
Google

AARHUS UNIVERSITY

# Hyper-Local, Directions-Based Ranking of Places

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Google Inc.

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Aarhus University

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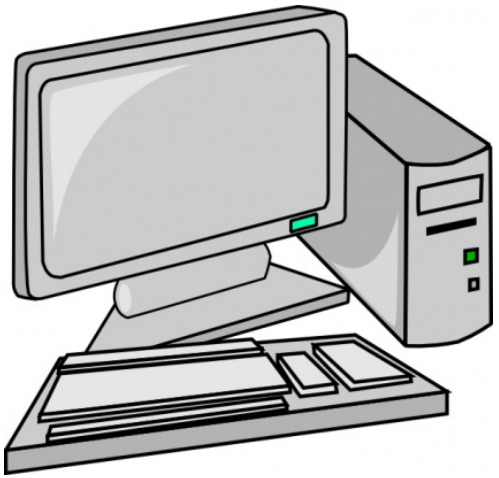
# Search queries have local intent!

~25%



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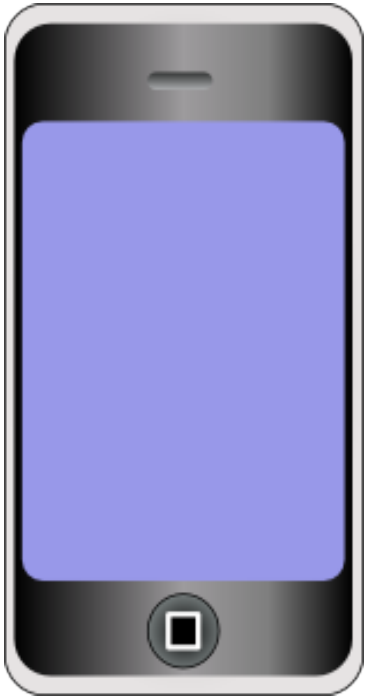
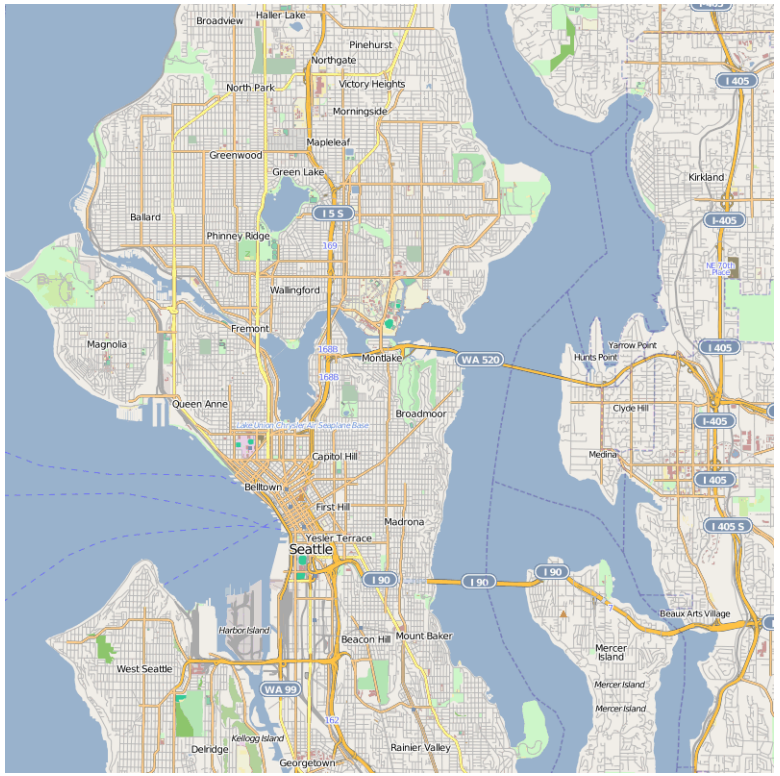


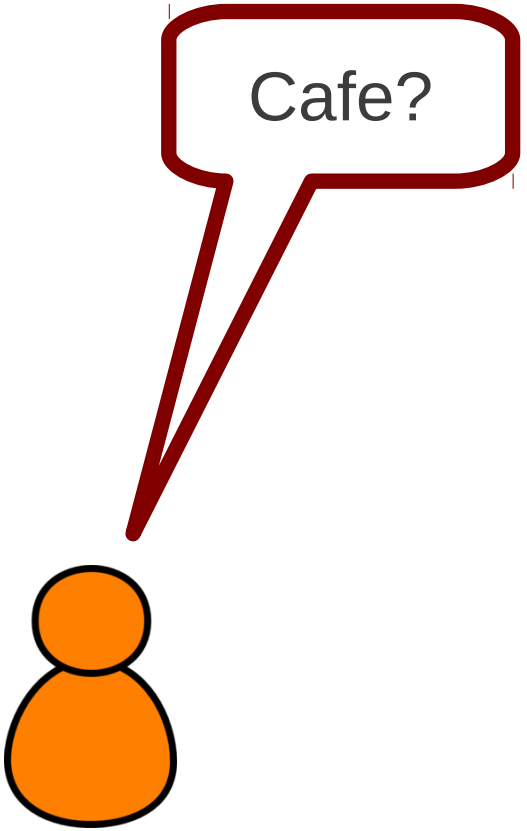
# Accurate locations for users

- IP-based positioning
  1-10s km




- Current smartphones
  10s m

# Motivating example: looking for a cafe



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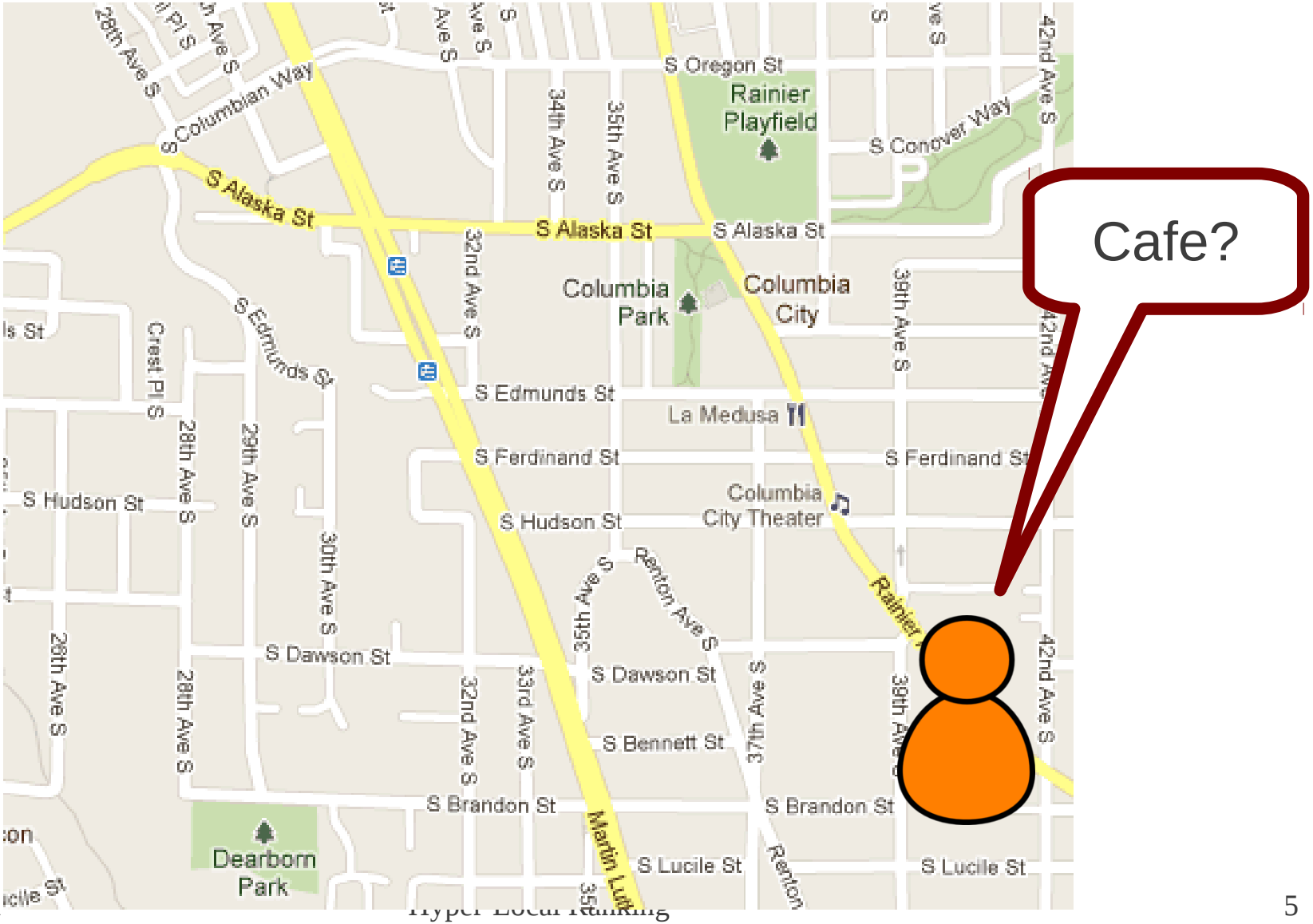

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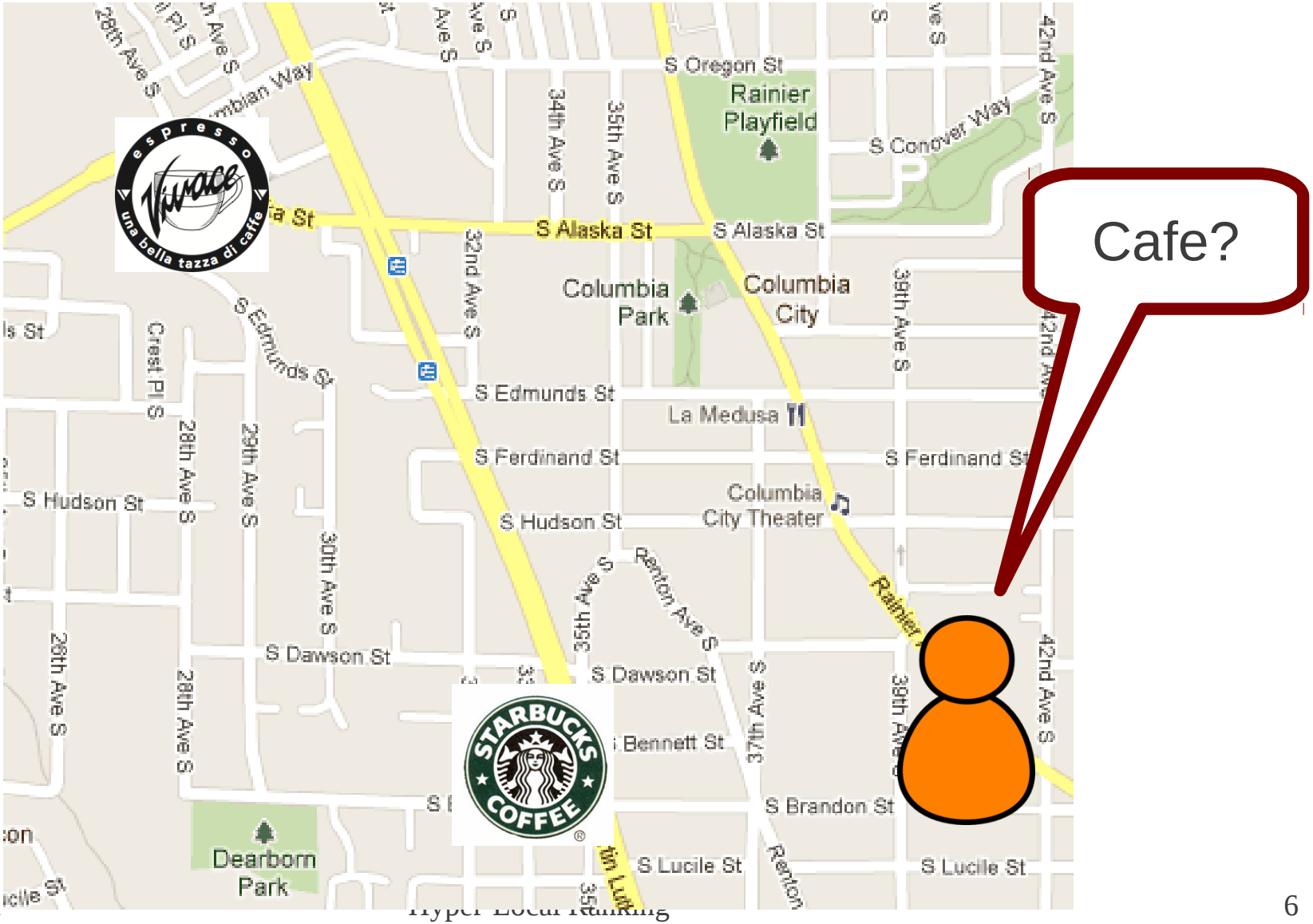


# New type of queries: hyper-local

- Known user location
- User determines
  - Interest (e.g., cafe)
  - Willingness to travel (e.g., 2 kms)

# Problems

1)Which data sources?

- Current solution: Reviews
  - Expensive
  - Lacking new businesses
  - Lacking time aspect
  - Sparse

2)How to scale?

# Contributions

1)Directions query logs
- Easy to access
- Time aspect
- Many, many more than reviews

2)Scalable ranking architecture

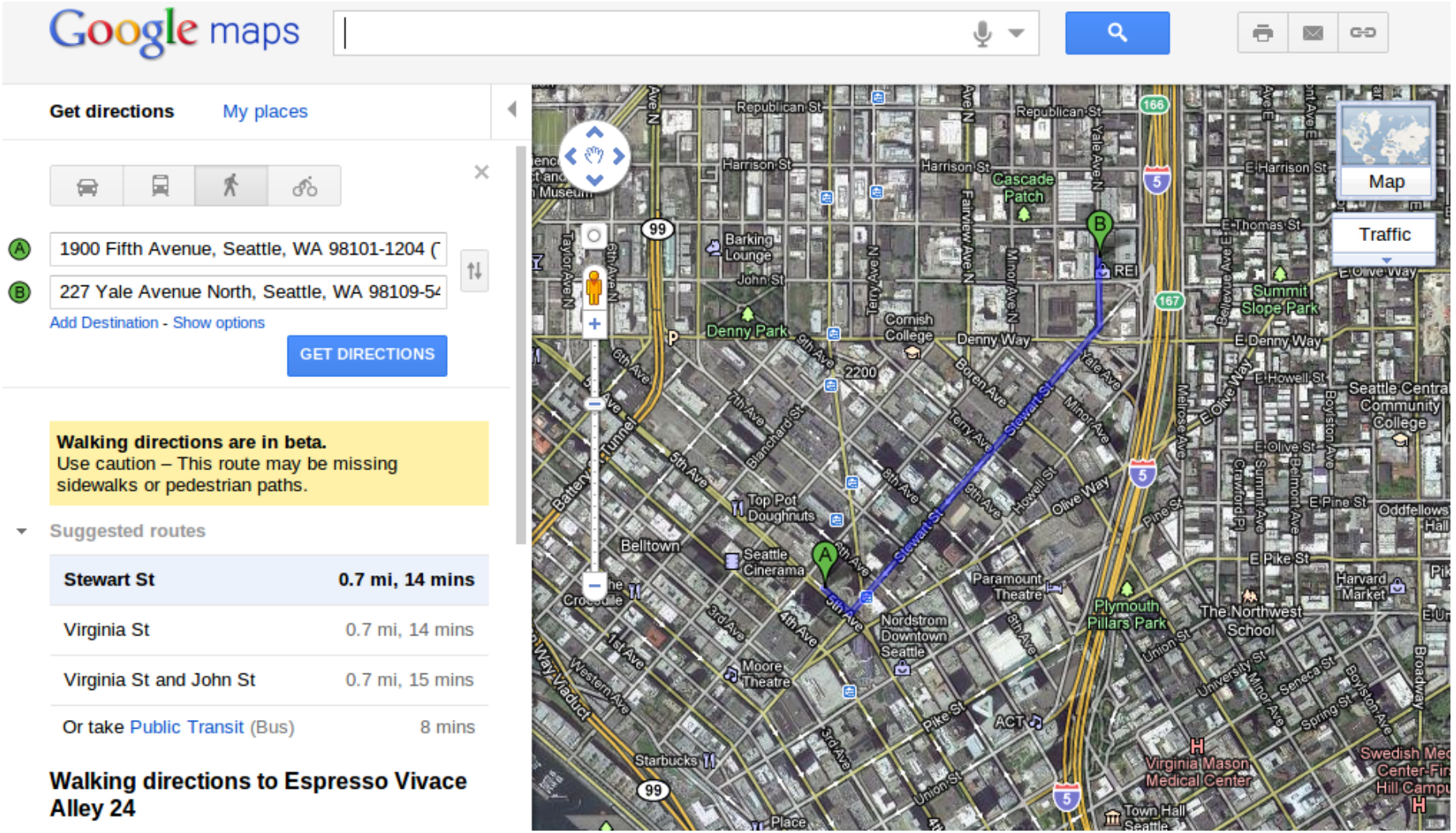
# Outline

Data sources

Efficient ranking

Experiments

# Directions query logs



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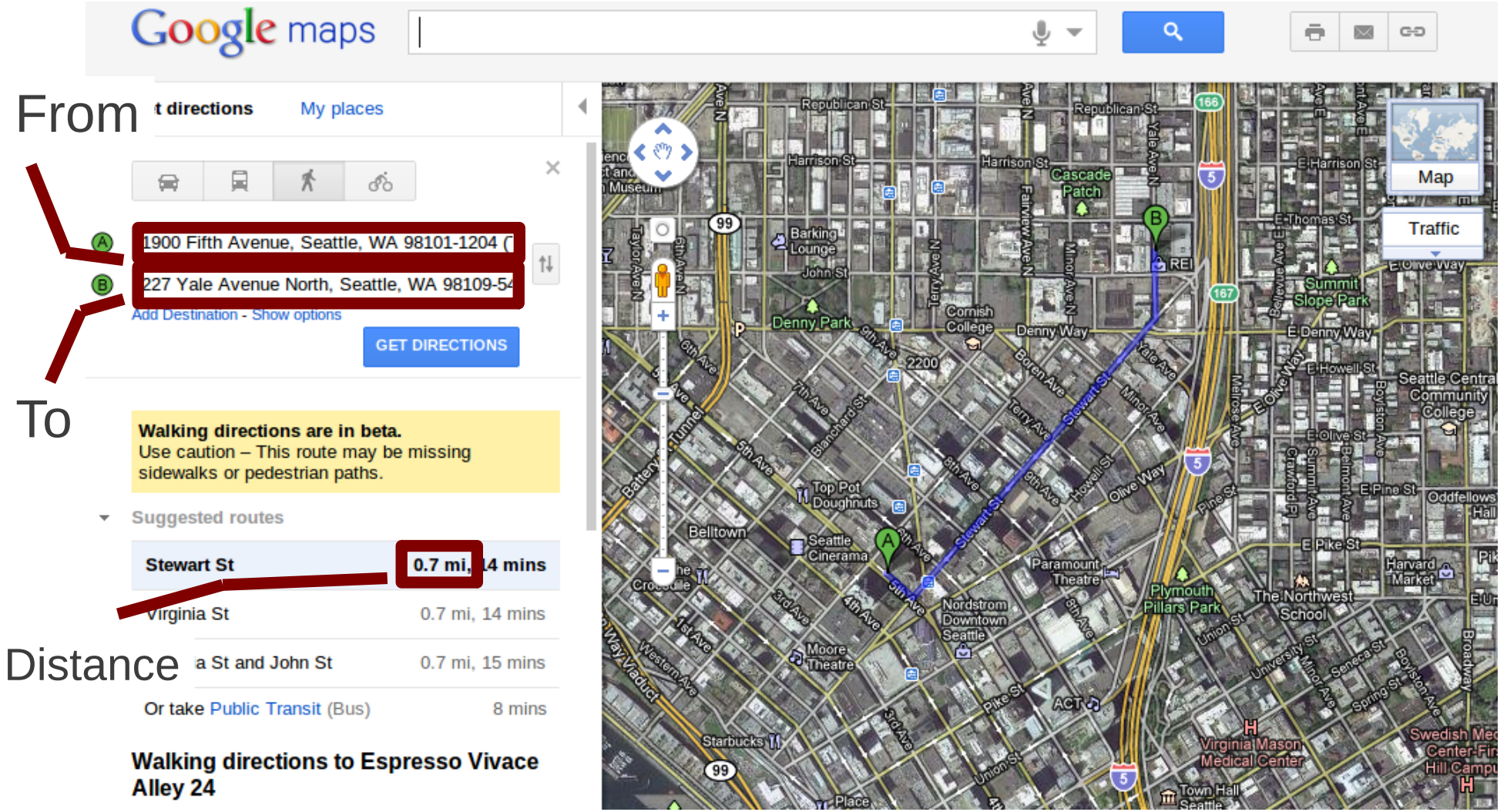

# Directions query logs

- Example database entries:
  - From, To: in (latitude, longitude) pairs

| From | To | Distance | Time Of Day | Day Of Week |
|---|---|---|---|---|
| Westin Seattle | Espresso Vivace | 0.7 miles | 12:20pm | Tuesday |
| House A | Espresso Vivace | 2 miles | 12:22pm | Tuesday |

- Users **willingly** expose FROM and TO locations

# How to use directions query logs?

- Destination popularity
- Distances traveled to reach a destination
- Co-located people's destinations
- Time-based destination popularity

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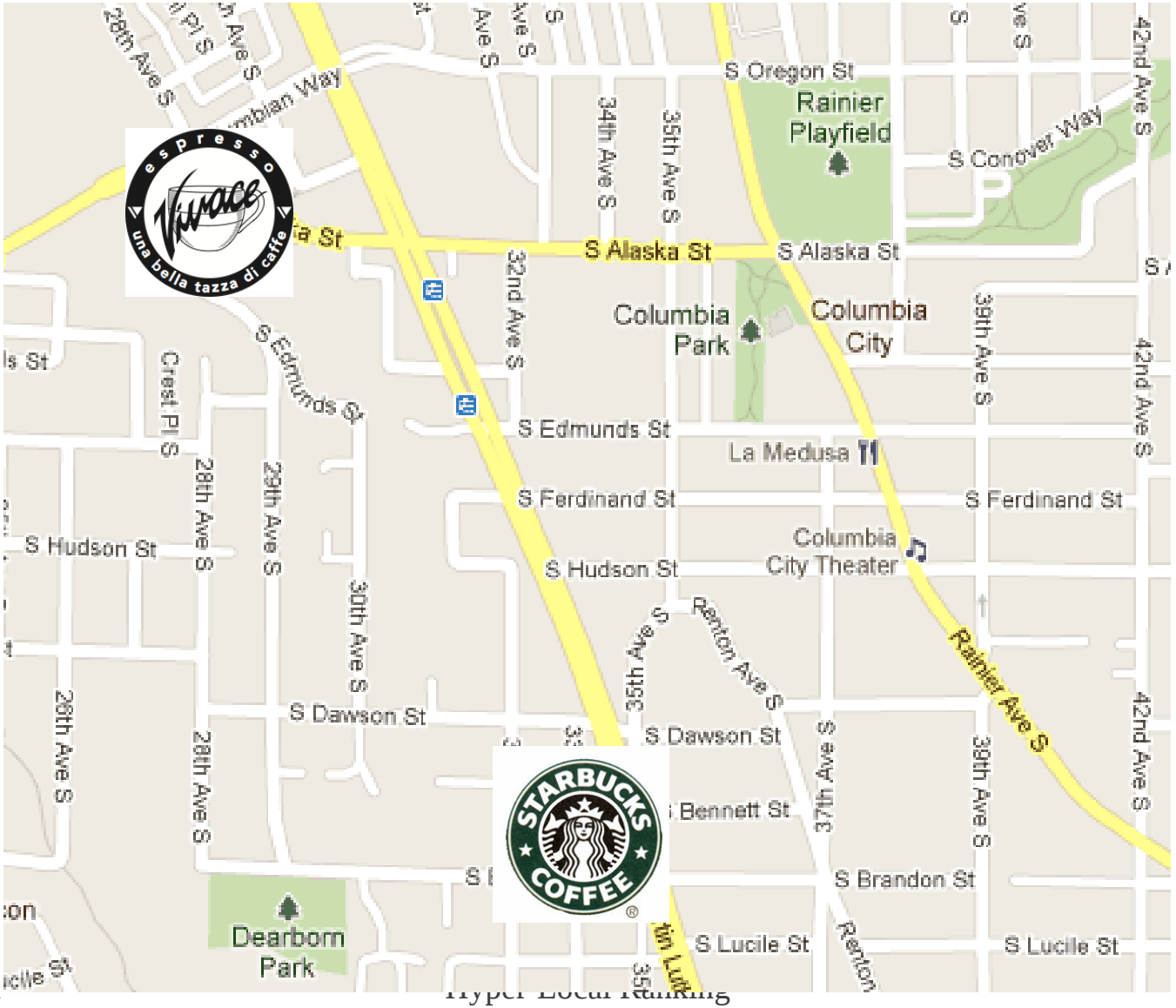
# Scoring model: example



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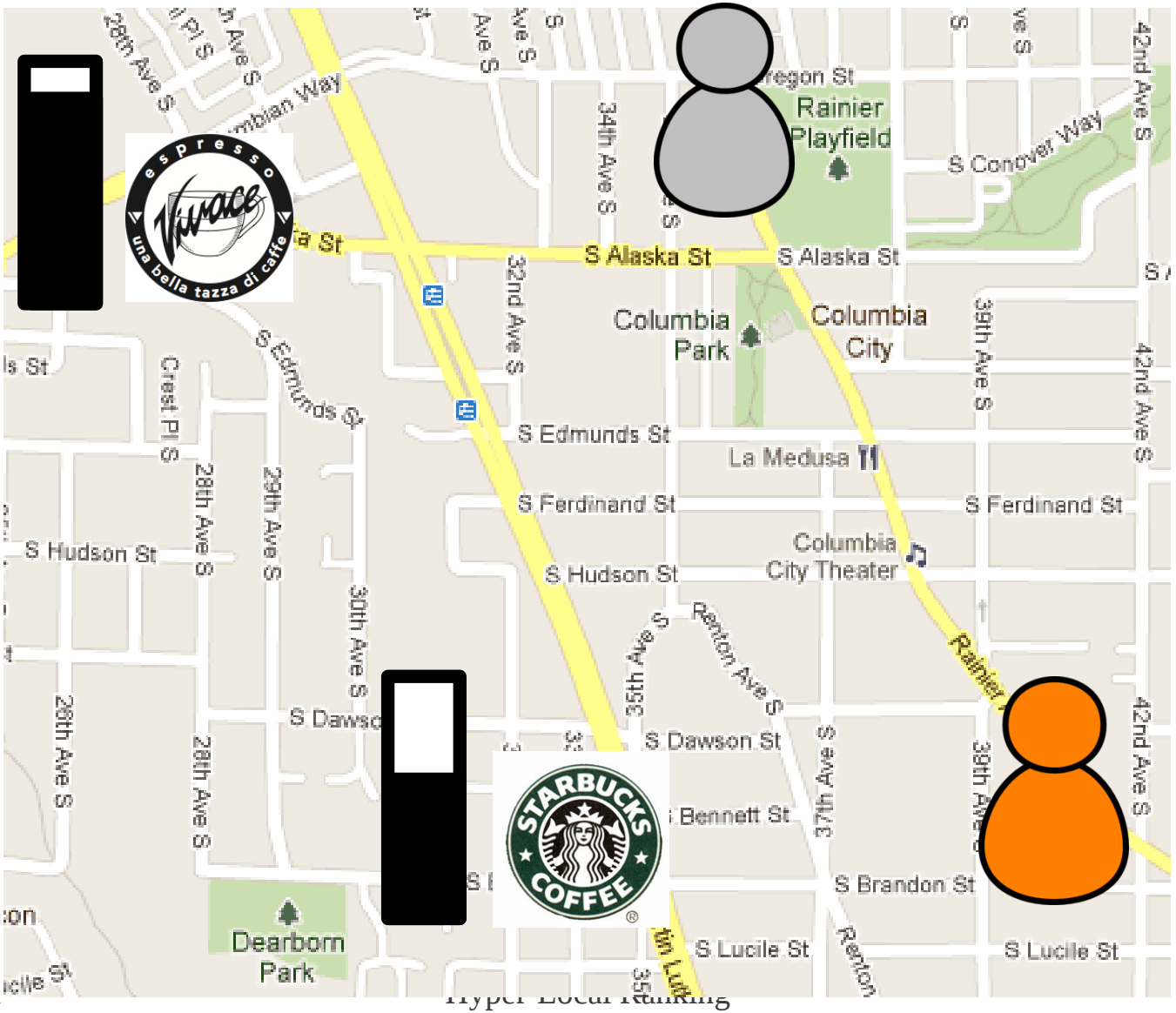

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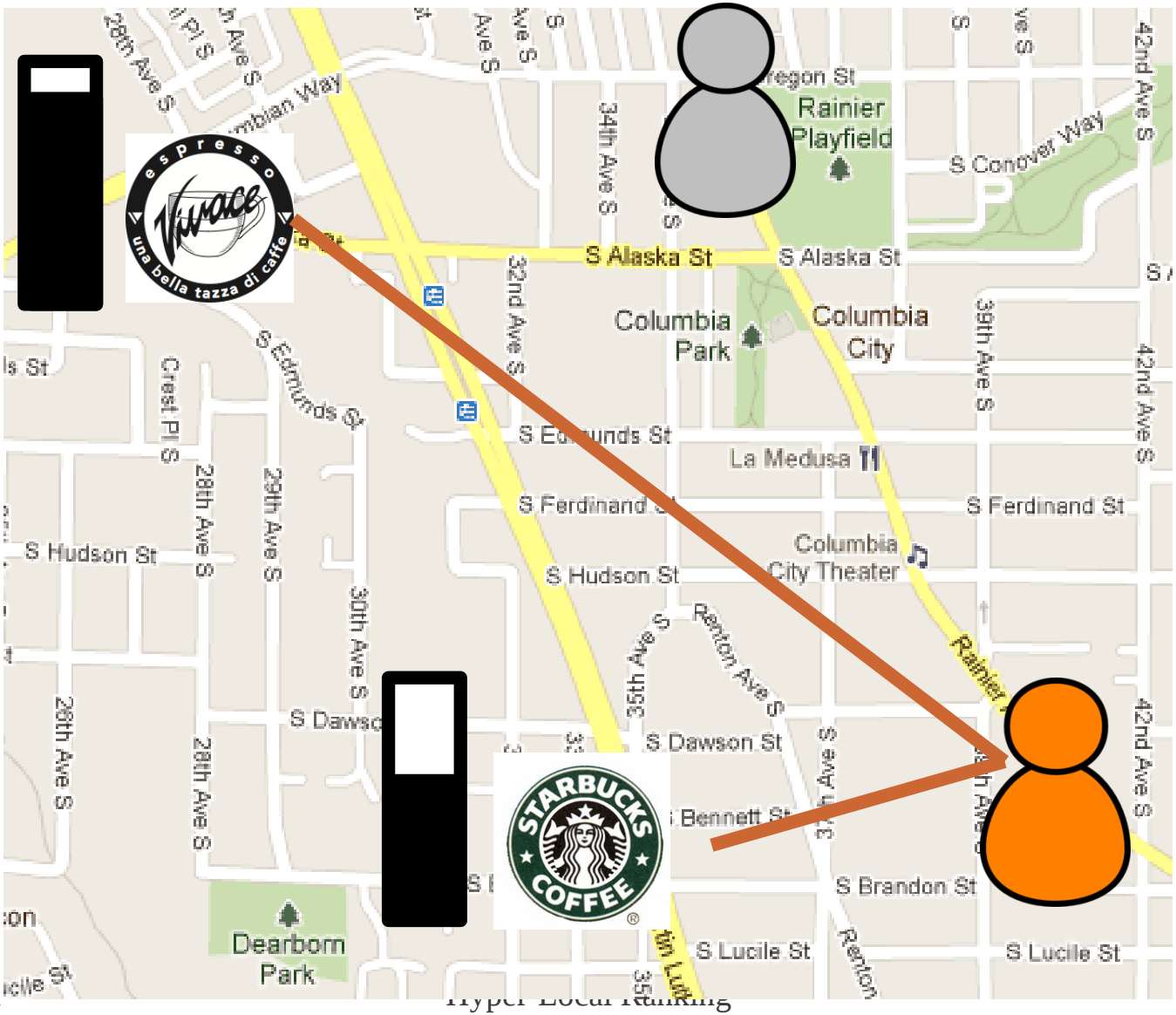

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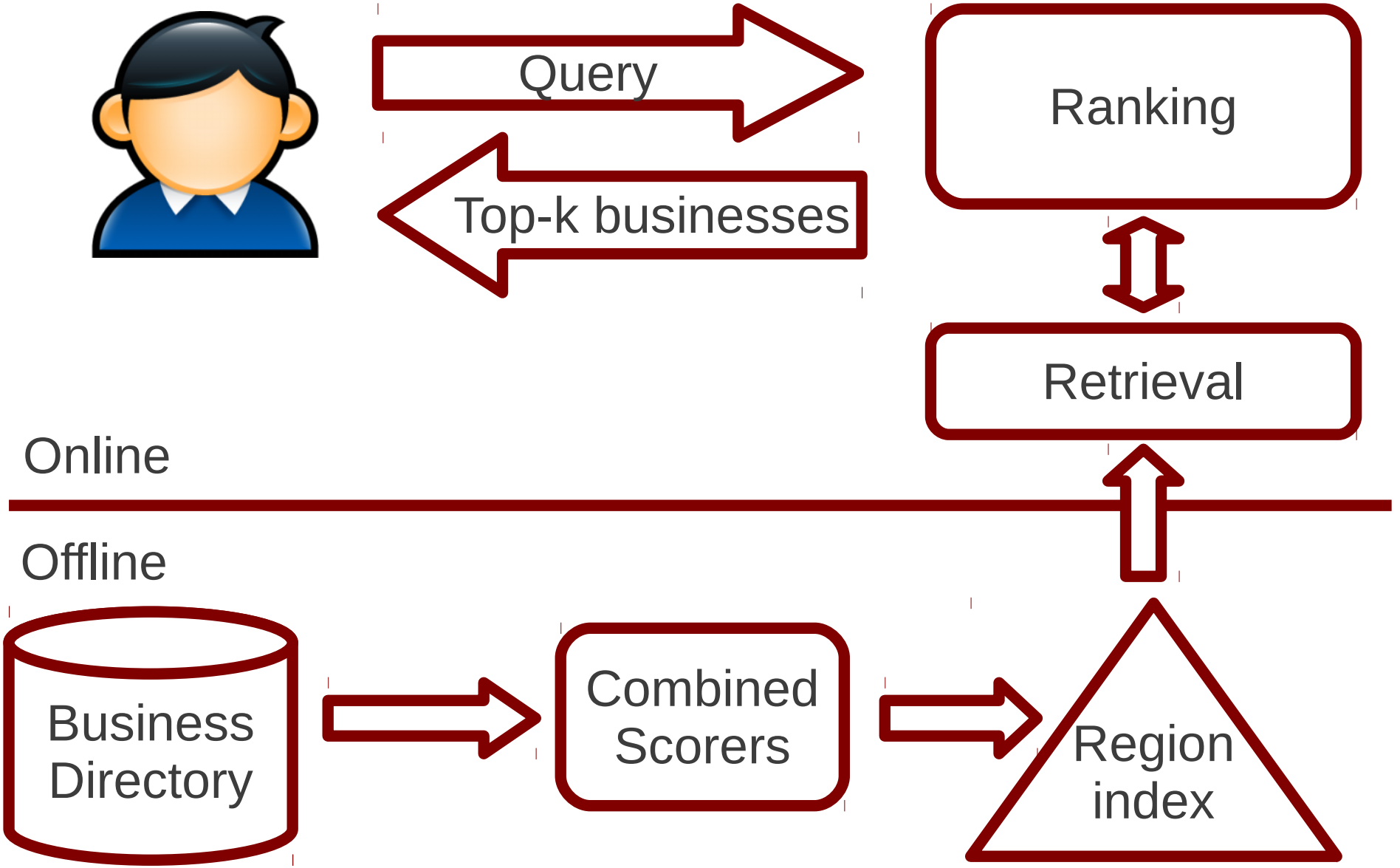
# Scoring model

- User U, place P
- **Popularity(P):**
  - Quality/Popularity of place P
- **Willingness(distance(U, P)):**
  - Willingness of user U to travel the distance to place P
  - Assumption:
    - Non-increasing function of the distance
- **Score(U, P):**
  - Popularity(P) x Willingness(distance(U, P))

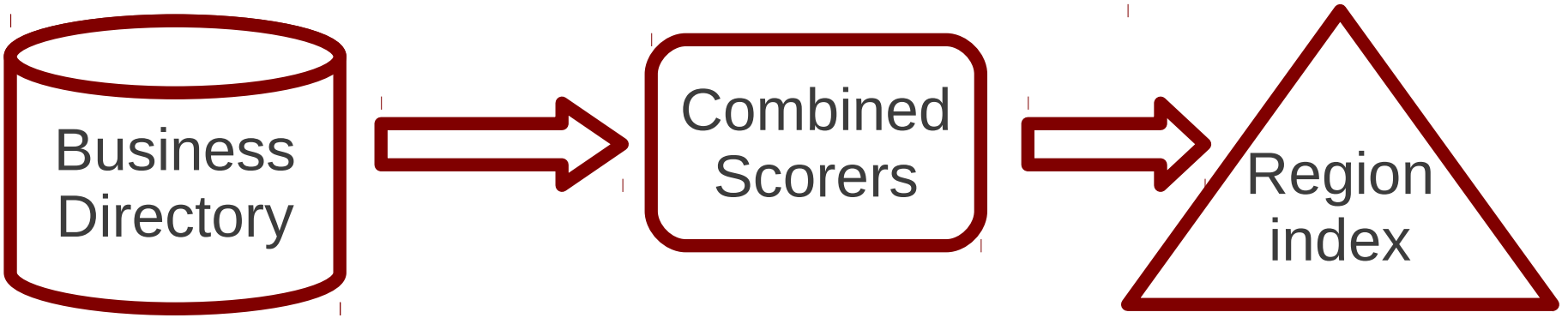
# Ranking process



# Ranking process (offline)

1)Divide area into regions

2)Within regions rank businesses **by (offline) combined scores**



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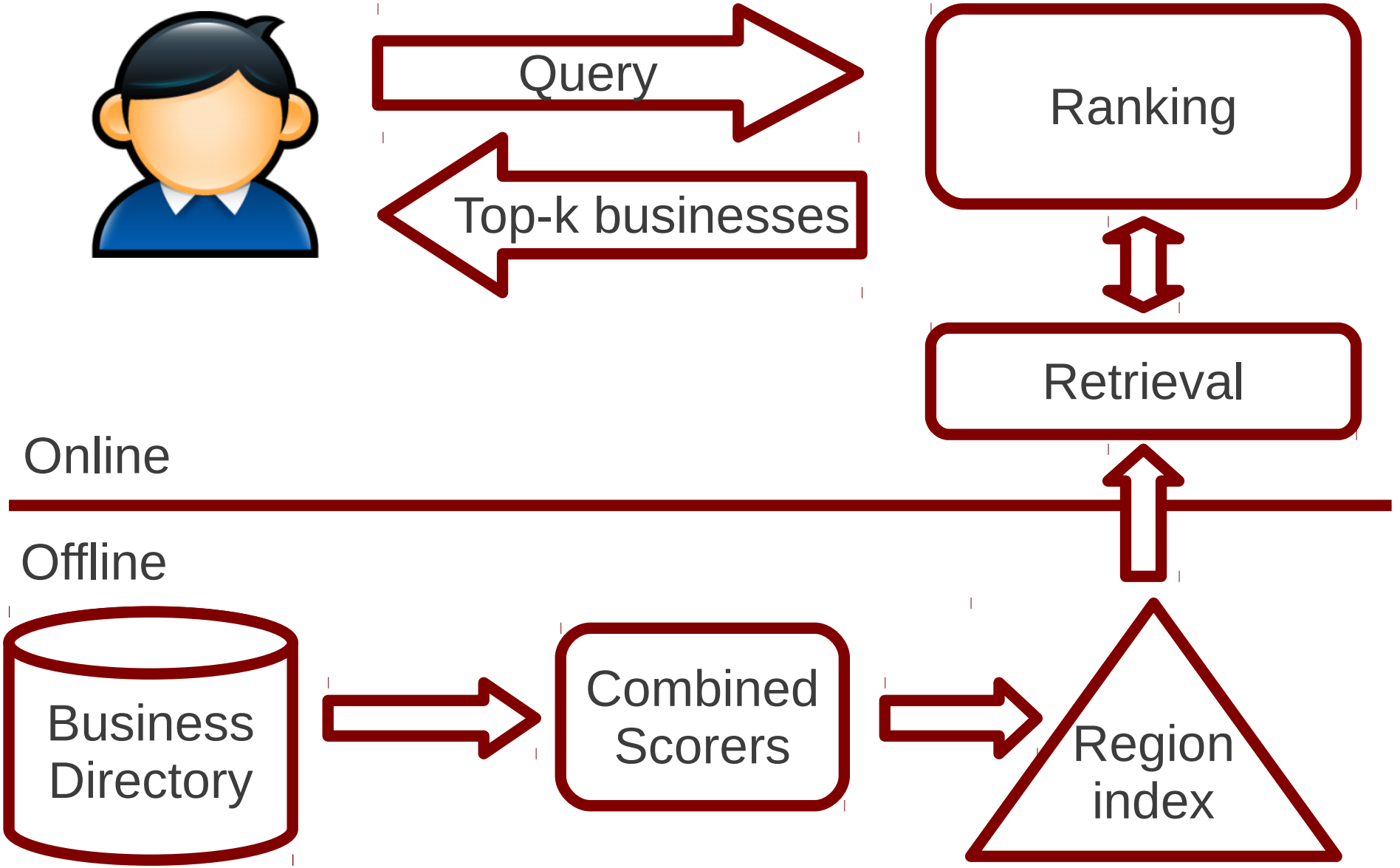

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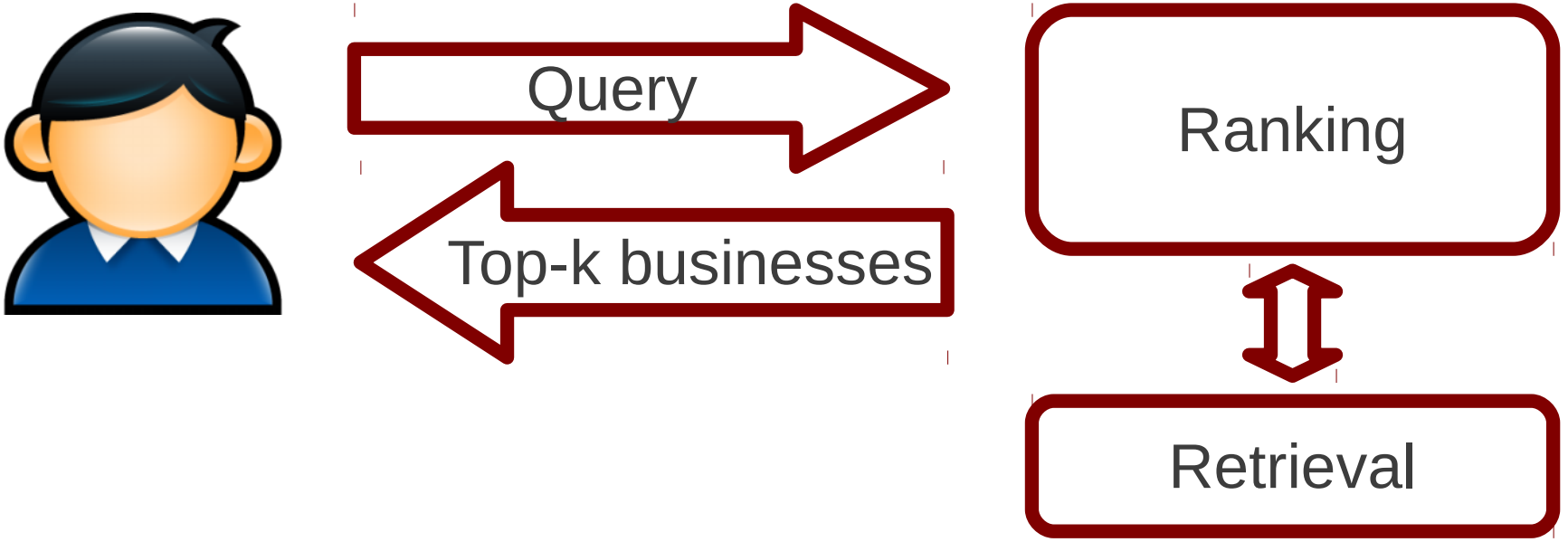



- Find interesting regions
- Calculate distances between user and regions
- Retrieve next most promising business from lists
- Stop when you have k items

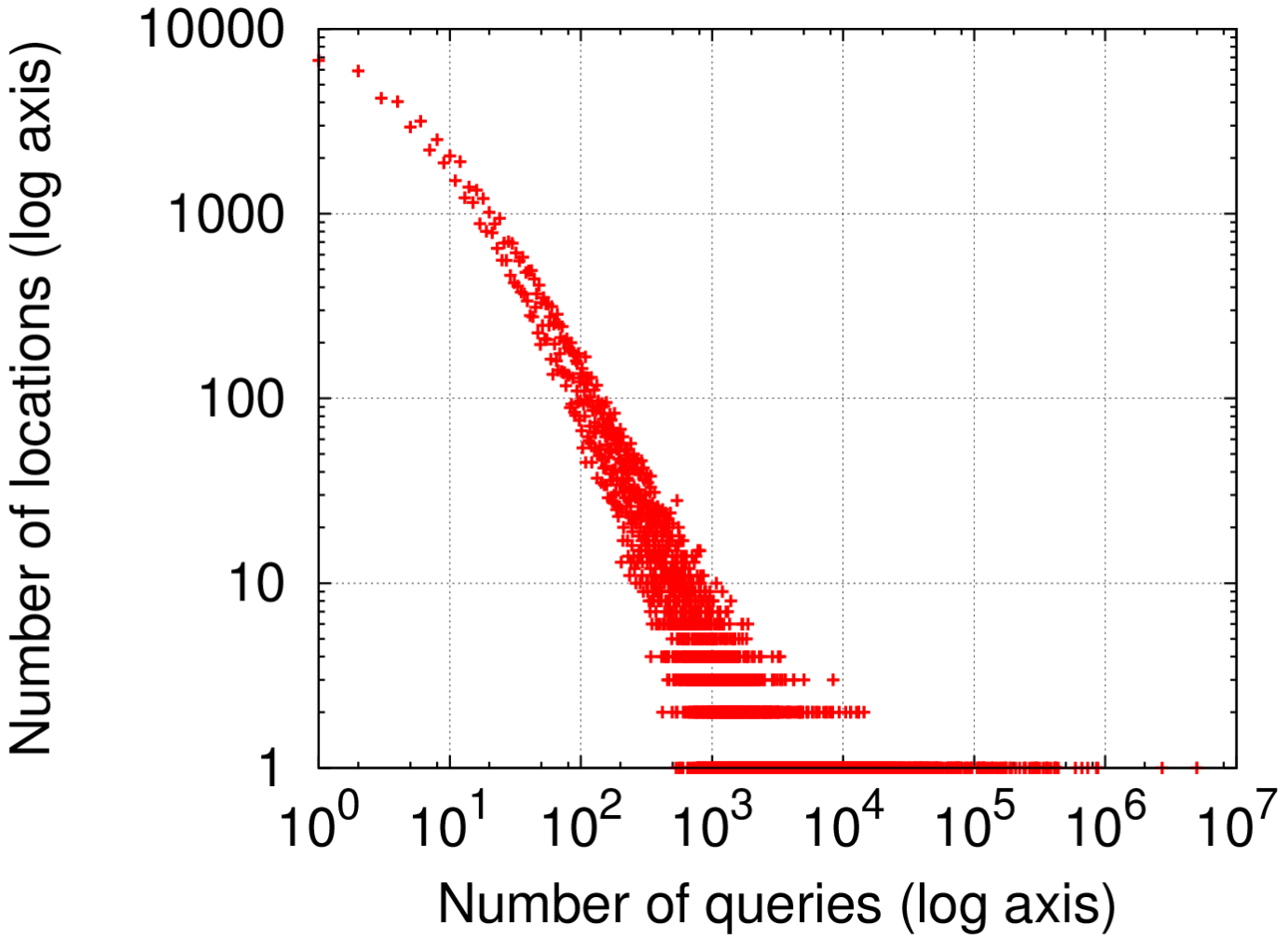
# Experiments

- How valuable are directions logs?
  - Comparison with reviews
- How efficient is our ranking architecture?
  - Comparison with baseline

# Dataset

- Directions logs (Google)
  - July 2009
  - Subset of USA
  - ~19M unique destinations
- Business listing (Google)
  - ~150K businesses
    - Museums, hotels, restaurants, bars, clubs, landmarks
  - Data quality issues

# Query distribution across locations



# Many more queries than reviews

- Reviews from Google, Yelp, and other systems

- **Queries** for businesses = ~50M
- **Reviews** for businesses= ~550K

- 20% higher coverage
  - Businesses with **queries** = ~130K (/150K)
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# Evaluation framework

- Humans evaluate businesses
  - Provide a query
  - Evaluate each result (0-4)
  - 10 users, 45 queries, 675 businesses

# Evaluation framework

- Compared
  - Destination queries
  - Number of Reviews
  - Average score of Reviews
- Metrics
  - Average evaluation score
  - nDCG metric (how consistent a method's ranking is to humans' evaluations)
    - 0 is bad
    - 1 is good

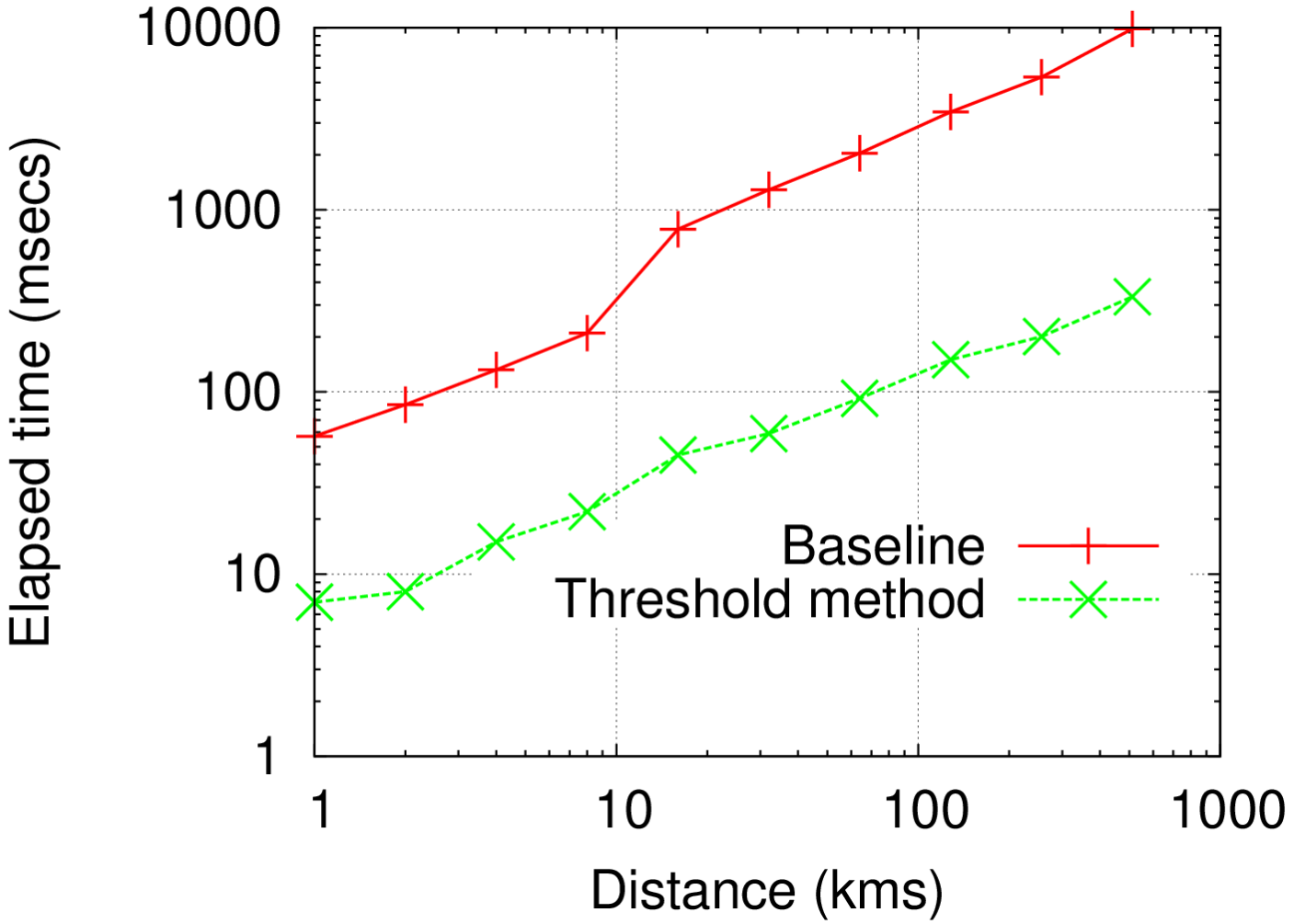
# Evaluators agree with directions log

- Average Evaluation Score for top-5
  - Destination queries: 1.96
  - Number of reviews: 1.453
  - Score of reviews: 1.498

# Ranking is questionable...

- nDCG for top-5
  - Destination queries: 0.787
  - Number of reviews: 0.827
  - Score of reviews: 0.845

# Performance evaluation



# More in paper...

- Time aspect
  - Example: brunch restaurants
- One range of sizes works best in all cases
  - Approximately squares of with ~2-3 kms edges

# Future directions

- Explore different ranking functions for different scenarios
- Personalized ranking

# Conclusions

- Direction Query Logs
  - Numerous
  - Cheap
  - Retrieve good businesses
- Scalable architecture
  - Fast comparing to database solutions
  - Incremental in nature

Thank you!

Questions?