Deriving Tourist Mobility Patterns from Check-in Data

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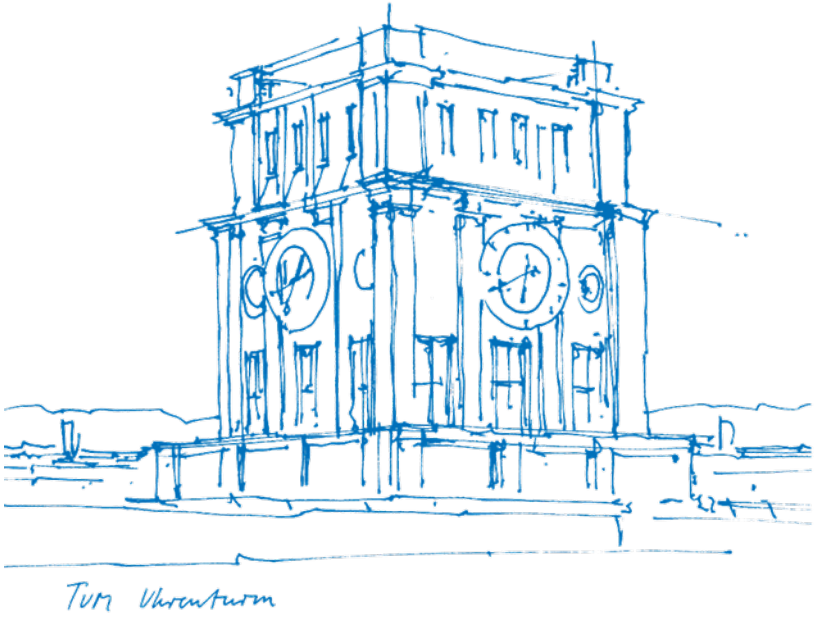

Introduction

Problem
Recommend **composite** trips of travel **destinations**

Motivation
Independent travel planning is **complex**,
information is **scattered**, **outdated**, of **uncertain quality**

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Introduction

Interactive Recommender Systems

- User modeling
- Recommendation algorithms
- UI/UX aspects
- **Item characterization**

Research questions

1. Which destinations to use in the travel knapsack (constrained by time & money)?
2. How long to stay at a specific region?

Solution

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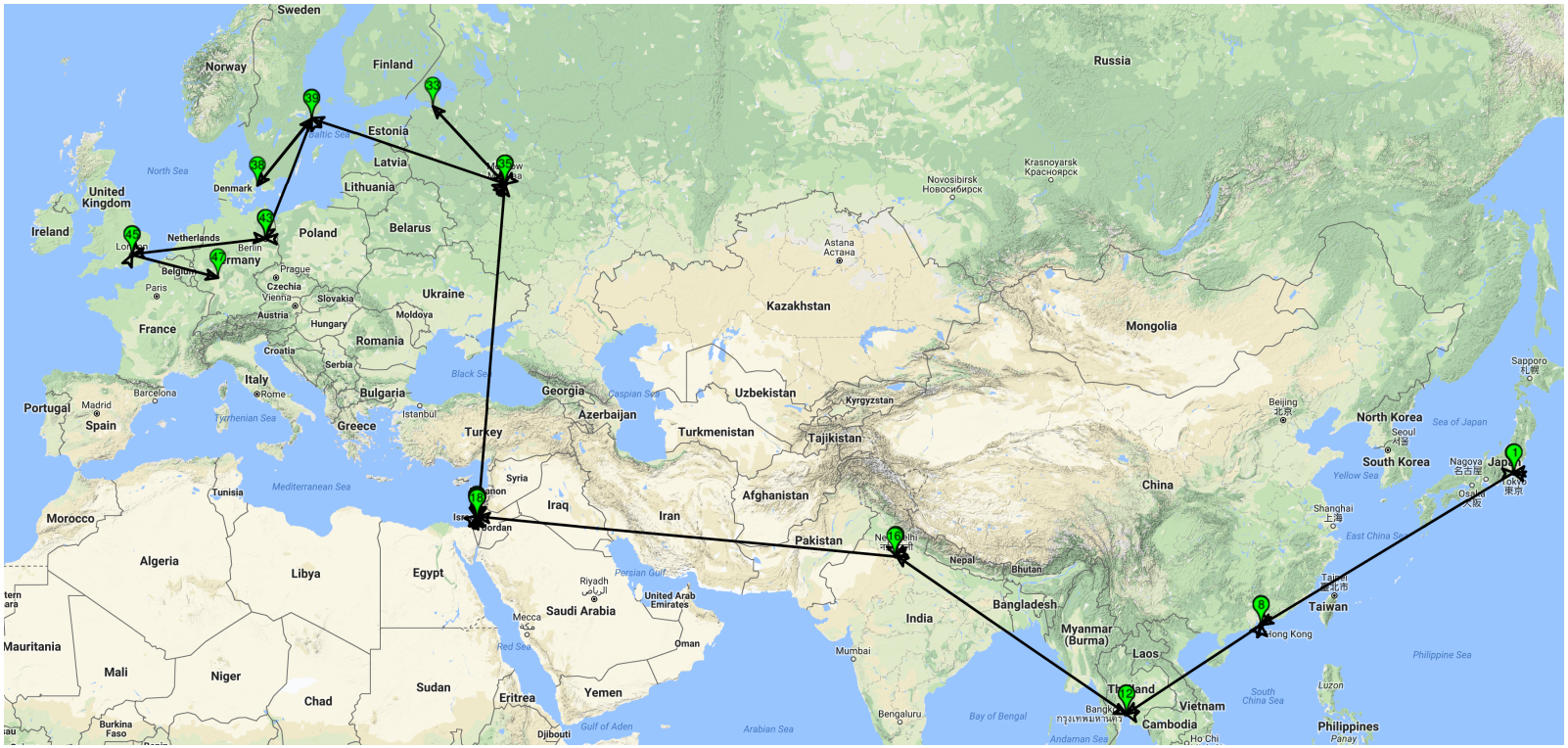
1. Which countries are frequently visited (together)
2. How long travelers typically stay at a specific region



Visualization of a trip © 2017 Google

Data

FOURSQUARE

Global check-in data set

- April 2012 to September 2013
- 266,909 users $\Rightarrow$ **65,745 travelers**
- 3,680,126 venues
- 77 countries
- 415 cities

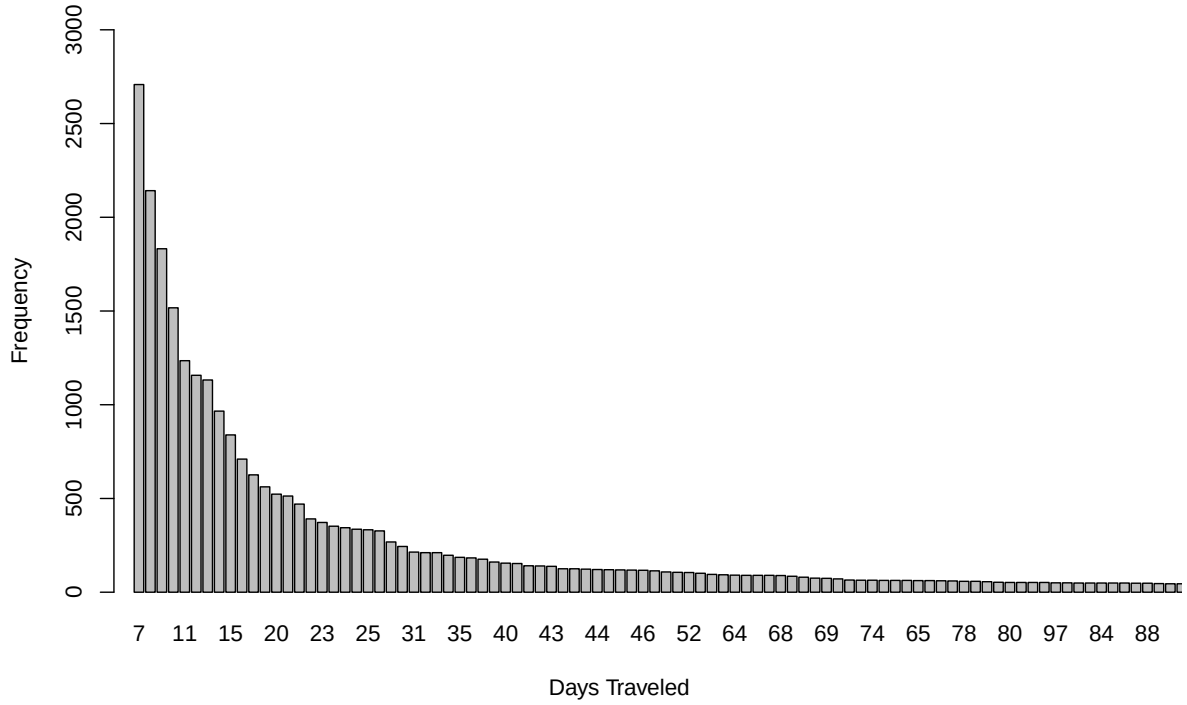
Source: `https://sites.google.com/site/yangdingqi/home/foursquare-dataset`

Metrics

Trip duration

Check-in rate, check-in density

Transition time



Metrics

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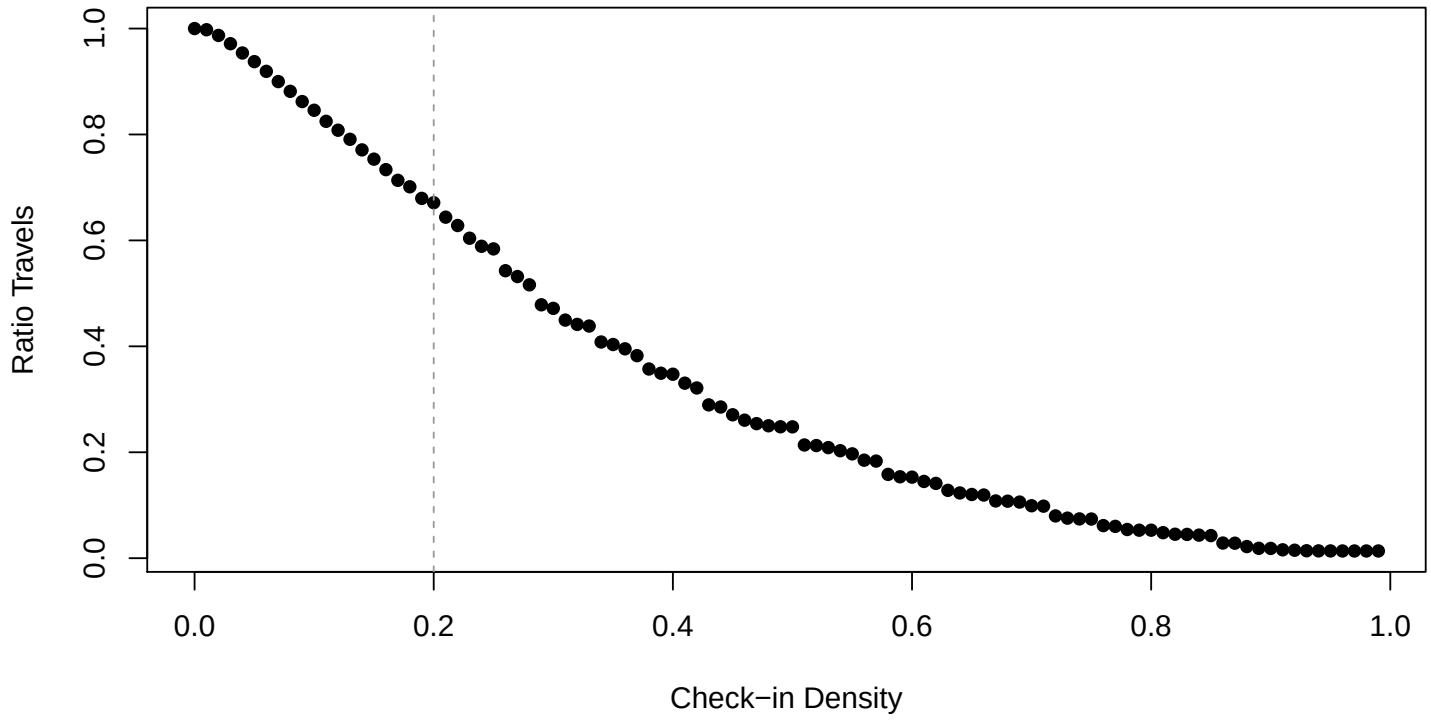

Metrics

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Check-in rate, check-in density

Transition time

$$\textit{Home}\ d_0 \rightarrow_3 \overbrace{\underbrace{d_3\ \textit{Brazil}\ d_{30}}_{\textit{Trip}}}^{\text{Block}} \rightarrow_1 \textit{Home}\ d_{31}$$

Metrics

Trip duration

Check-in rate, check-in density

Transition time

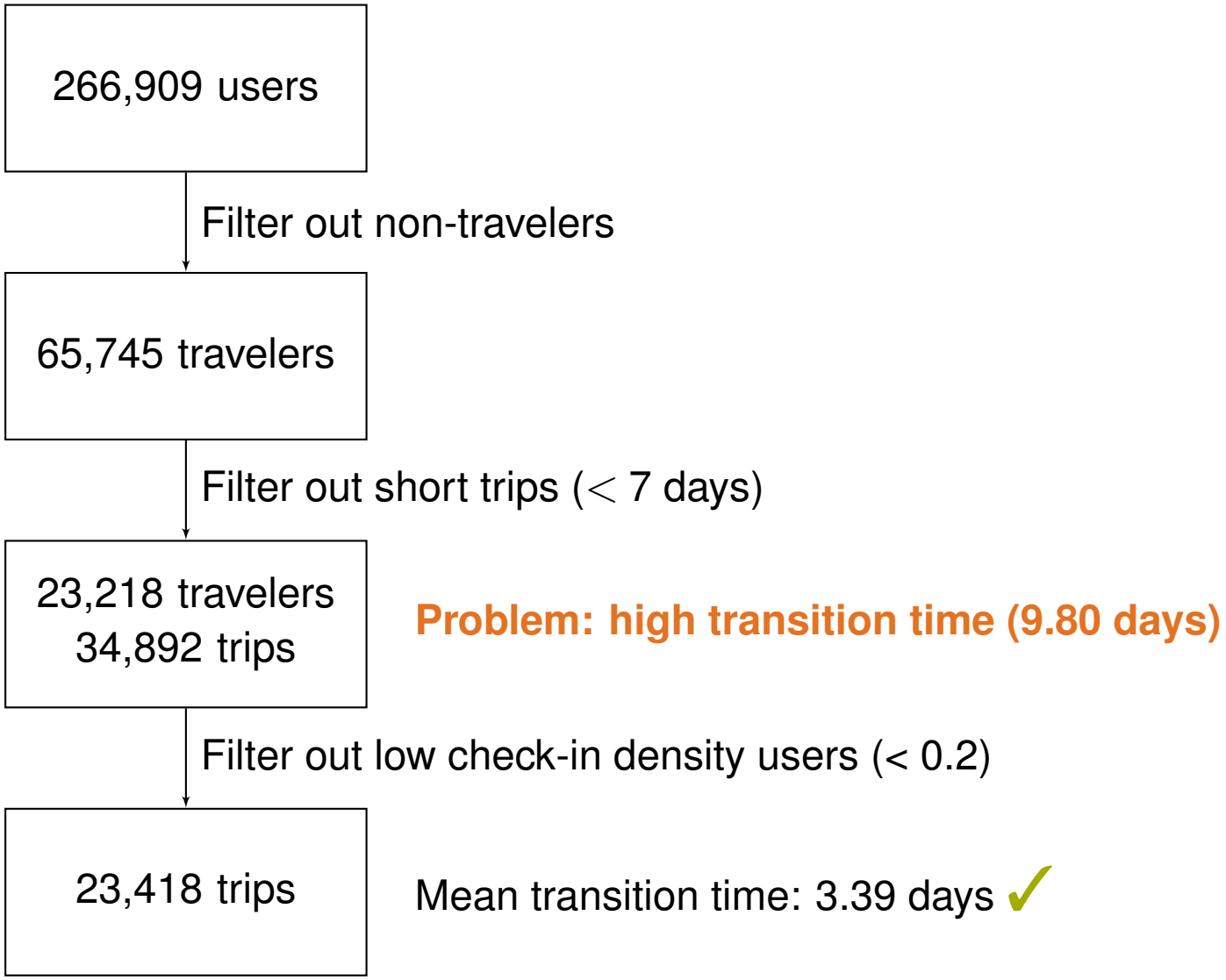
$$\textit{Home}\ d_0 \rightarrow_3 \overbrace{\overbrace{d_3\ \textit{Brazil}\ d_{30}}^{\text{Block}} \rightarrow_1}^{\textit{Trip}}$$

$$\rightarrow_1 d_{31}\ \textit{Home}\ d_{100} \rightarrow_1$$

$$\rightarrow_1 \overbrace{\overbrace{d_{101}\ \textit{Netherlands}\ d_{101}}^{\text{Block}} \rightarrow_0 \overbrace{d_{101}\ \textit{Germany}\ d_{105}}^{\text{Block}} \rightarrow_1 \overbrace{d_{106}\ \textit{France}\ d_{118}}^{\text{Block}} \rightarrow_3 \overbrace{d_{121}\ \textit{Germany}\ d_{124}}^{\text{Block}} \rightarrow_0 \overbrace{d_{124}\ \textit{Netherlands}\ d_{124}}^{\text{Block}}}^{\textit{Trip}} \rightarrow_6$$

$$\rightarrow_6\ d_{130}\ \textit{Home}\ldots$$

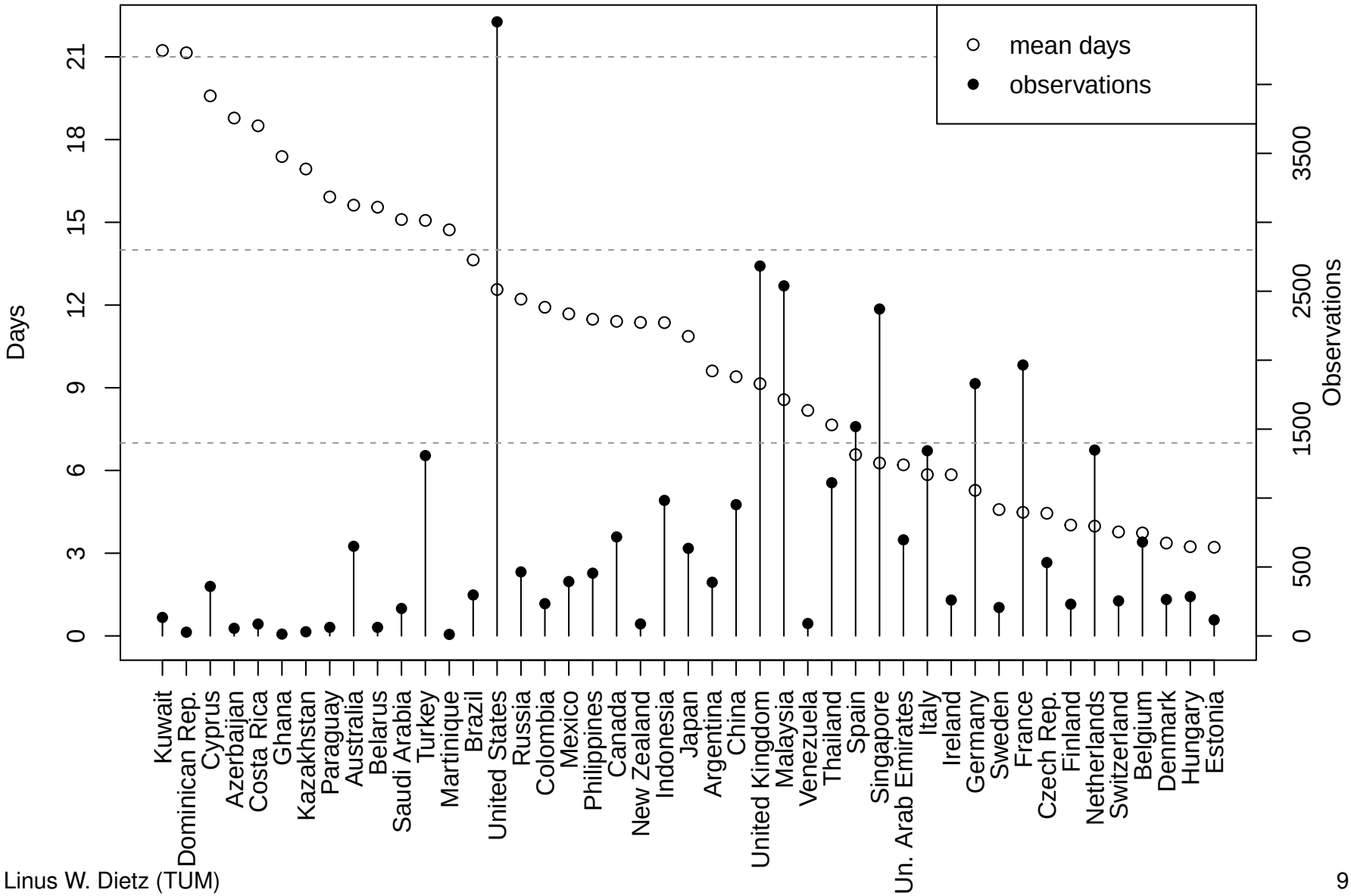
Data Processing



Results Country Co-occurrences

n	Countries	Observations
2	Malaysia, Singapore	269
	Canada, USA	162
	United Kingdom, France	156
	France, Italy	79
	United Kingdom, USA	79
3	France, Italy, Spain	50
	France, Belgium, Netherlands	38
	United Kingdom, France, Italy	34
	United Kingdom, France, Spain	29
	Thailand, Malaysia, Singapore	22
4	United Kingdom, France, Italy, Spain	21
	France, Belgium, Germany, Netherlands	17
	Austria, Czech Rep., Germany, Hungary	13
	France, Belgium, Italy, Netherlands	10
	France, Germany, Italy, Spain	10

Results Durations of Stay



Conclusions & Future Work

Check-in data $\Rightarrow$ tourist mobility patterns $\Rightarrow$
- **durations of stay**
- **destination co-occurrences**

Metric-driven data mining approach

Data models (destinations, trips)

Limited by data availability

$\rightarrow$ Evaluate metrics with more data

$\rightarrow$ Fine-grained region model

$\rightarrow$ Combine several data sources

Refine heuristics

Determine traveler types

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Questions?

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Data Model

Region tree of the planet

Earth
- → continents
  - → countries
    - → states
      - → counties

GeoTree model

Continents
- → Continental sections
  - → Countries
    - → Regions
      - → More regions
        - → Cities
          - → Districts

Wikitravel model

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Wikitravel model

Current granularity on country level only!