Towards Privacy-Preserving Semantic Mobility Analysis

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http://geoanalytics.net
Mobility analytics

• Movement data:
  • Are collected by individuals, governments, and businesses
  • Sometimes are available for analysis
  • Numerous methods for analysis
  • Extensive bibliography, hot topic @ VAST & EuroVA
Mobility analytics: problems

1. Privacy concerns
2. Patterns are territory-specific, difficult to compare
Chorems

- Introduced by Roger Bruner (born 30 March 1931)
Schematization approach

- images from
  D. De Chiara, V. Del Fatto, R. Laurini, M. Sebillo, G. Vitiello

A chorem-based approach for visually analyzing spatial data ☆

From geography to activity space

So far, constructed manually - based on literature and our experience in analyzing human mobility
Activity space

- So far, constructed manually
  - Based on literature search and our experience in analyzing human mobility
Data

- Two one-year data sets representing individual mobility in Germany and USA
- Activity detection based on stop detection and
  - temporal patterns of place visits (personal places)
  - matching stops to POI databases (public places)
- Data transformed to the activity space
Multi-perspective view on movement data analytics

- Details:
  
  **Visual Analytics of Movement**
  Springer-Verlag 2013
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Clusters of daily trajectories of a single person

- Days of week
- Start hours
- End hours
Temporal patterns of trajectories of two persons

- Persons from Germany (blue) and USA (orange)
Temporal patterns of activities and flows
Comparison of flows
Comparison of hourly situations: presence and flows

- Spatial distributions have been clustered according to:
  - Presence at locations
  - Flows between locations

Similarity of colors reflects similarity of situations
Conclusions

1. Privacy-preserving representation

2. Results of analysis are comparable across different individuals, regions, and spatial scales

3. Many of existing visual analytics methods are directly applicable or adaptable

4. Open issues:
   - Activity recognition
   - Creation of chorematic representations
   - Need for appropriate distance measures in the semantic space
   - Semantic mobility analysis at large