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United Nations International Conference on Space-based Technologies for Disaster Risk Reduction

# Social Sensing based on Big Geo-data

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**Peking University**
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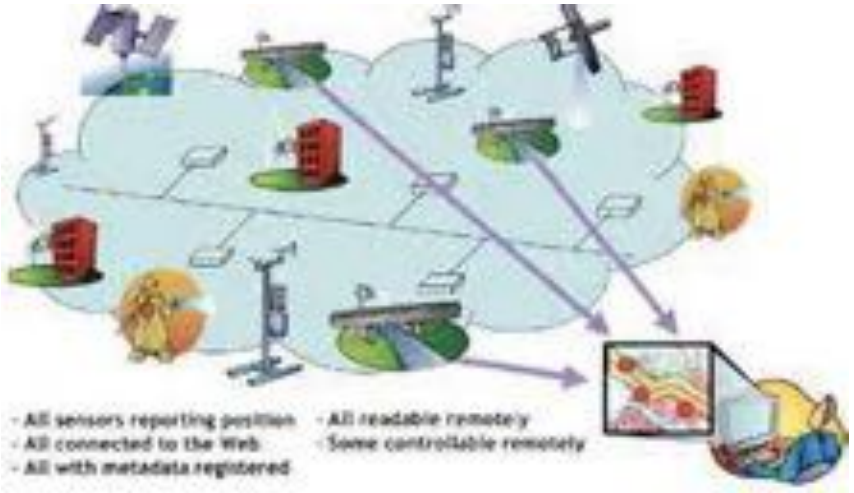
# 1. Big Data

- With the development of ICT, we have entered the BIG DATA

Mobile Devices



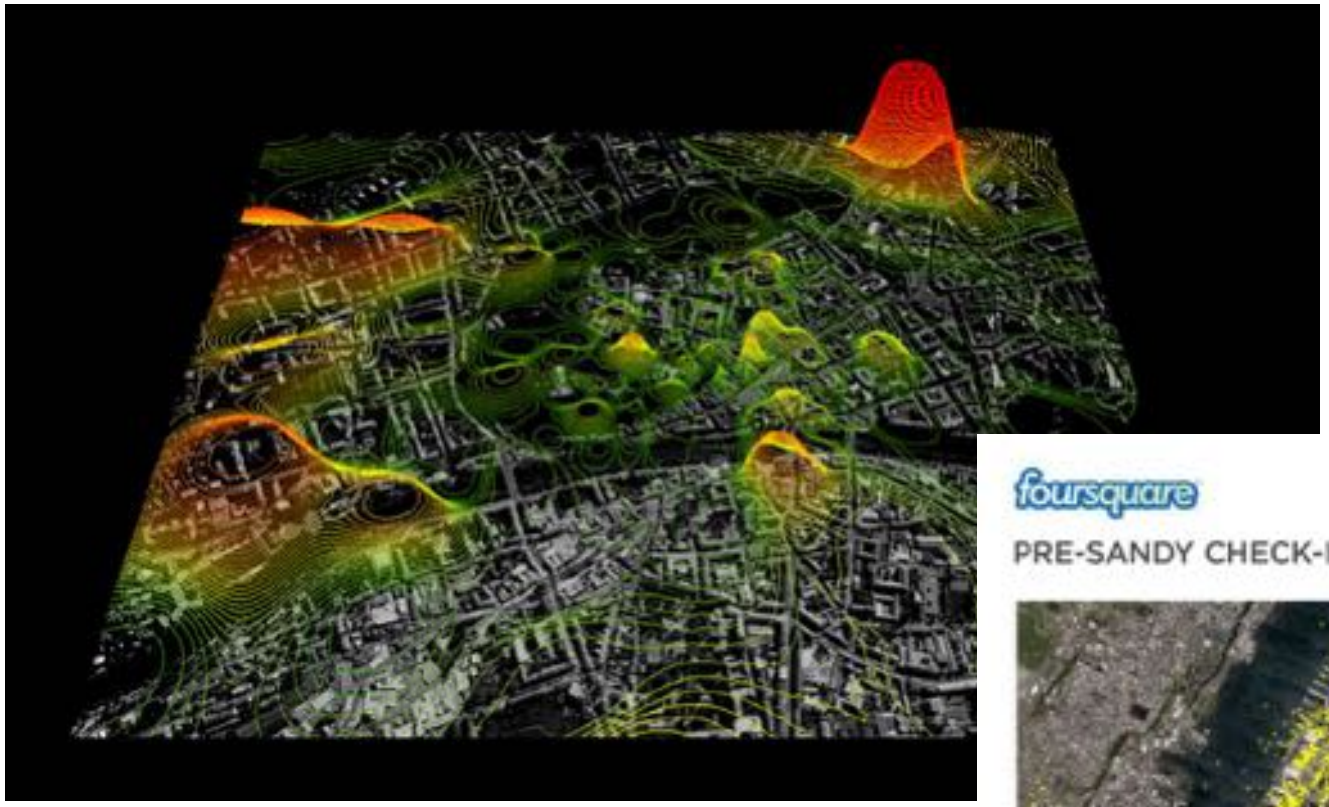

Sensor web

GPS-enabled vehicles

# Big Geo-Data

- Properties of Big Geo-Data
  - Besides 4Vs (Volume, Velocity, Variety, Variability)
    - Spatio-temporal tags
    - Associated with individuals
  - Including:
    - Location based social media data, Mobile phone data, Taxi data, Metra card data…

# Examples of Big Geo-data (1)



Population distribution: estimated using mobile phone data

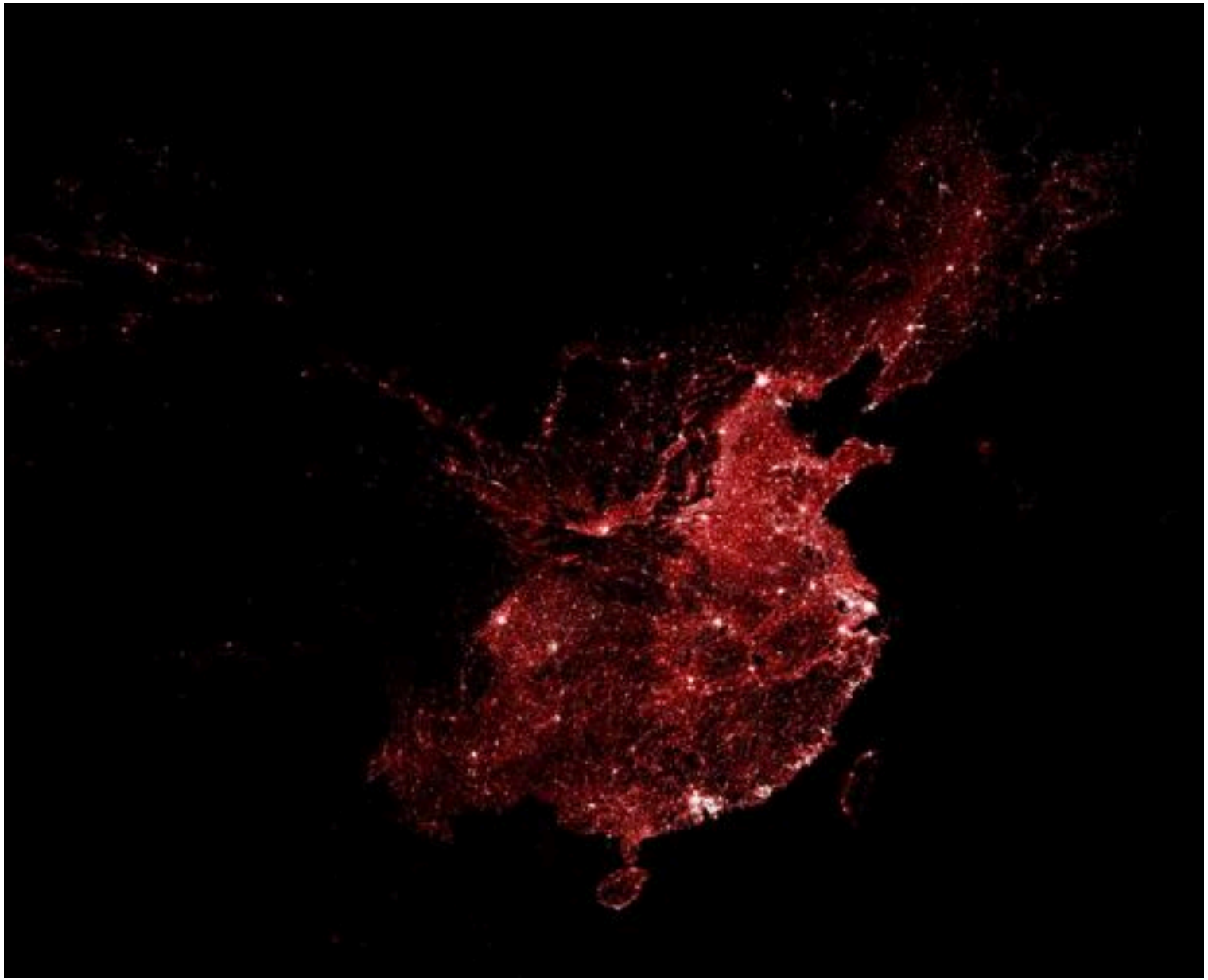
Population distribution before and after Hurricane Sandy: estimated using Foursquare check-in data

# Examples of Big Geo-data

Taxi data of NYC

# Examples of Big Geo-data

Nationwide population from Baidu mobile app data



# 2. Social Sensing

- Individual-based geospatial big data can be viewed as an analogue of remote sensing data in social science research
- While remote sensing data have been widely and successfully used to map physical features, social sensing data can capture human behaviors and consequently reveal socio-economic features
- Why the term “Sensing”
  - Analogue of remote sensing
  - Each individual plays the role of a sensor

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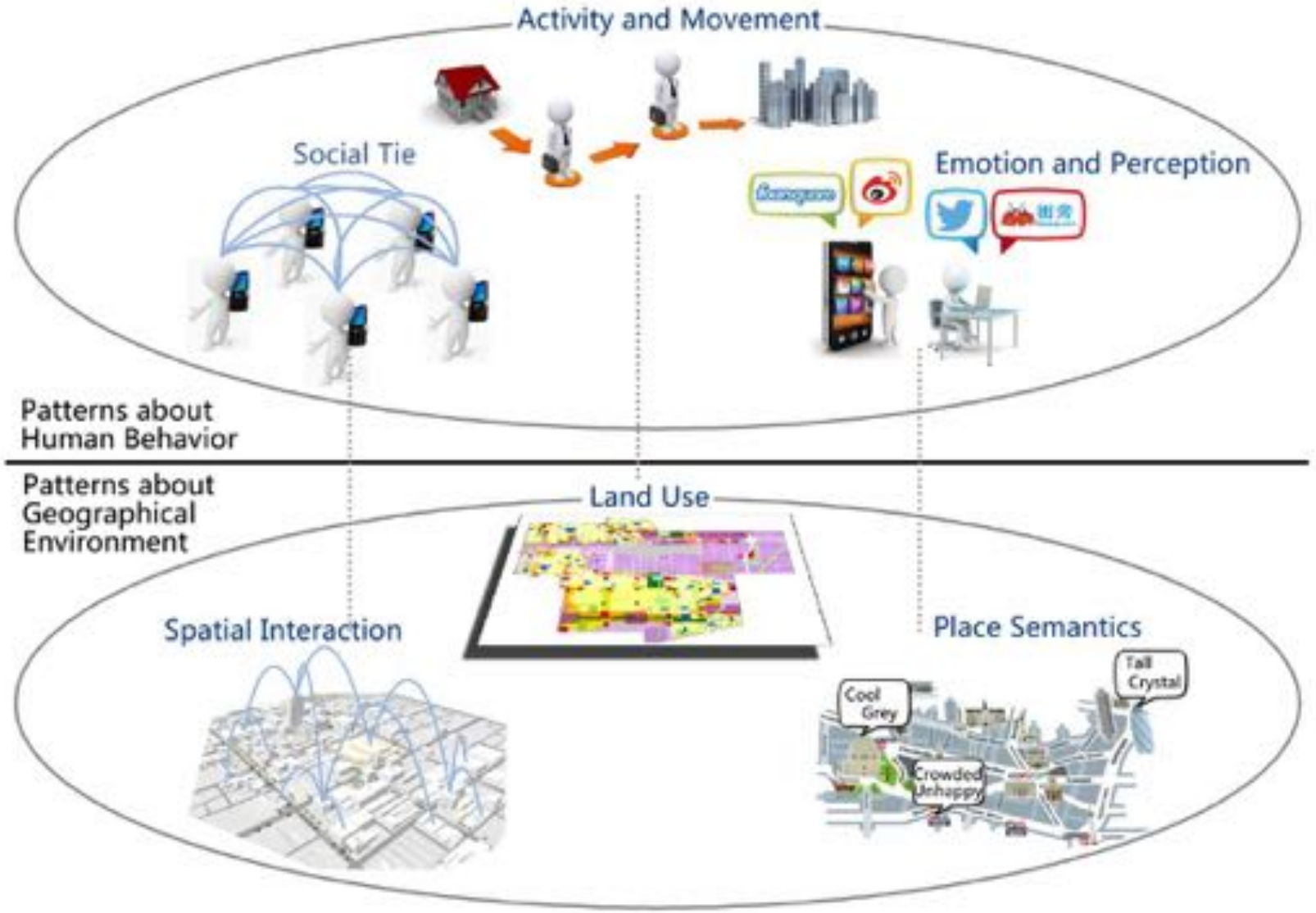
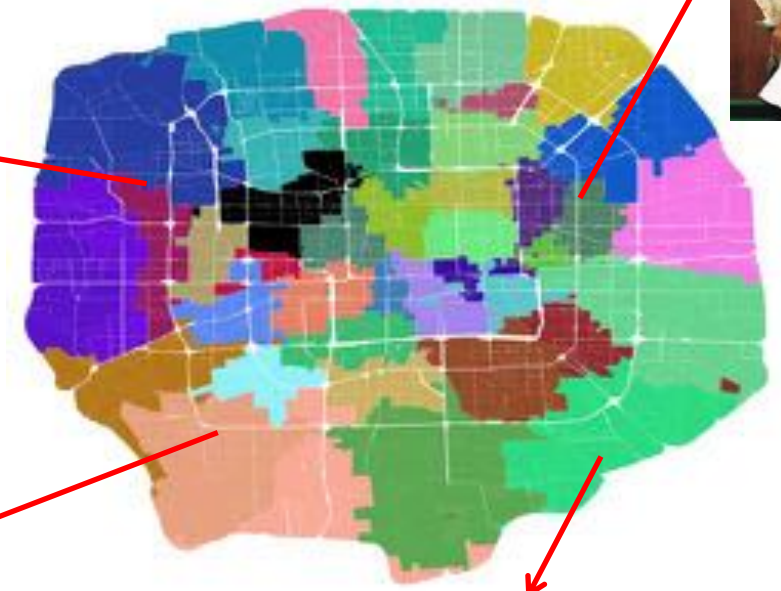
# Framework of Social Sensing



# Understanding Intra-urban heterogeneity





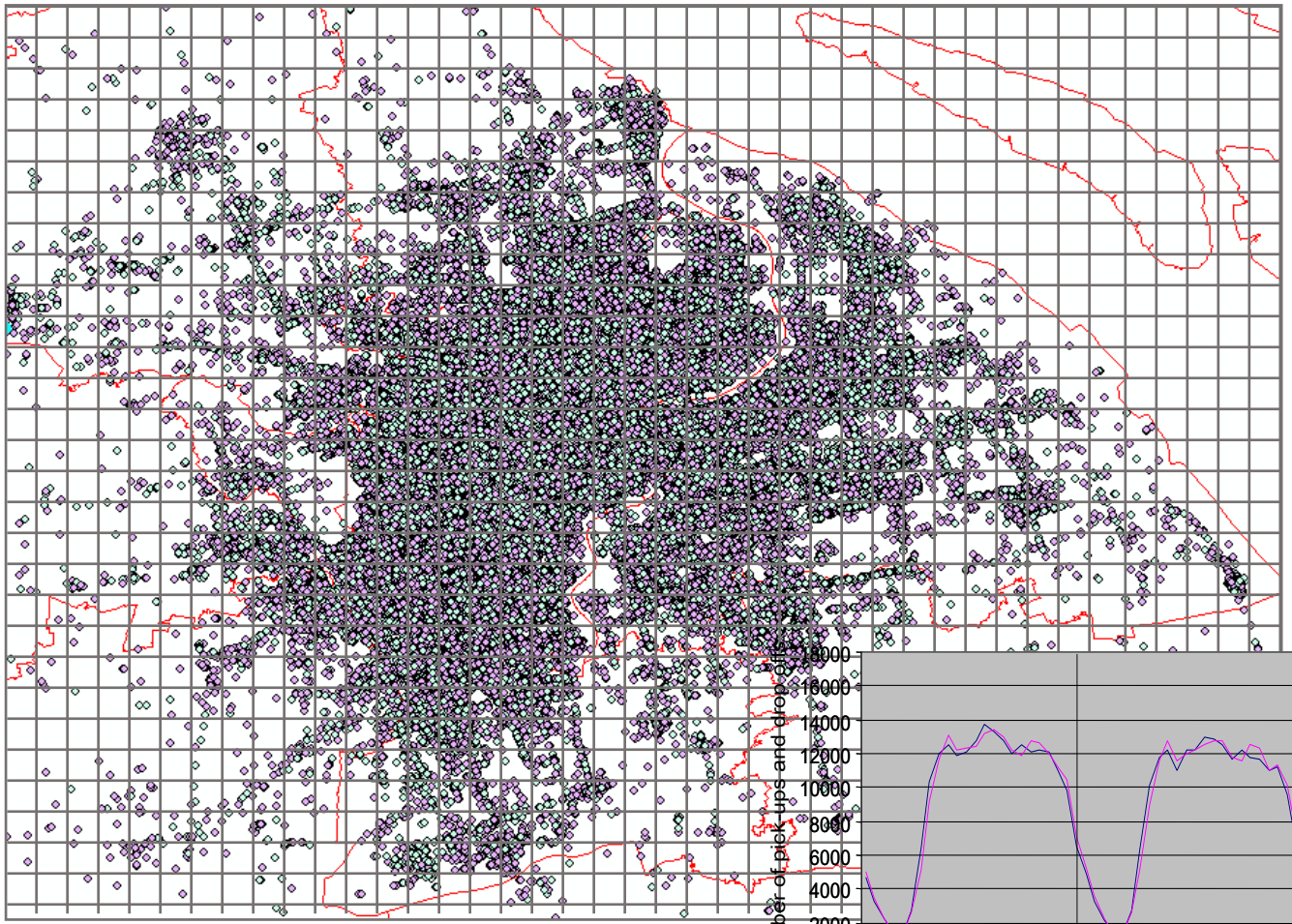


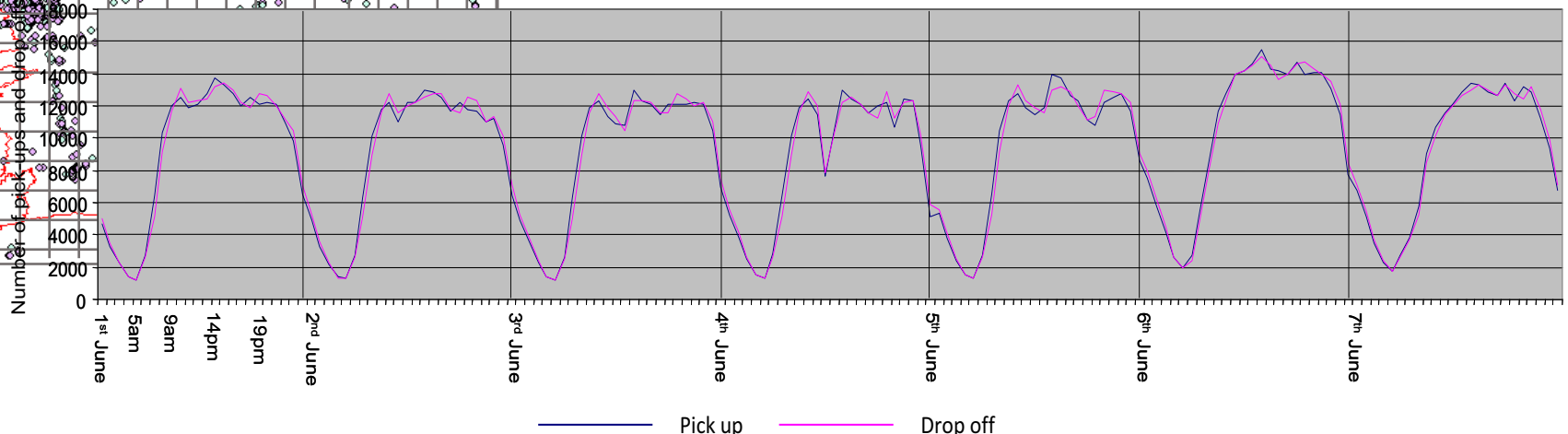


Different places ➔Different landscapes + Different demographical properties

# An Ant Tribe Village in Beijing


# Temporal Rhythm of Shanghai Taxi Trips

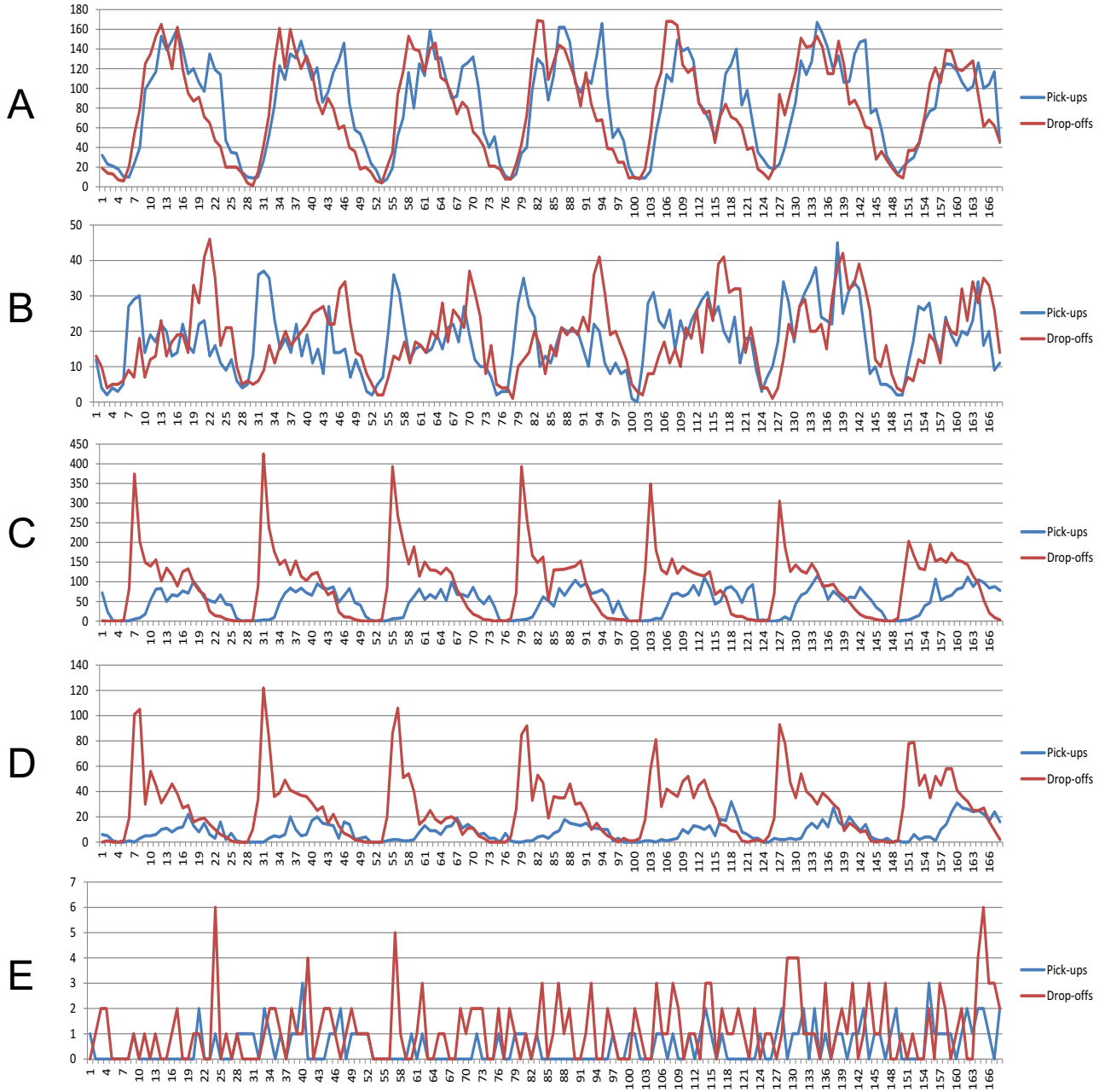




# Local Temporal Signatures

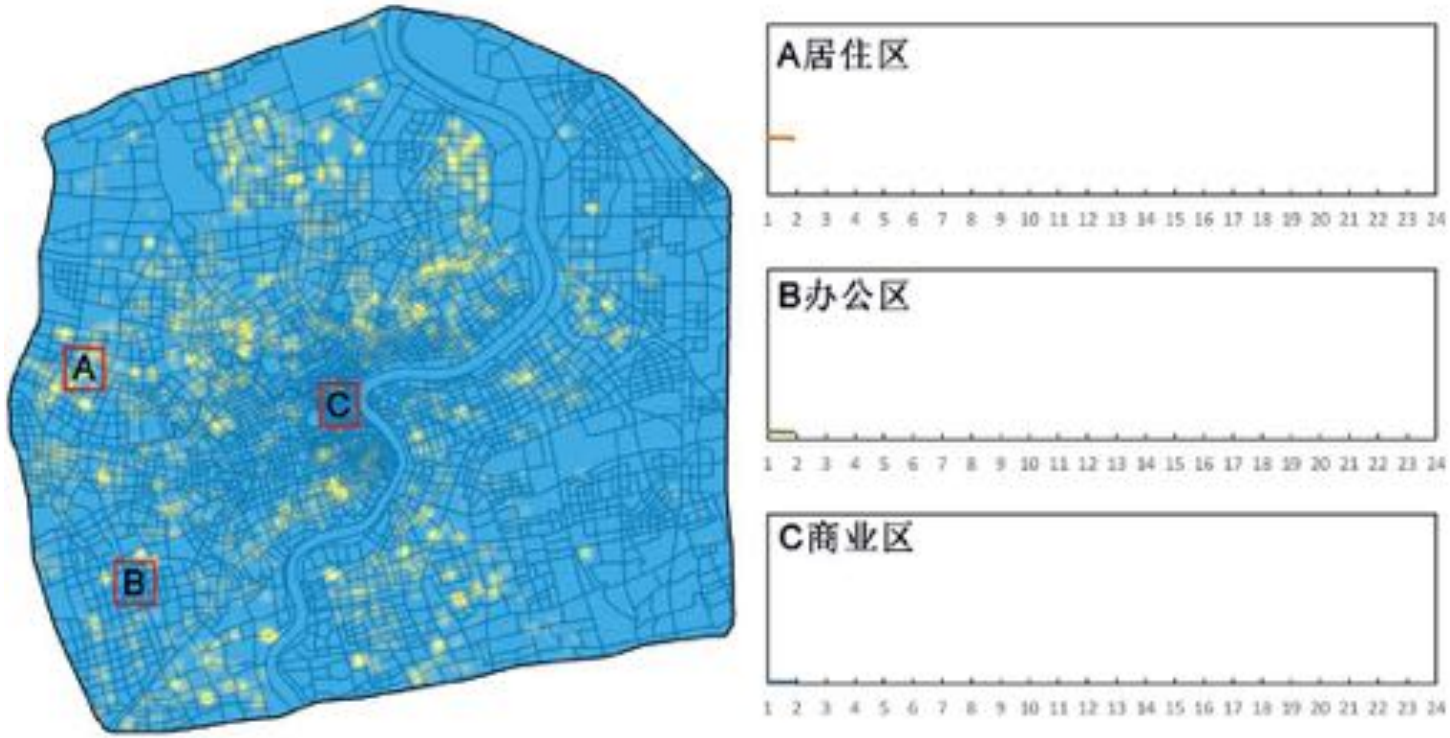

Hongqiao Airport

Pudong Airport



# Linking Temporal Signatures with Land Uses

Given that different urban land uses are associated with different temporal signatures of human activities, which can captured by various big geo-data, we can infer land use categorizes from the observed temporal signatures.



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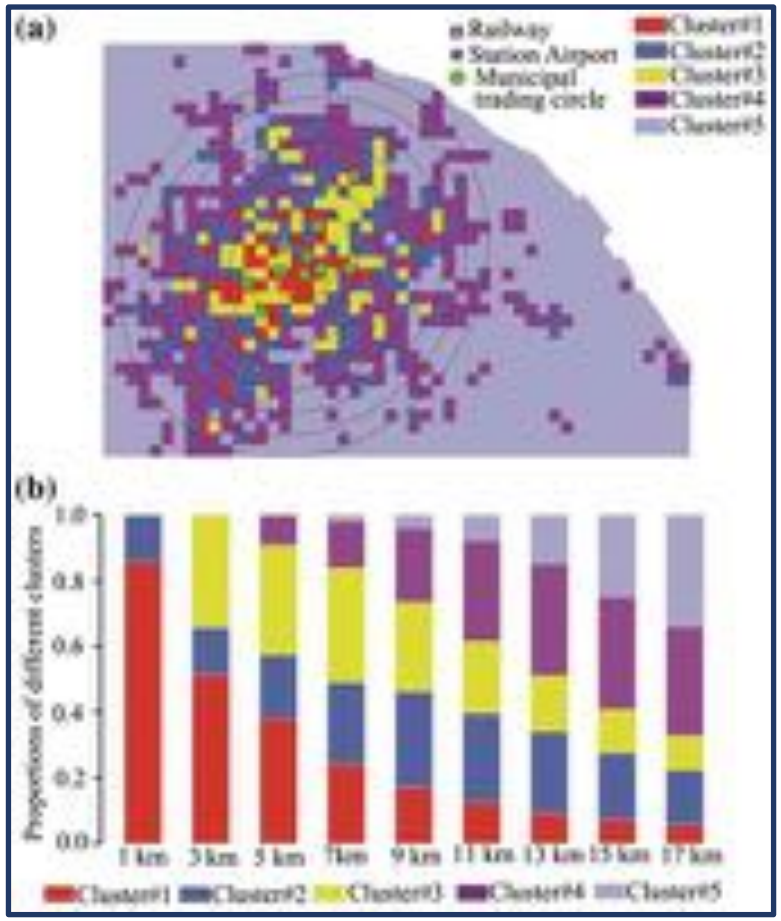
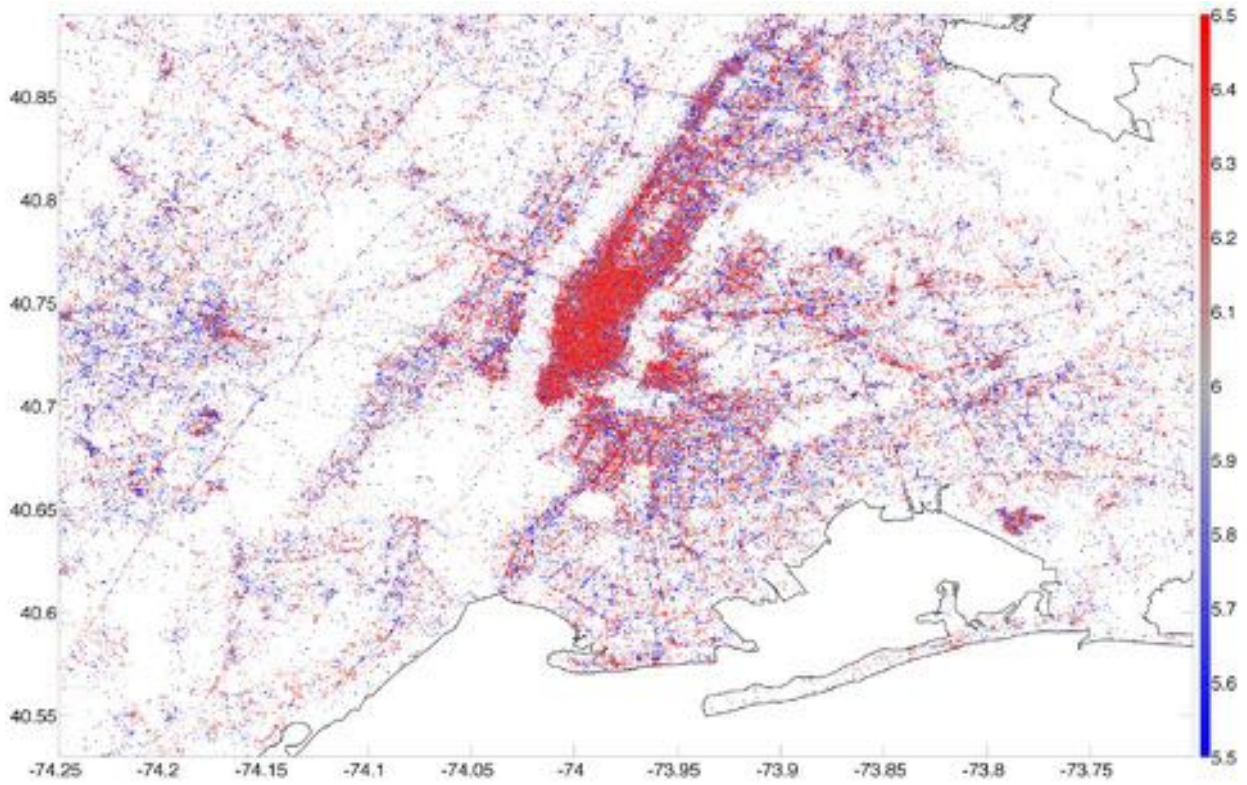
# Case study: Shanghai

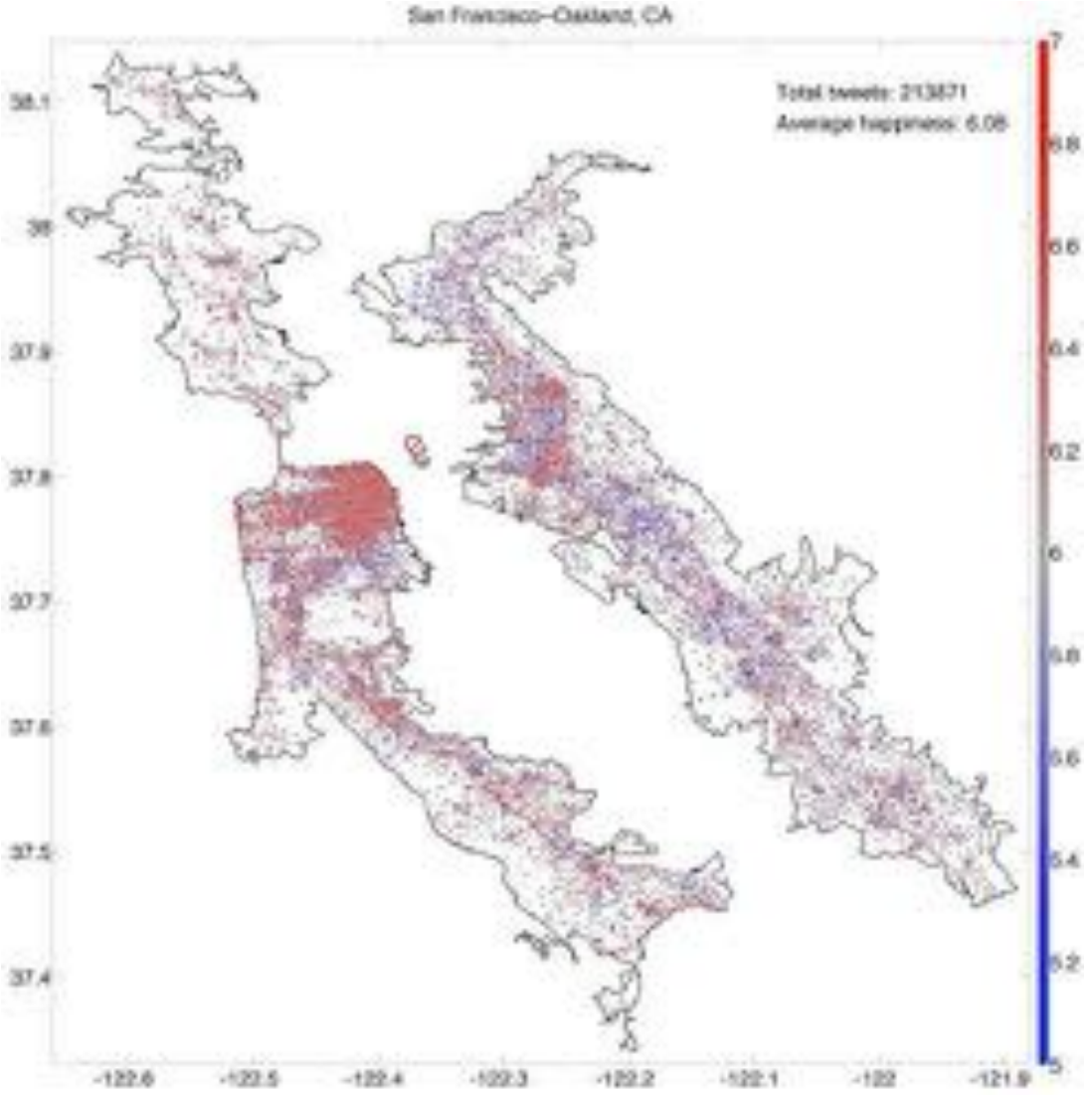




Reveal the concentric ring urban structure from taxi data and social media data, using unsupervised classification

# Sensing Urban Heterogeneity: Other Approaches




Measuring happiness using natural language analysis based on Twitter data

# Sensing Urban Heterogeneity: Other Approaches

"little girl is eating piece of cake."

"baseball player is throwing ball in game."

"woman is holding bunch of bananas."

"black cat is sitting on top of suitcase."

"a young boy is holding a baseball bat."

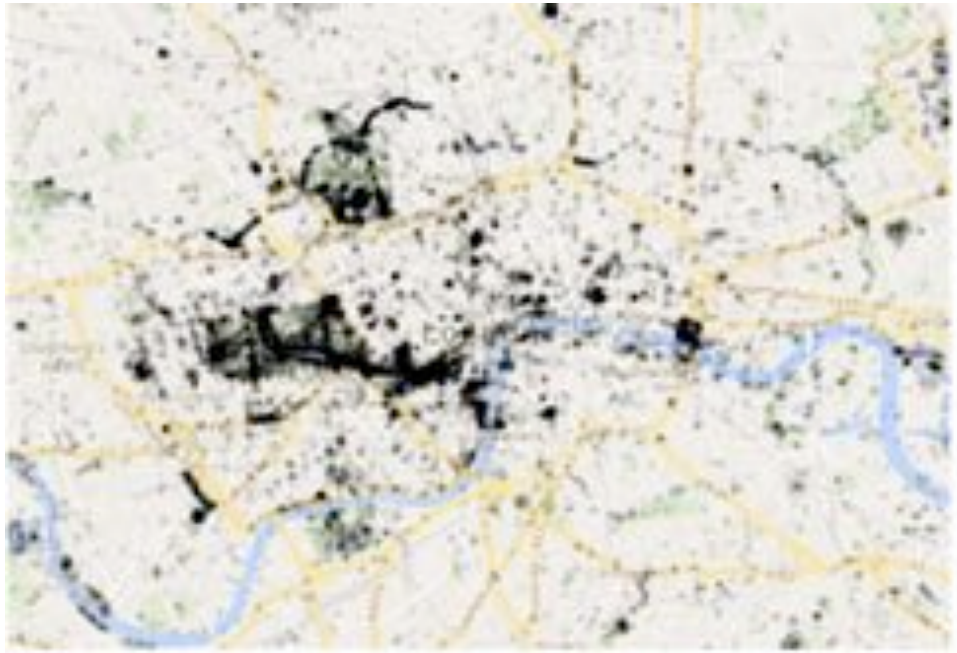
"a cat is sitting on a couch with a remote control."

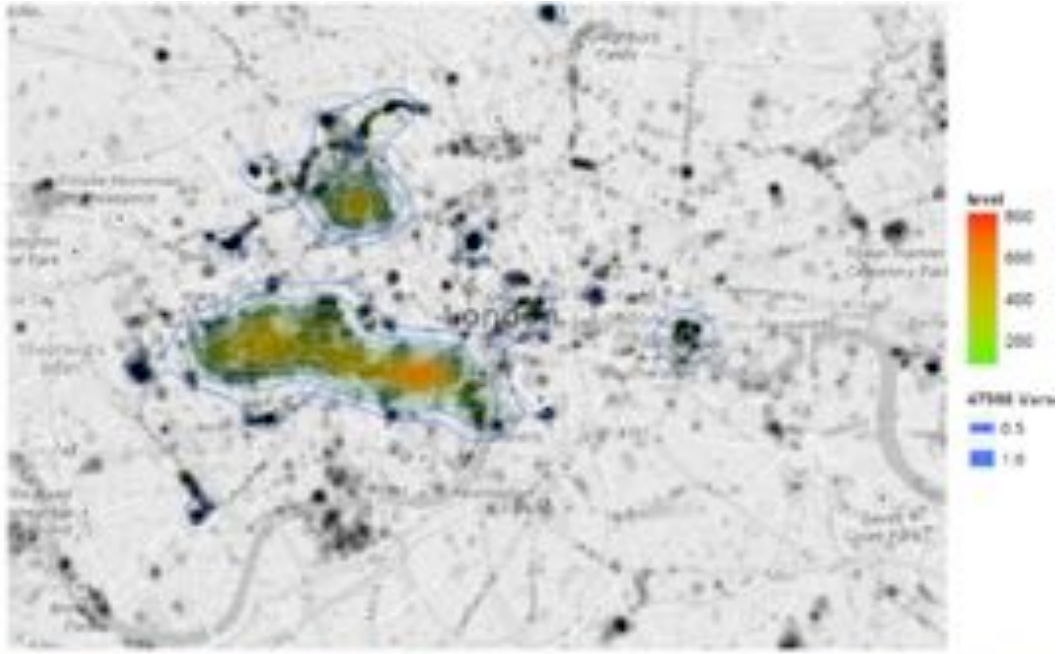
"a woman holding a teddy bear in front of a mirror."

"a horse is standing in the middle of a road."

Image content Analysis

# Sensing Urban Heterogeneity: Other Approaches





Measuring greenness using crowdsourcing images

# 3. Applications: 2014 Shanghai Stampede

On December 31, 2014, a deadly stampede occurred in Shanghai, on the Bund (Waitan), where around 300,000 people had gathered for the new year celebration. 36 people were killed and there were 49 injured,

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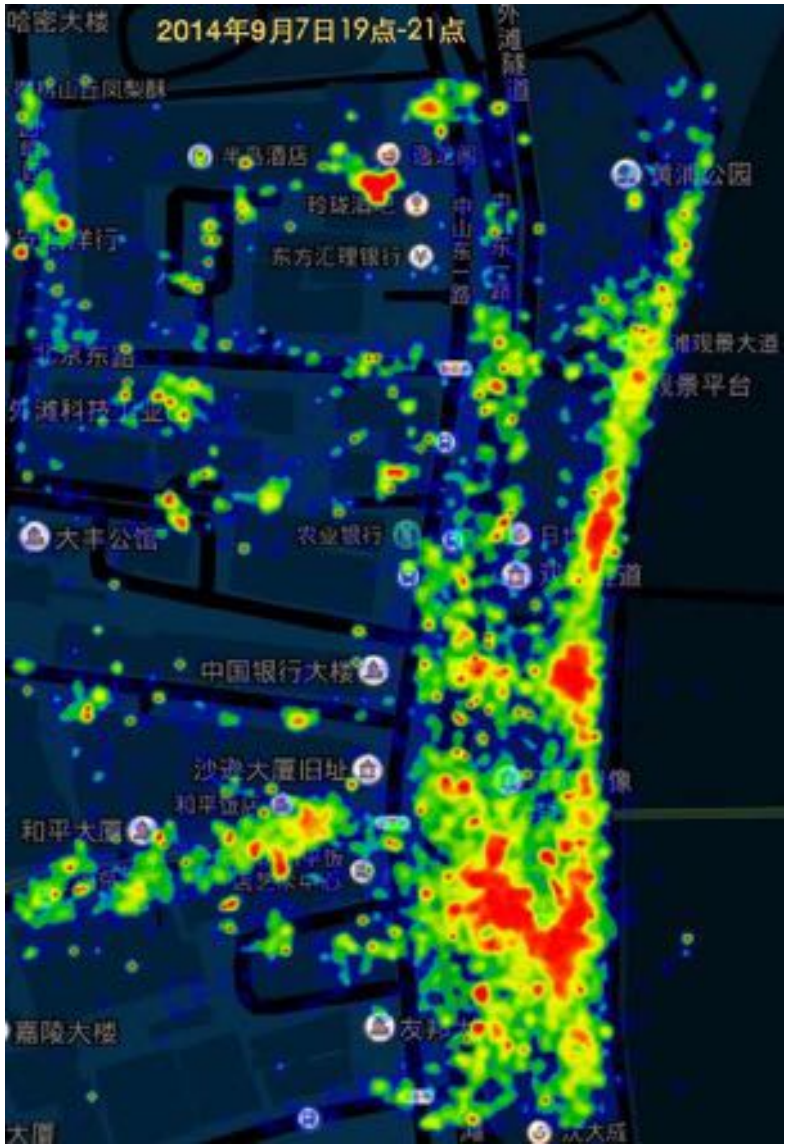
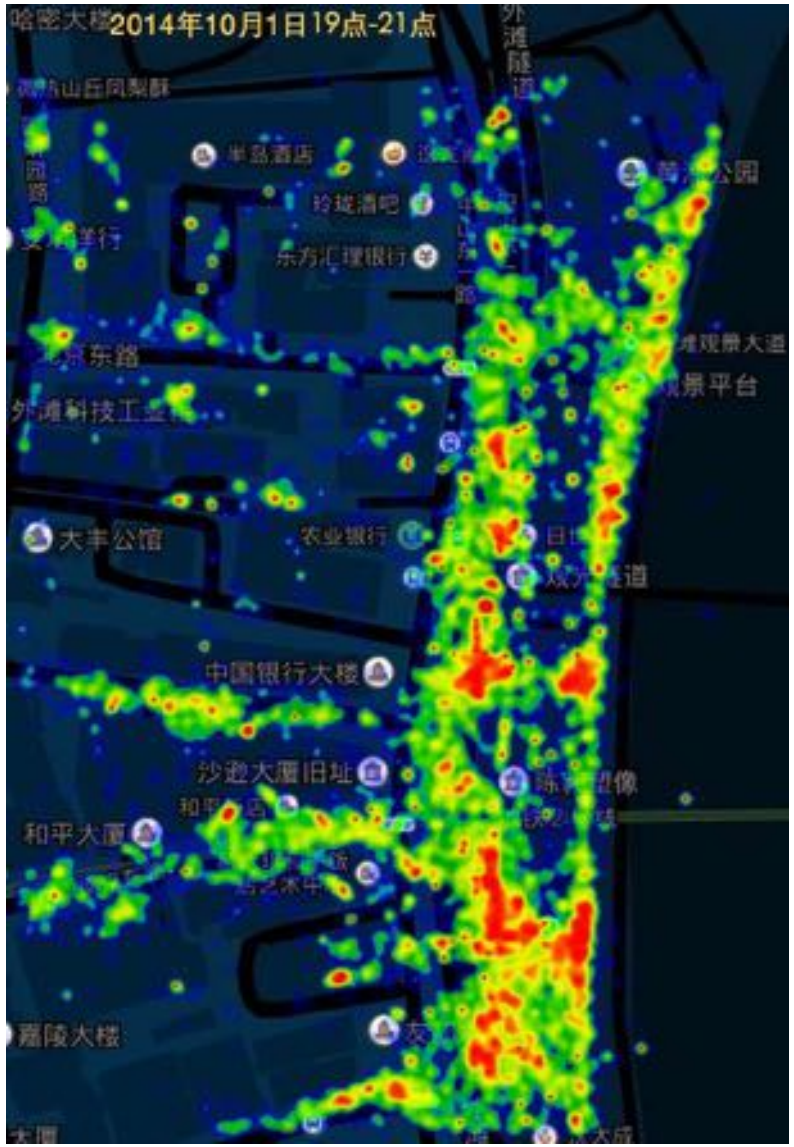
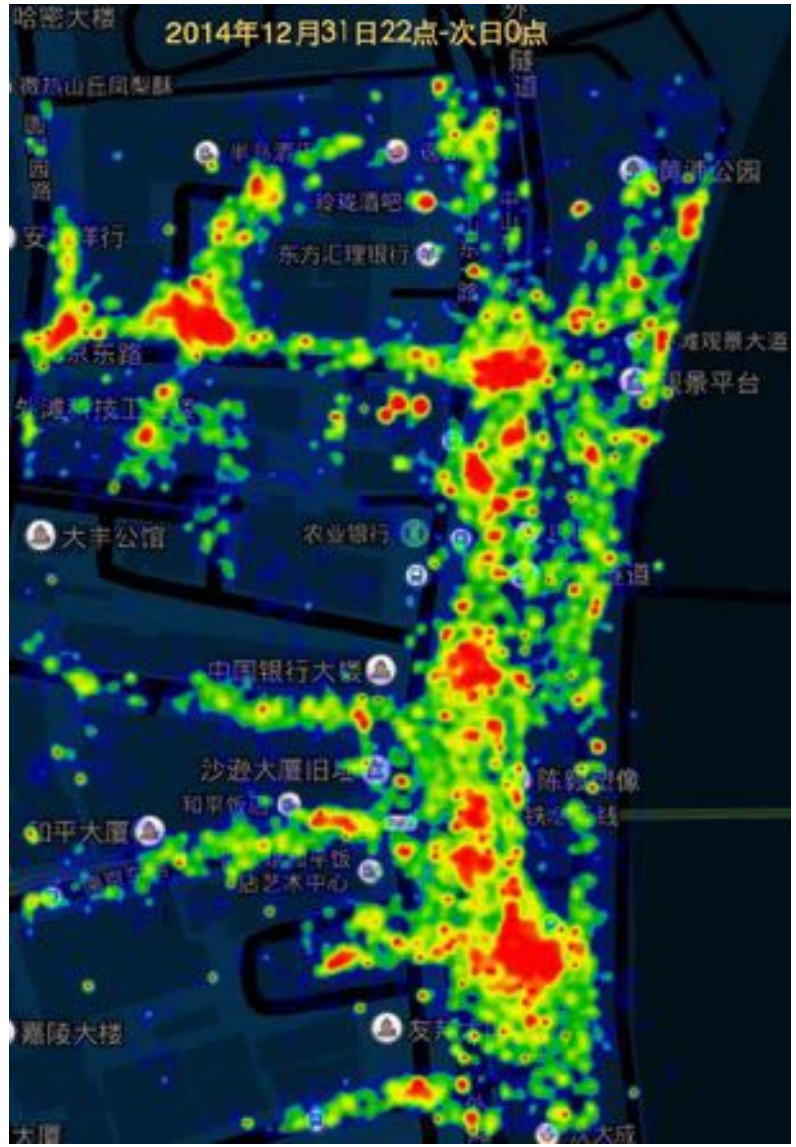
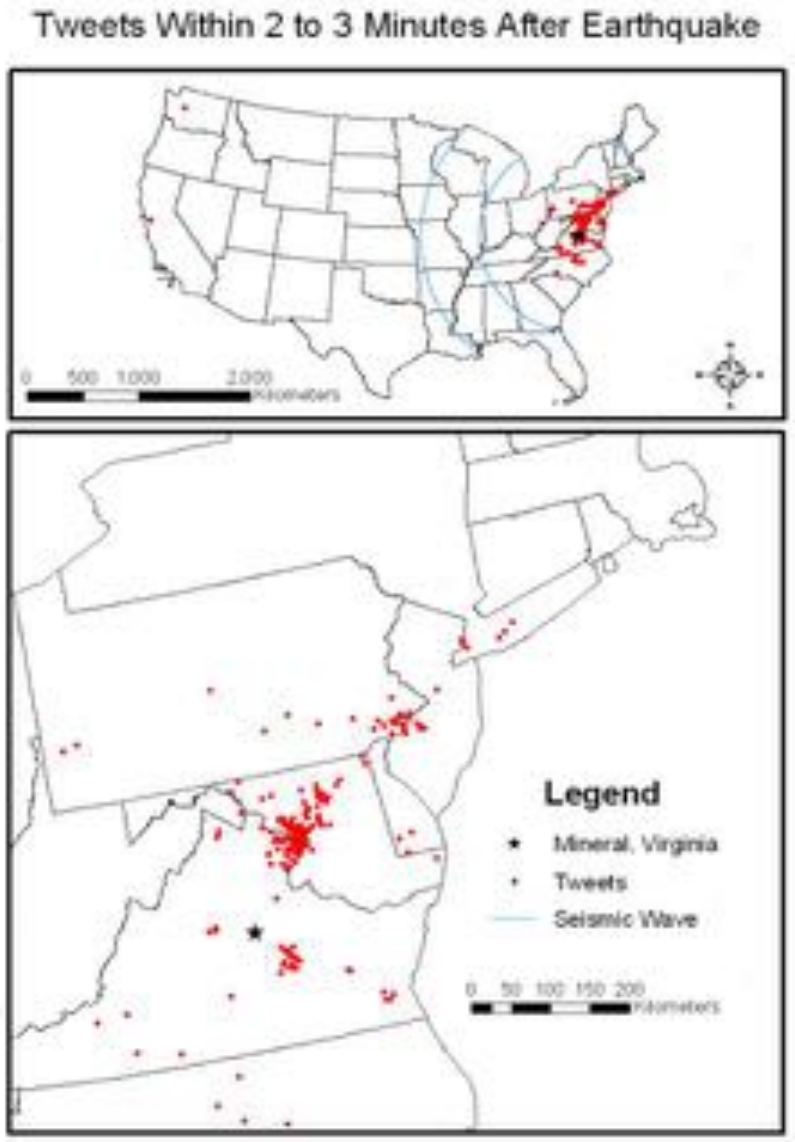
# Applications: 2014 Shanghai Stampede

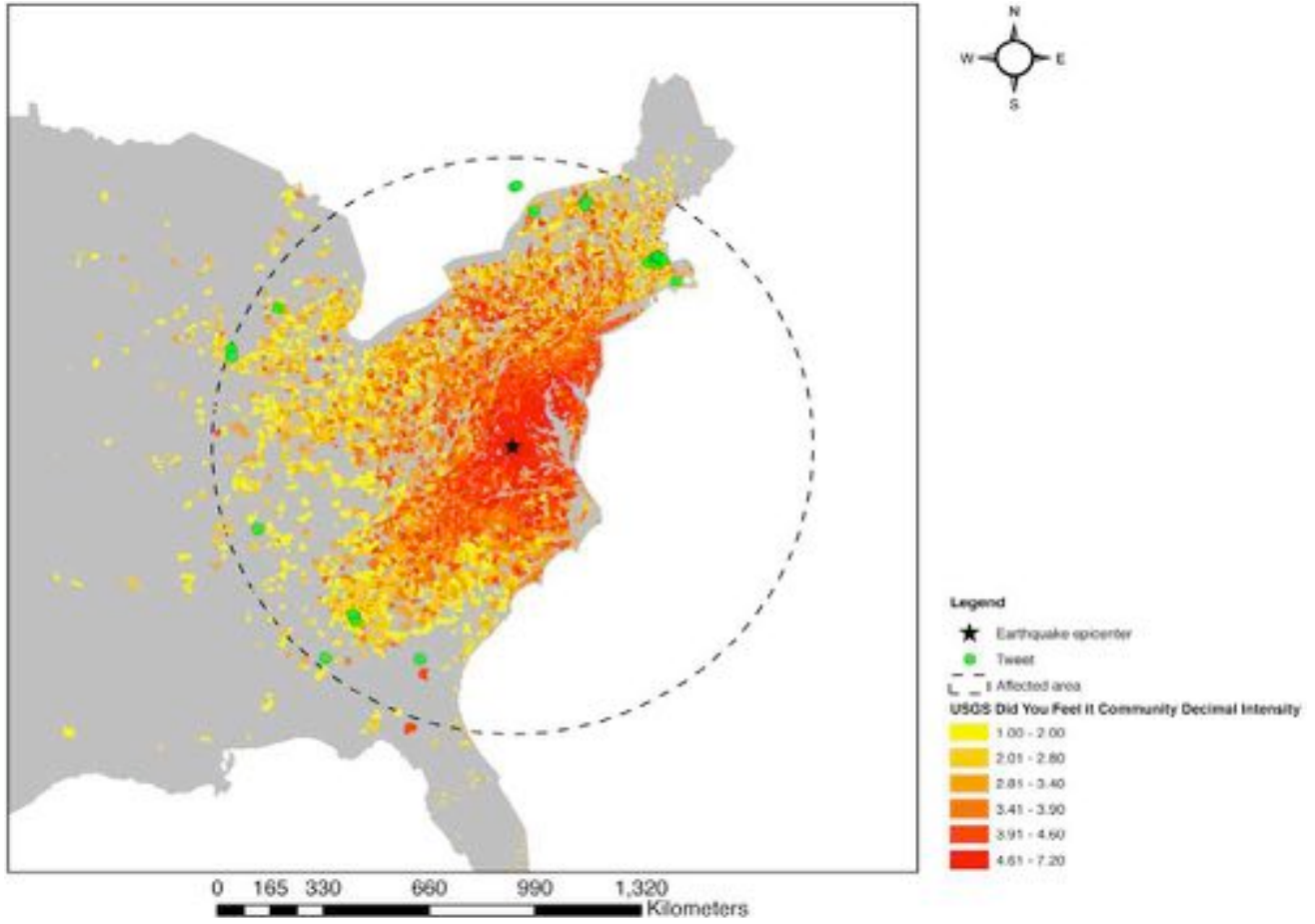


# Measuring Earthquake impacts

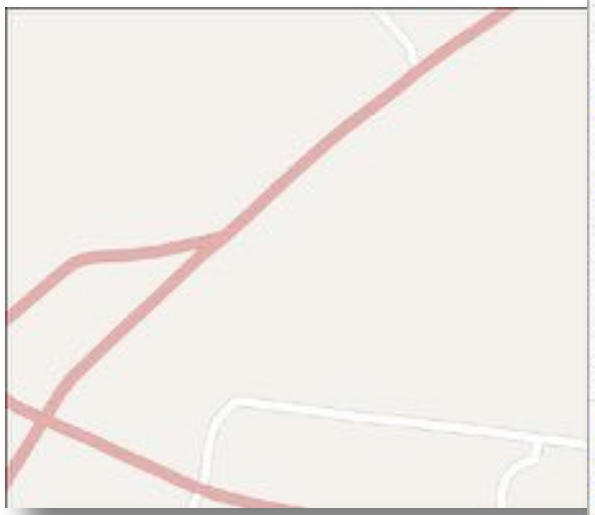


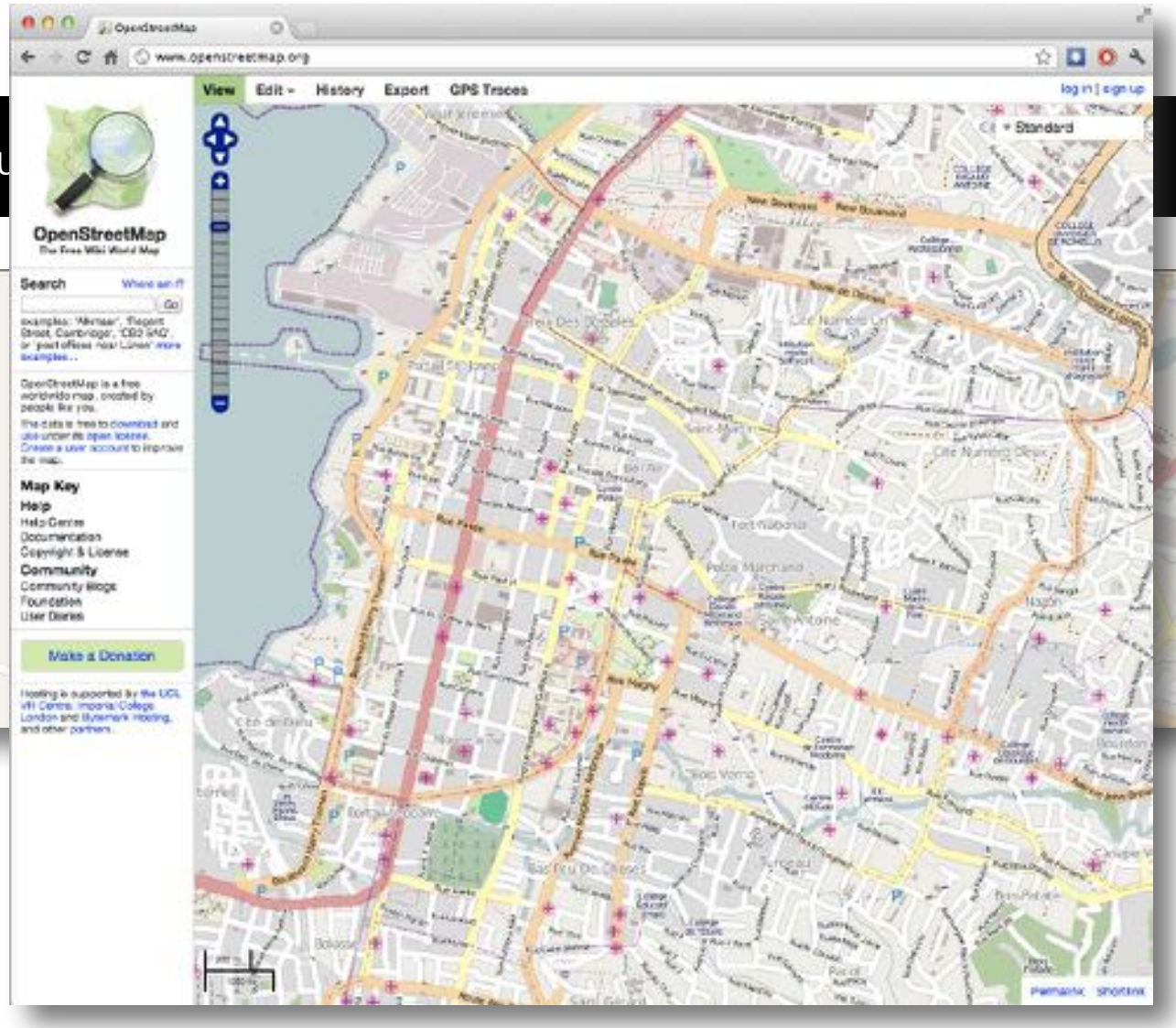




Twitter as a Distributed Sensor System for earthquakes (A. Crooks, et al. TGIS, 2013)

# Crowdsourcing Mapping

OpenStreetMap crowdsou






before the quake

April. 20. 2012

one week later

P. Boccardo et al., 2012 ISPRS Archives

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# 4. Conclusions

- Multi-sourced big geo-data provide an unprecedented opportunity to capture large volumes of individuals' behavior patterns.
- Big geo-data can reveal characteristics from both the human and geographical perspectives.
- Thus, big geo-data provide a promising approach to disaster management.