

# Application: Point-Of-Interest Recommendation

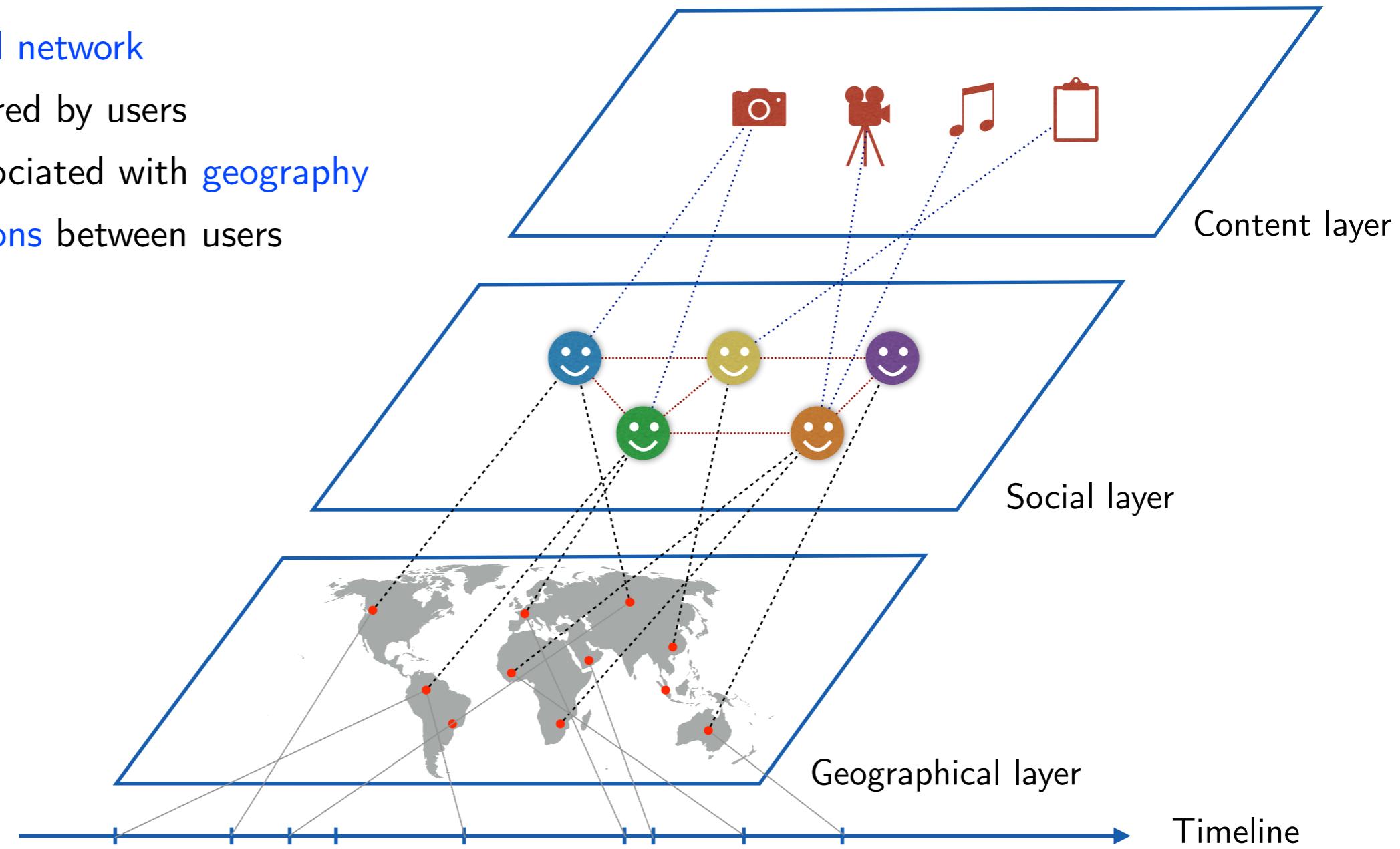
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# Location-Based Social Networks (LBSN)

- Online social network
- Content shared by users
- Content associated with geography
- Social relations between users



# Point-Of-Interest (POI) recommendation

- Recommend POIs, i.e., *locations* defined by  $(latitude, longitude)$
- Available information:
  - Users' [history](#), i.e., previous visits
  - Users' [social relations](#)
  - Users' [shared content](#)
- Different problems:
  - Next POI recommendation
  - POI itinerary recommendation
  - In-town/out-of-town POI recommendation

# Point-Of-Interest (POI) recommendation

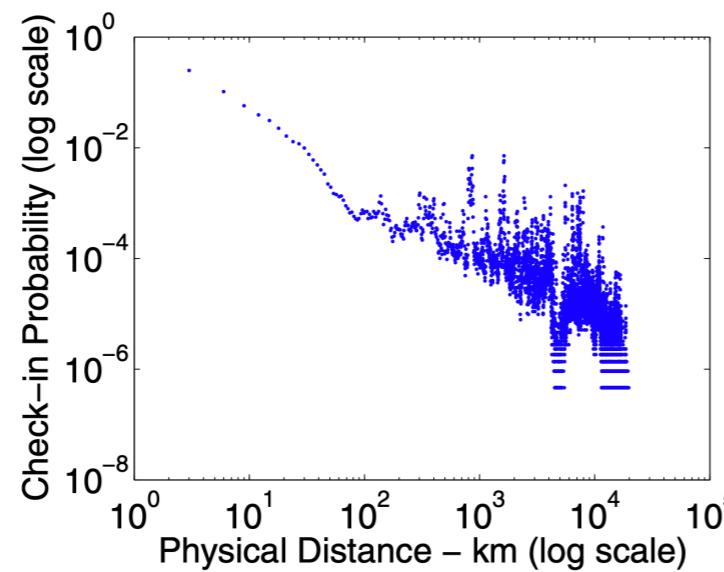
## Challenges

- Sparsity
- Scalability
- Modeling:
  - ▶ Geographical influence
  - ▶ Social influence
  - ▶ Temporal influence

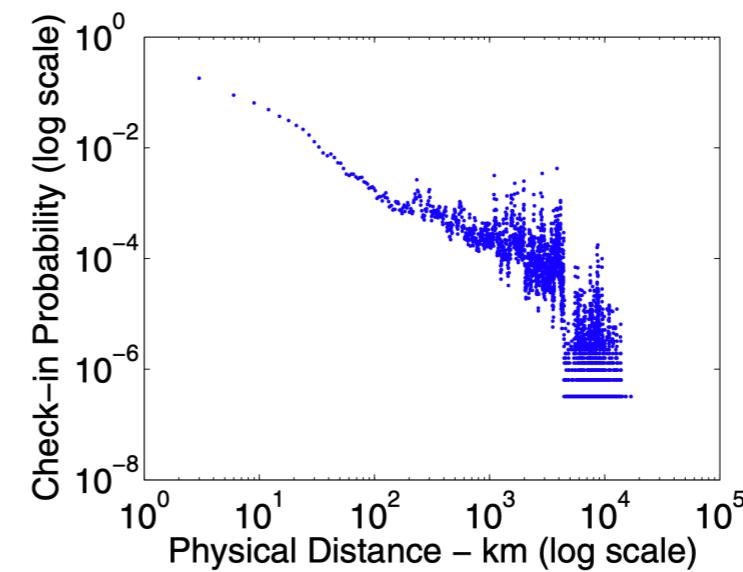
# Geographical influence

Tobler's first law of geography.

*"Everything is related to everything else, but near things are more related than distant things."*



(a) Foursquare

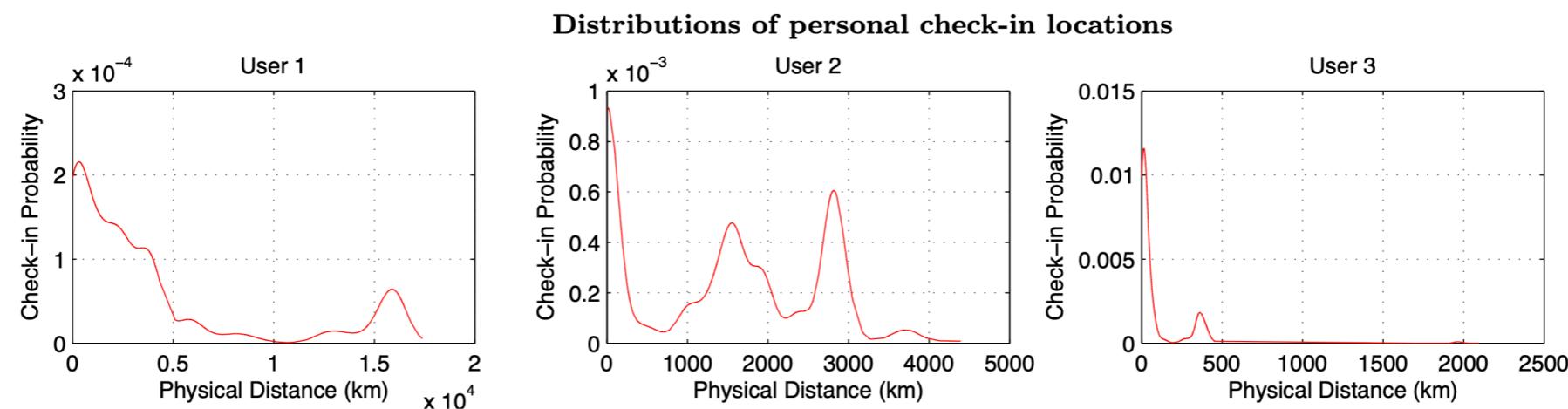
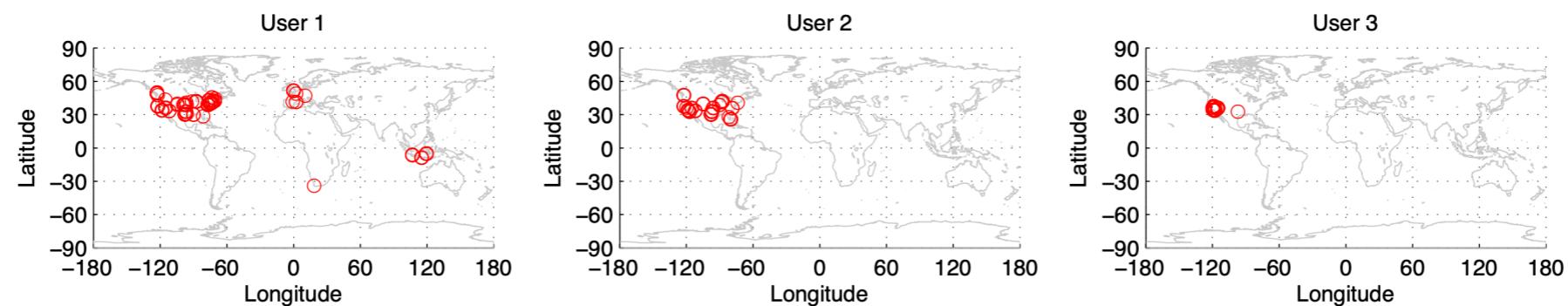


(b) Whrrl

## Geographical influence probability distribution

Extracted from "Exploiting Geographical Influence for Collaborative Point-of-Interest Recommendation",  
Ye et al., SIGIR'11.

# Geographical influence



Personal check-in probabilities over geographical distances

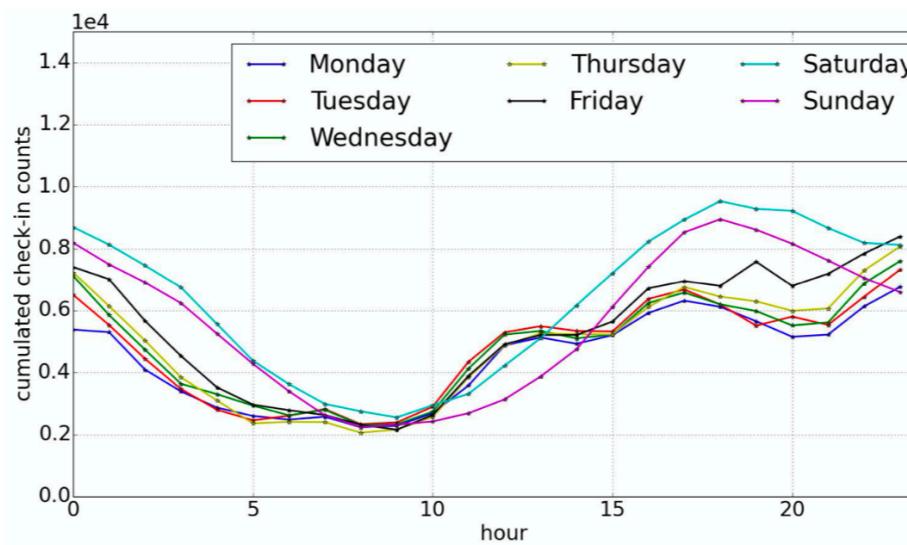
Extracted from "iGSLR: Personalized Geo-Social Location Recommendation - A Kernel Density Estimation Approach", Zhang and Chow, SIGSPATIAL'13.

# Social influence

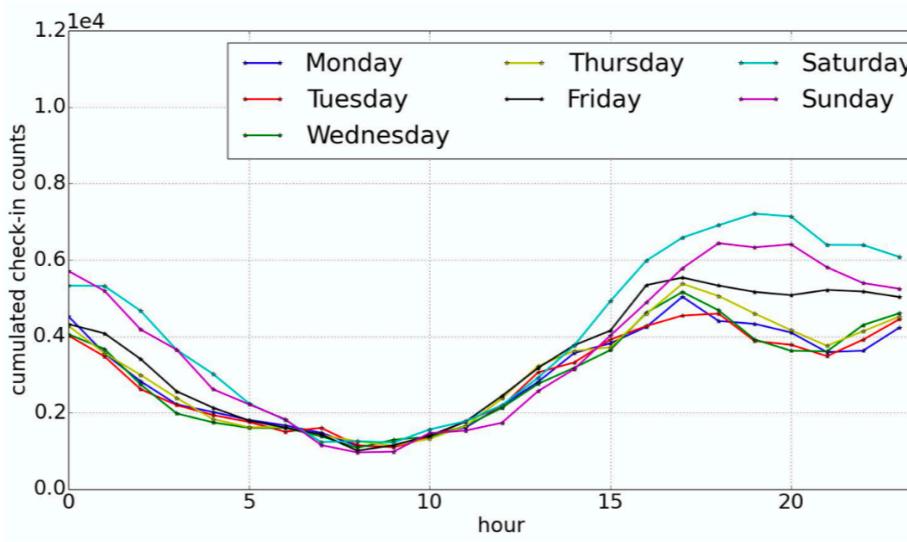
- Social friends are more likely to share common interests in POIs than strangers
  - From the [Gowalla](#) dataset:
    - Average overlap of a user's check-ins with his friends' check-ins is 9.6%
    - Almost 38% of users visit POIs that are not visited by their friends
    - Almost 90% of users visit less than 20% of POIs visited by their friends
- Social relationships have [limited effect](#) on users, but [cannot be ignored](#)

Extracted from “*Fused Matrix Factorization with Geographical and Social Influence in Location-Based Social Networks*”, Cheng et al., AAAI’12.

# Temporal influence



(a) Foursquare



(b) Gowalla

Day of week check-in pattern at different hours

Extracted from "Geo-Teaser: Geo-Temporal Sequential Embedding Rank for Point-of-Interest Recommendation",  
Zhao et al., WWW'17.