

Analysis of Human mobility to develop pervasive urban applications

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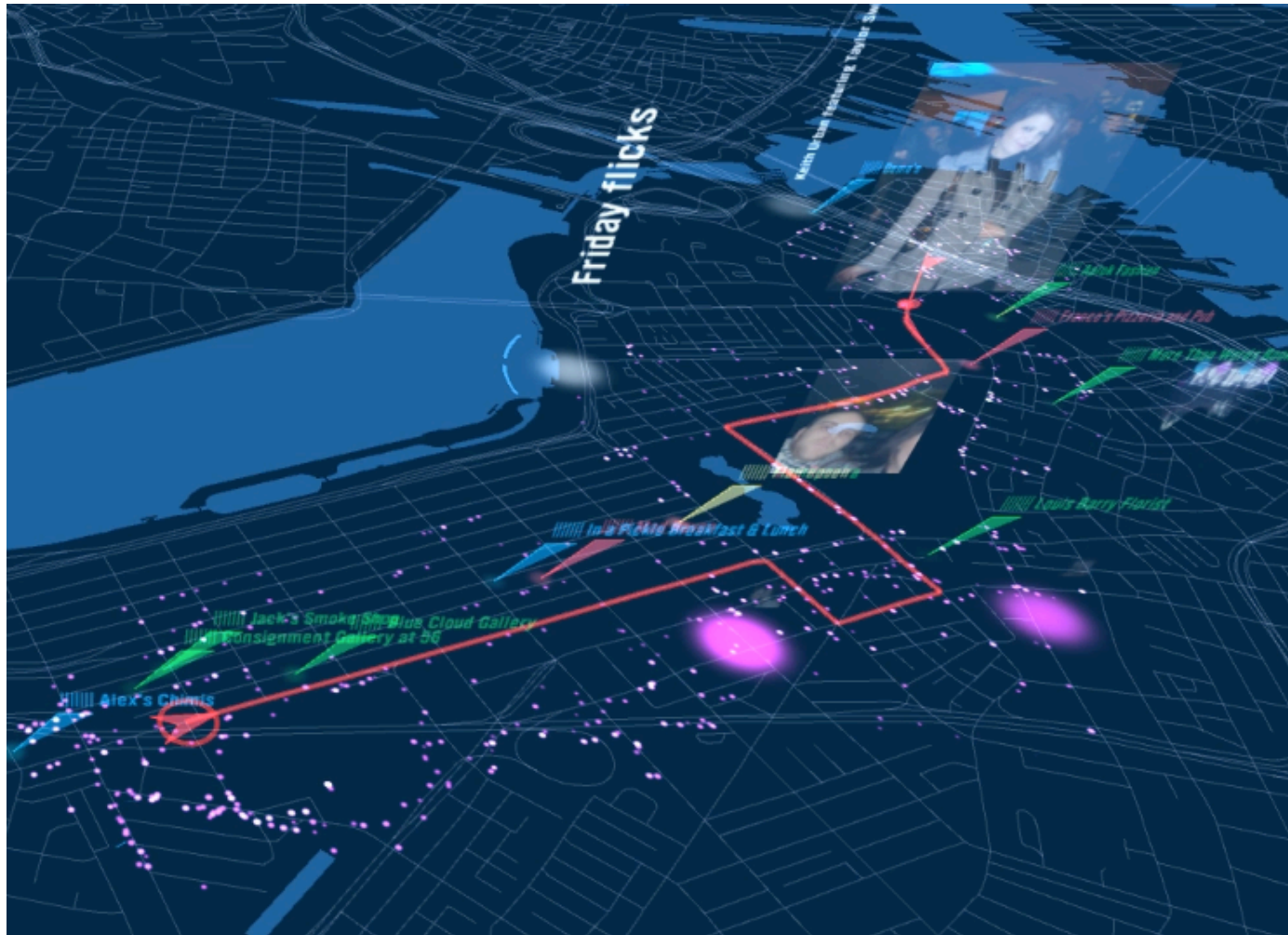
Research Affiliate

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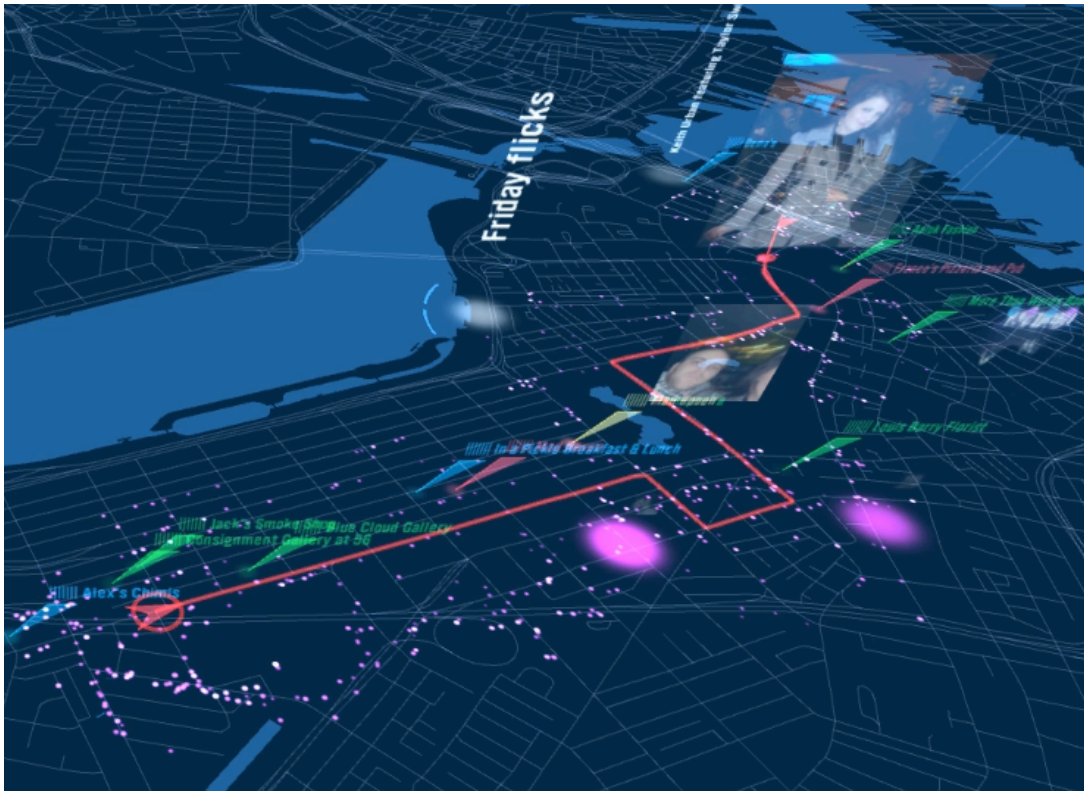


Why people move ?



AIDA - Activity detection and prediction module

Solution: driver mobility model

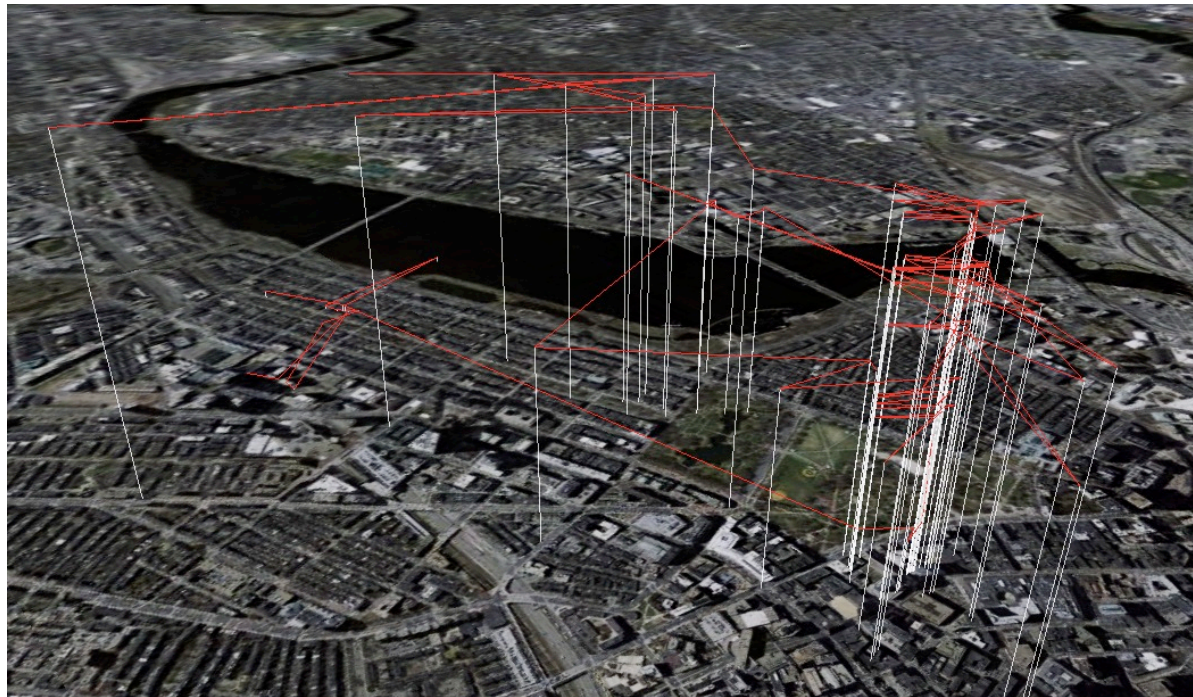


- 1) Which are the places where the user goes?
- 2) Which kind of activities he/she likes?
- 3) In which sequence he/she does some activities?

Activity based modeling of human mobility

In activity-based models, travel demand is derived from the activities that individuals need/wish to perform

Goal: Understand urban mobility from individual telecommunication usage in space



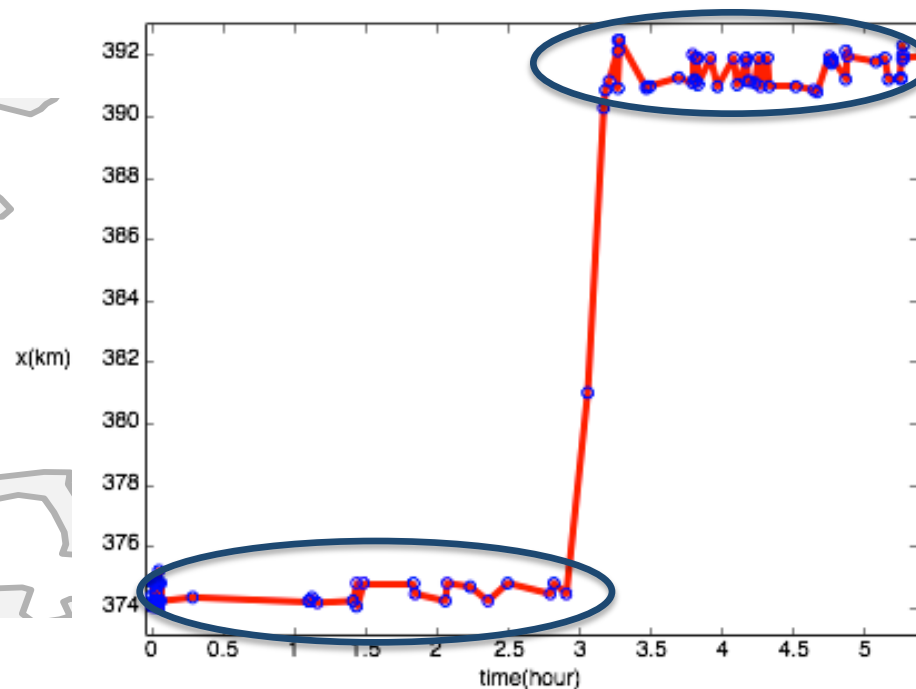
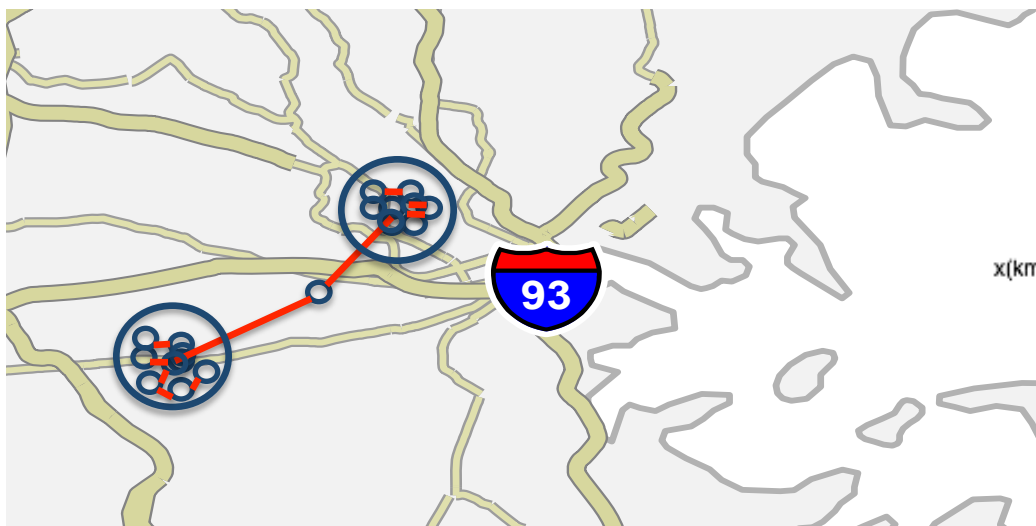
Mobile phone data set description

Sample:

- 130 million anonymous location estimations from approx. 1 million devices during 2 months
- 20% market share
- Location estimations when:
 - making or receiving a call
 - exchanging SMS messages
 - accessing internet
- Average localization error of 320 meters (median 220)

F. Calabrese, G. Di Lorenzo, and C. Ratti, Human Mobility Prediction based on Individual and Collective Geographical Preferences, Proceedings of 13th International IEEE Annual Conference on Intelligent Transportation Systems, ITCS, 2010.

Mobile phone trajectory



Individual mobility model

- Routine/non-routine
 - Routine: home, work, market, ...
 - Historical data can model the sequence of stops
 - Non-routine: concert, restaurant, a new city, ...
 - Historical data is not useful, but user preferences
- Individual/collective behavior
 - User preferences of the individual or of a group of people (e.g. people going to a concert)

$$P_{\text{NEXT}} = (1 - \alpha)P_I + \alpha P_C$$

Individual mobility model - Methodology

- For each user
 1. we extract the sequence of locations that he/she has visited during a day with a sampling rate of 1 hour.
 2. we connect each location to a geography of human activity
 3. we then employ a process to identify and classify recurring patterns of users
 4. we define an individual mobility model

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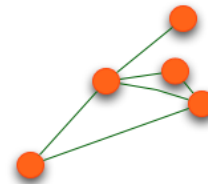


1. Stops
2. Sequence of trips

2. we connect each location to a geography of human activity

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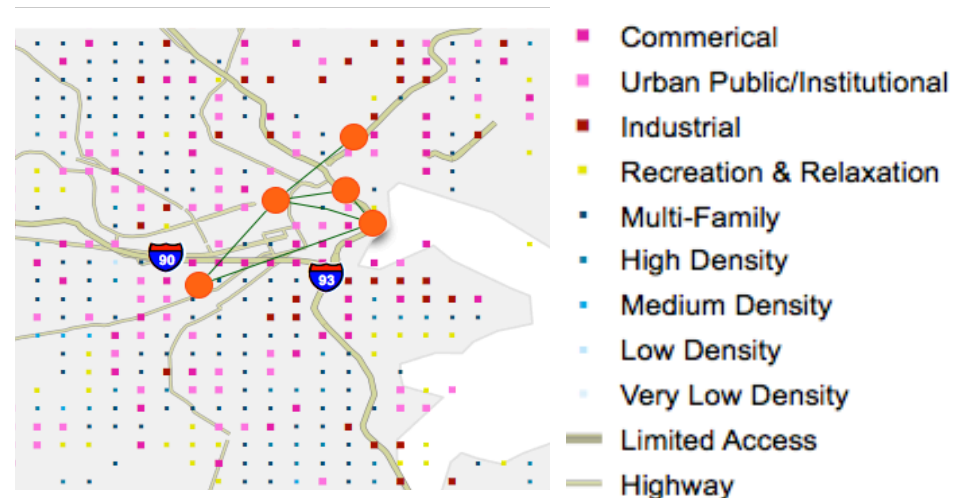
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1. Land use dataset
2. Point of interest dataset



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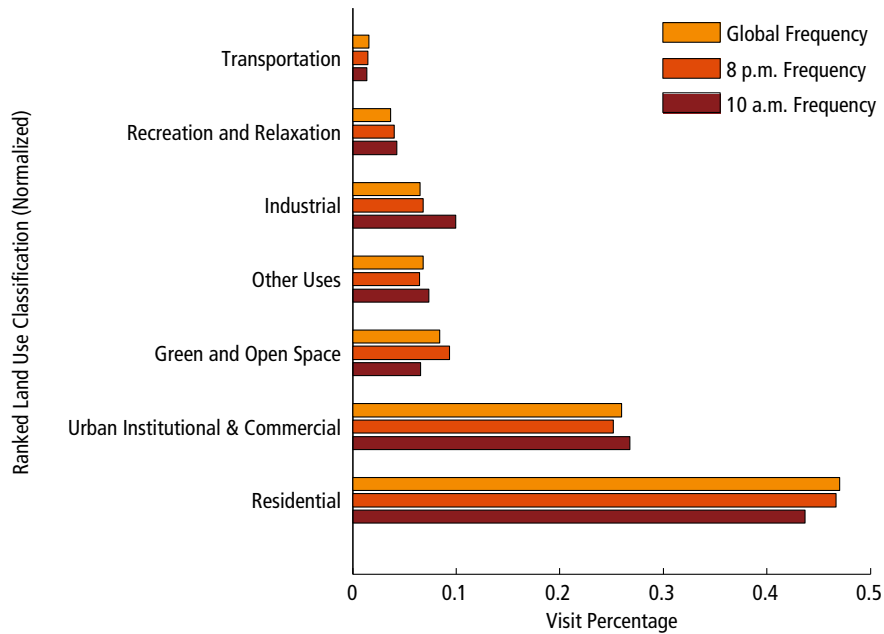


1. Land use and Point of interest visit percentage distribution
2. Trip length distribution

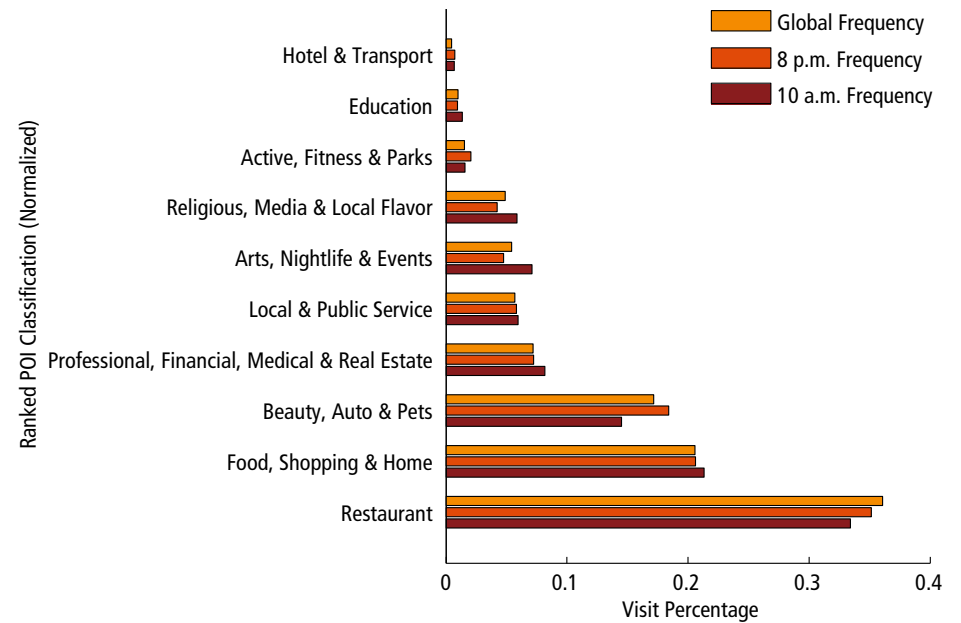
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Land use and points of interest visit percentage distribution

- Are geographical preferences useful?

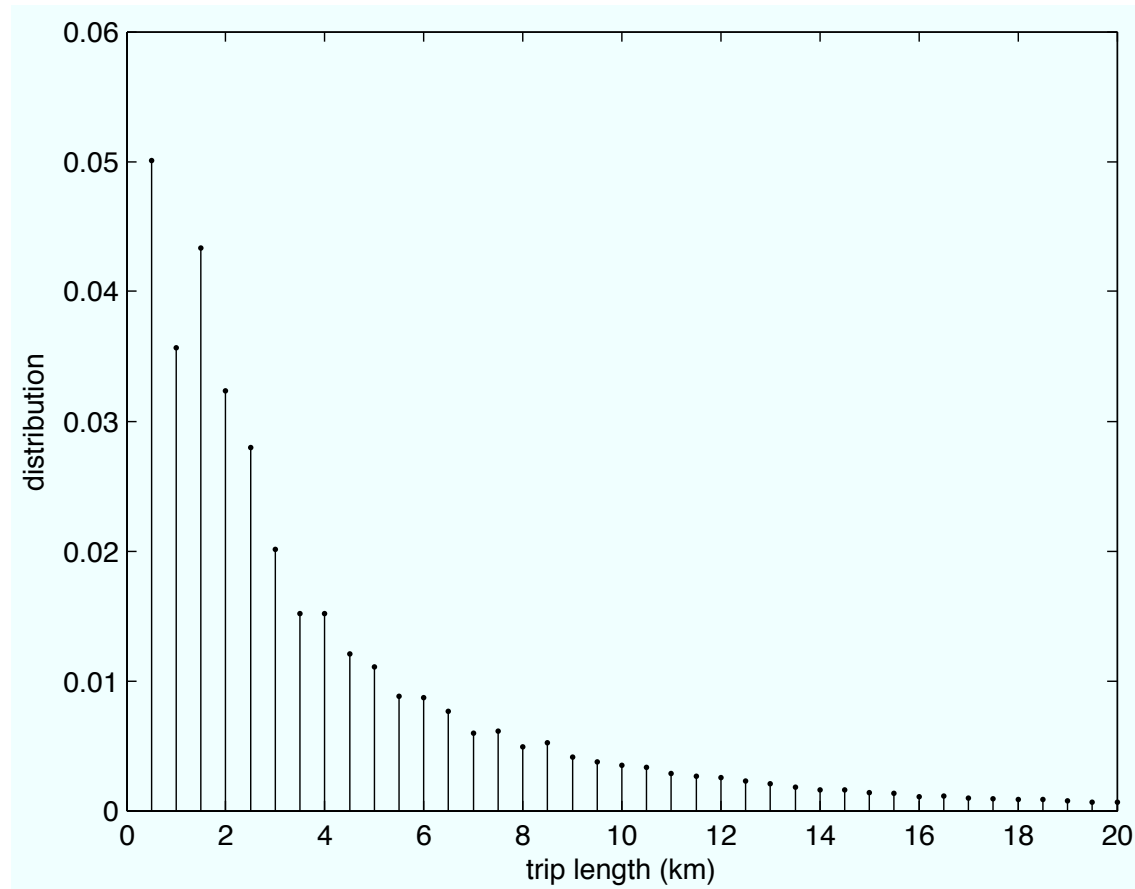


Distribution of visited land use categories



Distribution of nearby point of interest categories

Trip length distribution



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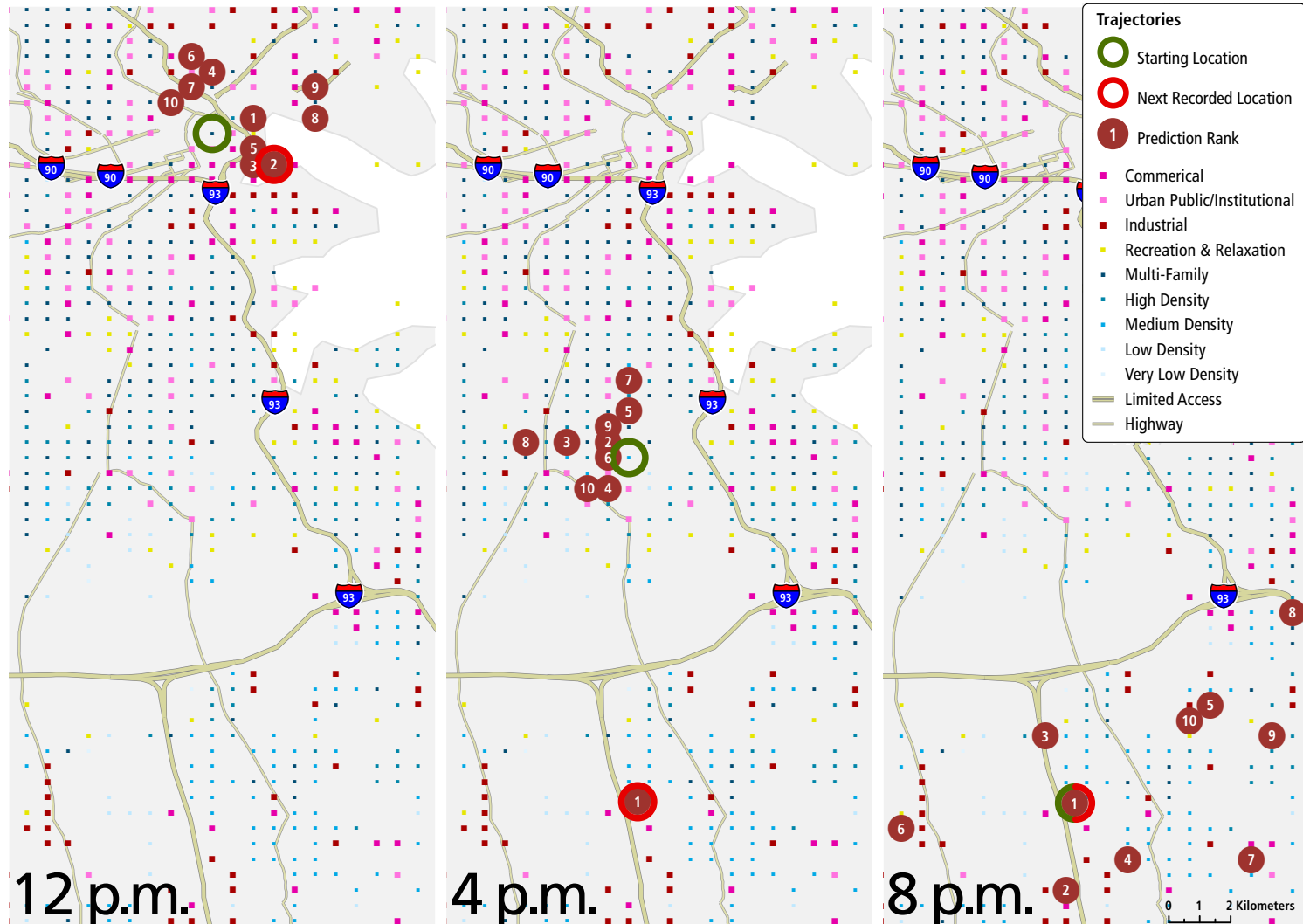
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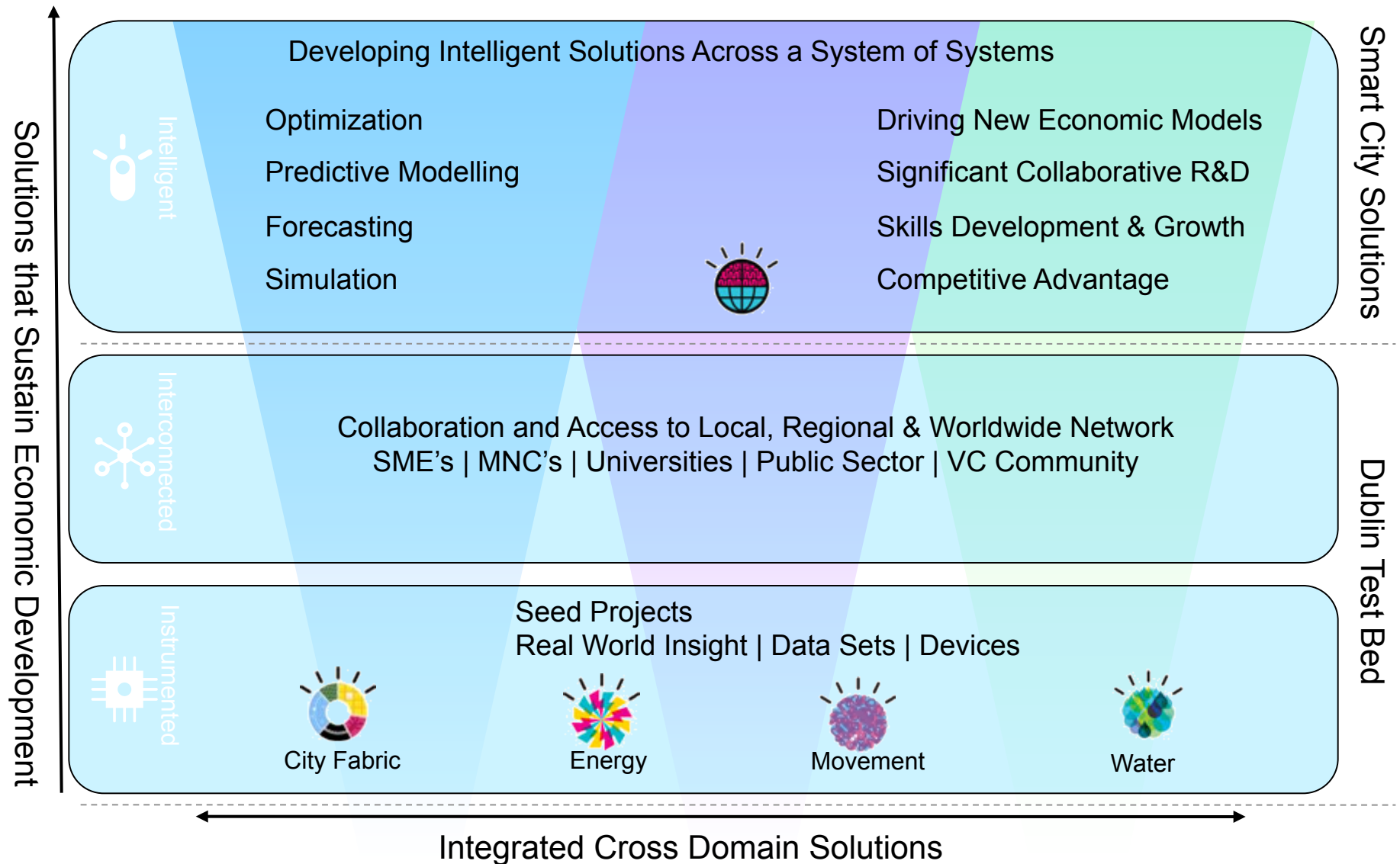


Individual and Collective behavior

Comparison of predictions & actual behavior of a randomly-selected user



The Smarter Cities Technology Centre merges Collaborative Research & Smarter Cities opportunities





Thanks
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