



Understanding Human Mobility: A Point-of-Interest Approach

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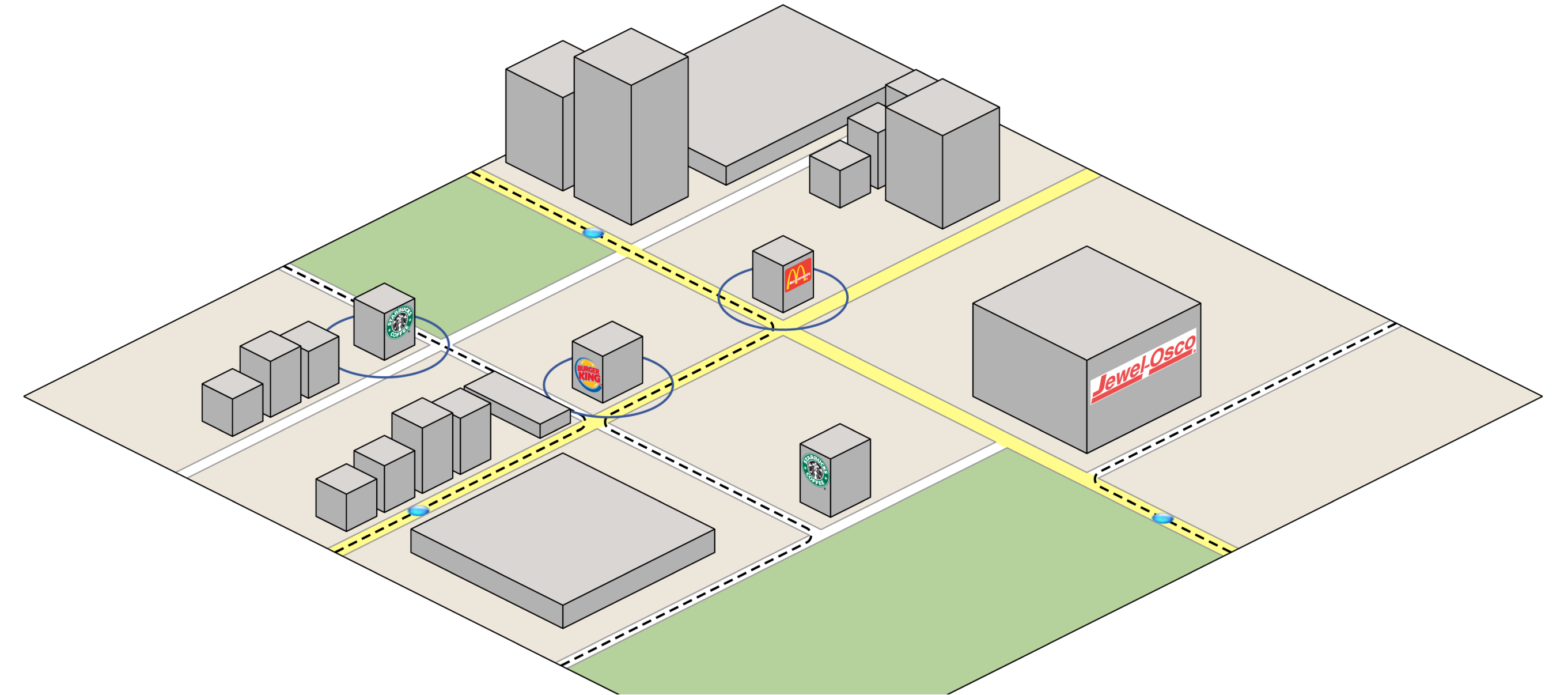
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Motivation

People's mobility is driven by goals and influenced by their surroundings: points of interest (POIs)

Goal: study interactions between human mobility and distribution of POIs to enrich mobility models with semantics



Datasets

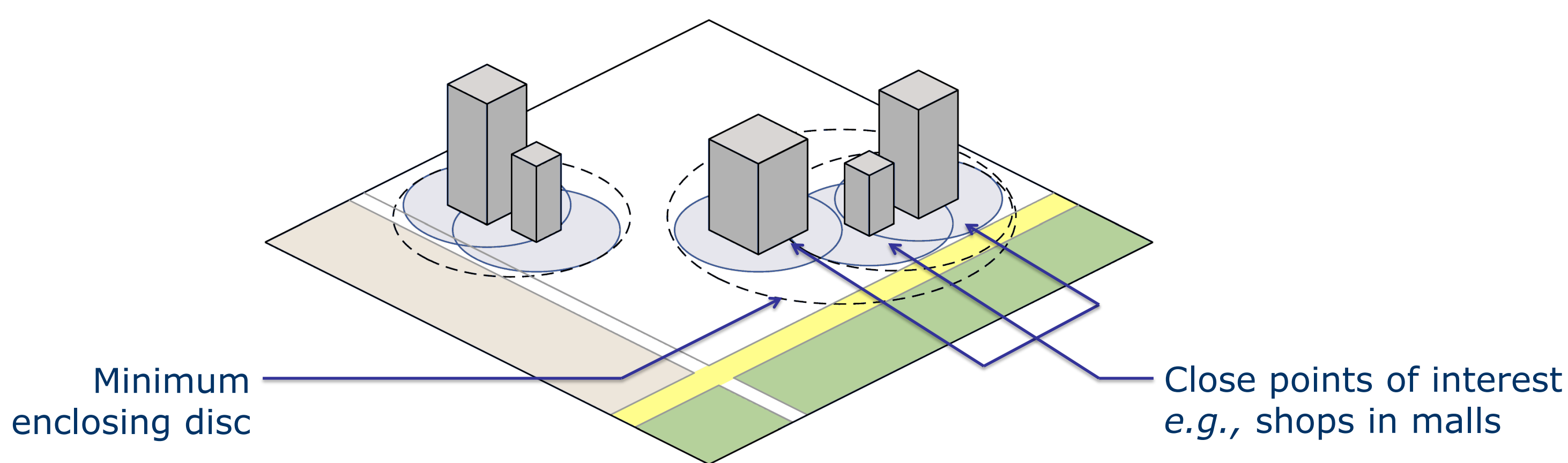
- GPS mobility traces from
 - US: Mobile provider)
 - China: Microsoft's GeoLife
- Point of Interest from GPS software
 - Incl. specific businesses (e.g., Starbucks)

	Illinois	Indiana	Michigan	China
Restaurants	19,400	9,231	14,671	116,095
Shops	56,768	25,454	46,199	267,541
Govt. Offices	4,645	2,890	5,185	137,837
Hospitals	748	466	963	54,545
Stadiums	692	372	585	40,361
Libraries	71	24	61	17,868
Population [M]	12.91	6.42	9.96	1,331
Size [1,000 sq. mi.]	57.9	36.4	96.7	3,705

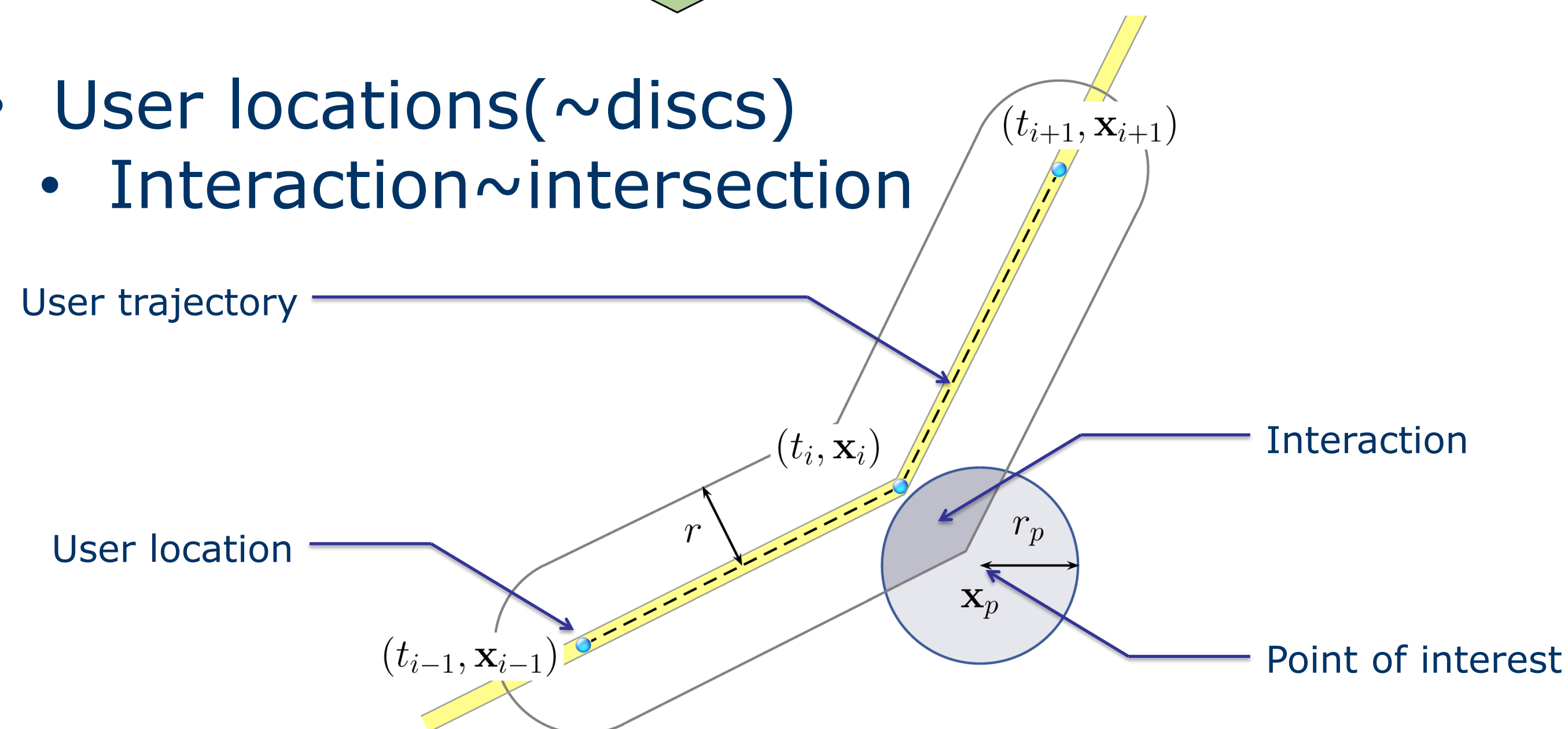
Methodology

Interactions based on *energy*:

- Points of interest (~discs)
- Merge close POIs in minimum enclosing disc



- User locations (~discs)
- Interaction ~ intersection

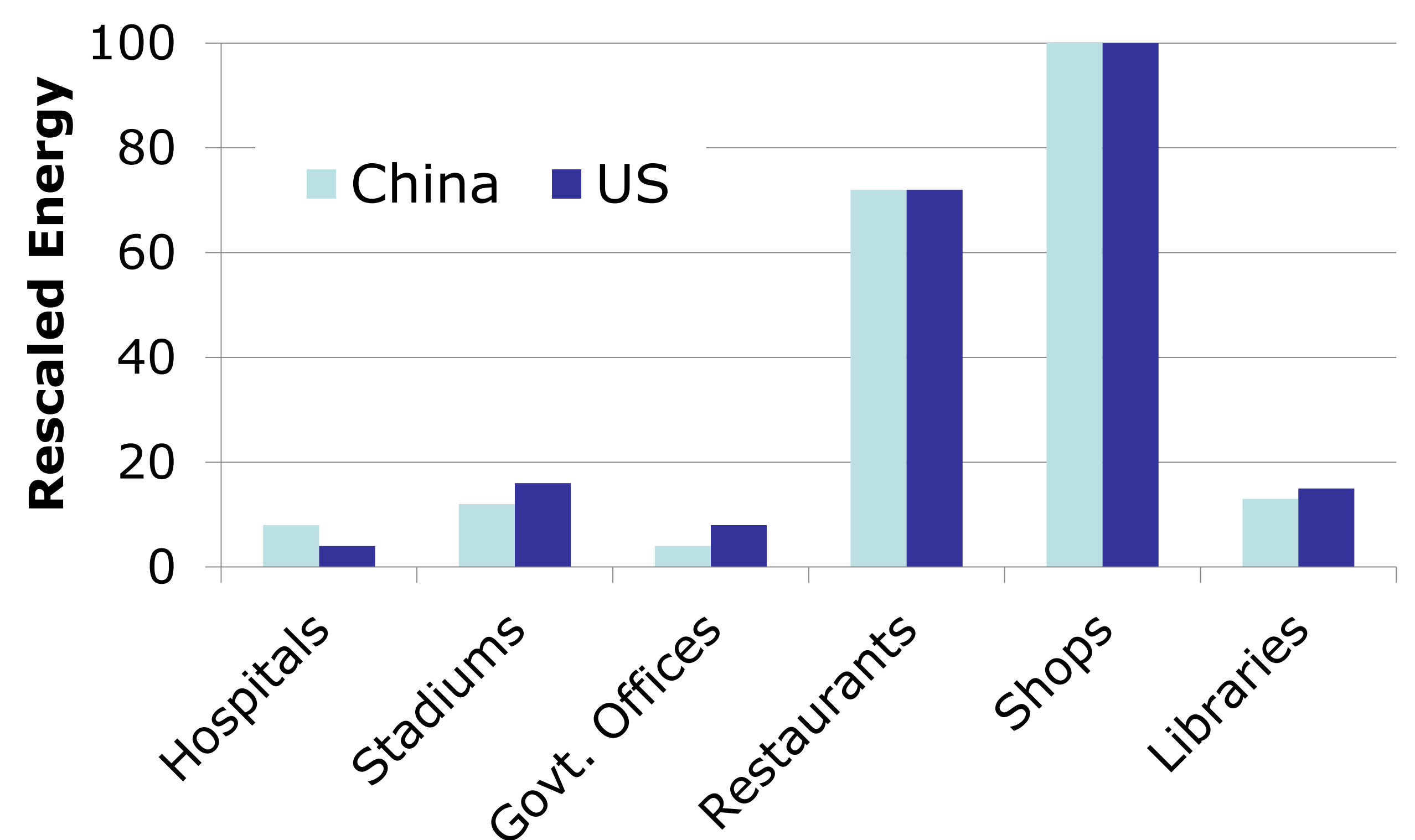


- ⇒ Power of interaction
- ⇒ Energy of interaction: *time* and *proximity*

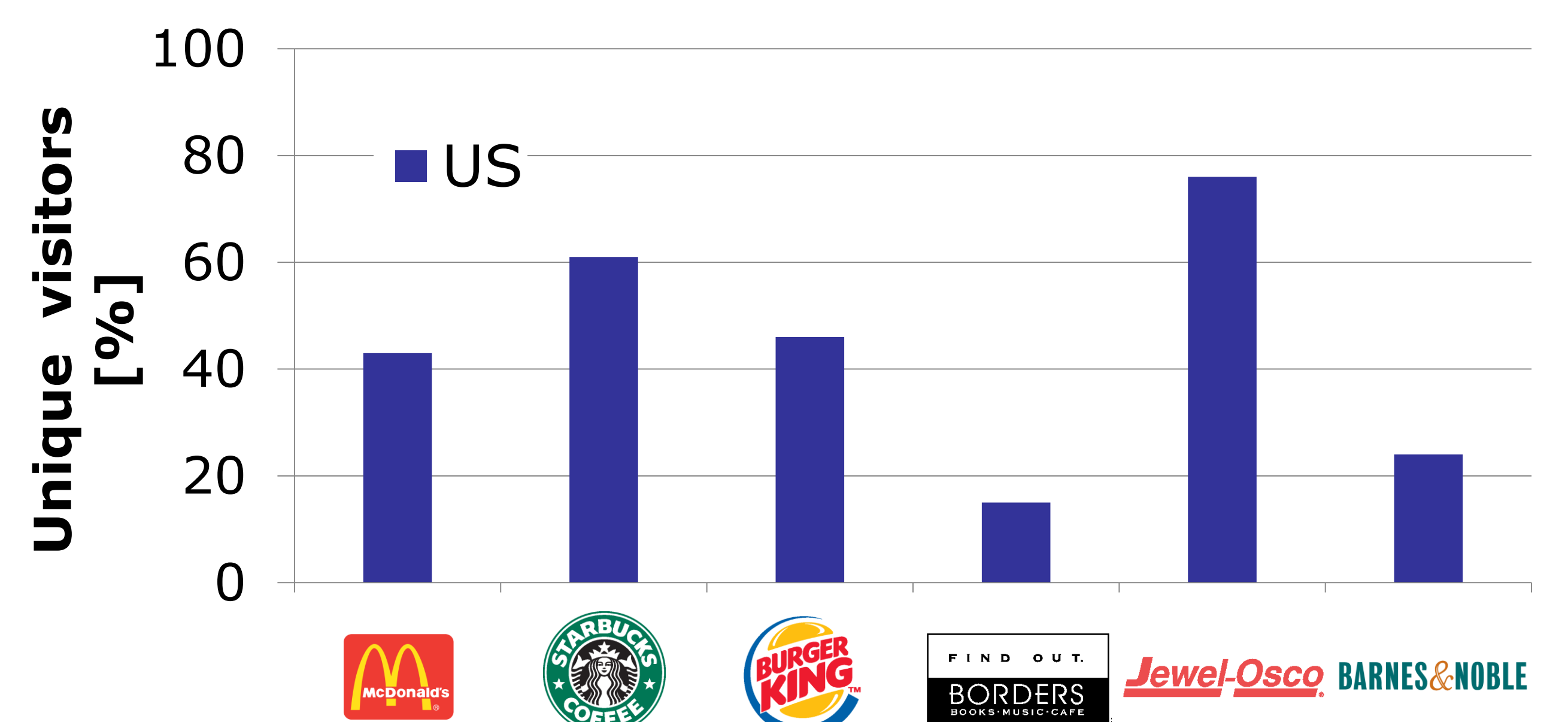
$$E((t_i, \mathbf{x}_i), (t_{i+1}, \mathbf{x}_{i+1}), \mathbf{x}_p, r_p) = \int_{t_i}^{t_{i+1}} p(d(\mathbf{x}(t), \mathbf{x}_p, r_p)) dt$$

Results

Energy of interactions with specific POIs



Visits at Specific businesses



Time-of-day Effect

- Top-2 POI types / time

	8:AM	1:PM	2:PM	7:PM	9:PM
US	Companies	Shops	Companies Govt. Offices	Libraries Restaurants	Stadiums
China	Companies	Govt. Offices Libraries	Libraries Restaurants	Companies Restaurants	Shops Stadiums

Applications

- Urban planning
- Mobile social networking and advertising
- Data off-loading using Wi-Fi @ businesses

Technical report available at <http://hal.inria.fr/inria-00616876>