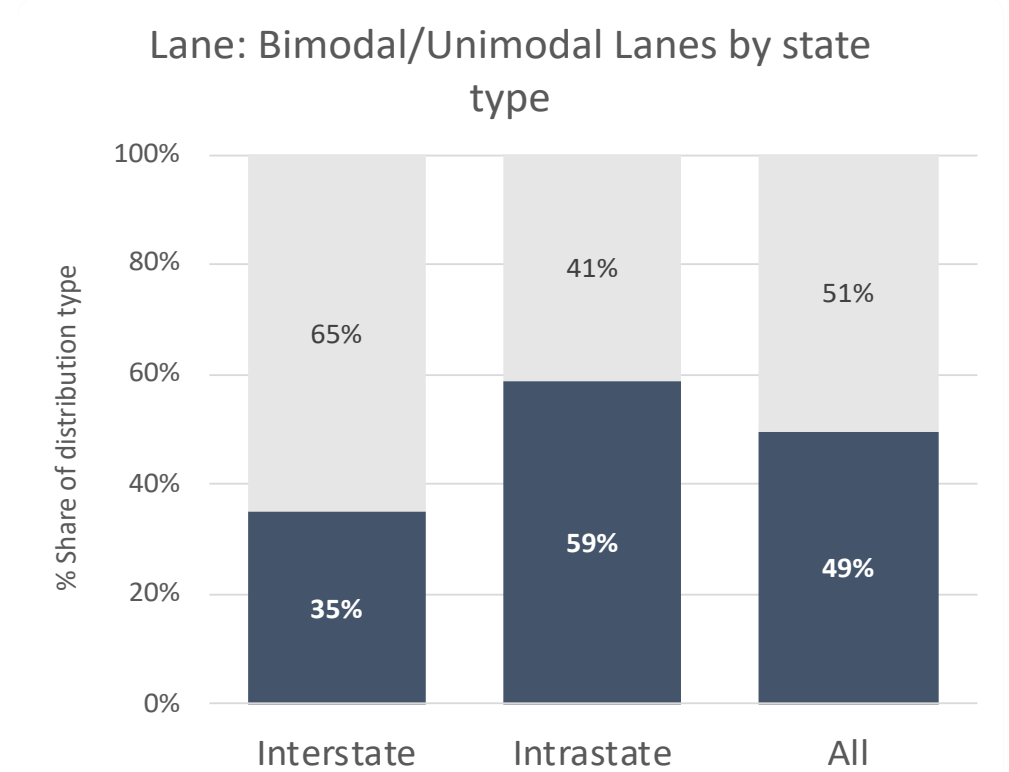
High levels of bimodality in second half of the week vs. the first half.

Saturday and Sunday trips have lower levels of bimodality than other days of the week

Intrastate lanes (within state lanes) had higher levels of transit time bimodality

Illinois to New York lanes were the most bimodal of interstate lanes

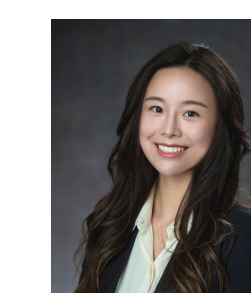
Numerical experiments found accounting for bimodality in a transit timetable could save companies up-to 16% in holding cost while maintaining service level.



Contribution

This project provides a method to support effective inventory decision making when selecting the most appropriate transit times. This includes producing:

- **Proved** transit time for **day of the week** are different.
- **Discovered** bimodality across 49% of the trips.
- **Developed** a **gaussian mixture model** to decouple bimodal transit time distributions.
- **Estimated** Inventory cost savings by accounting for bimodality



Didi Dai



Aravindan Jayantha