4th Advances in Destination Management
Visitor Data and Decision Making: Challenges and Opportunities

Modeling of human movement behavior: from data to applications

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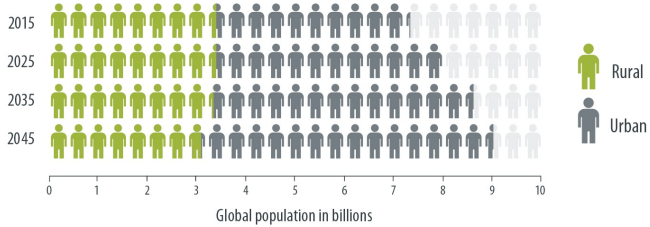
Data revolution

From data to knowledge

Urbanization

- 1950: **30%** of the population lives in cities
- 2014: **54%** of the population lives in cities



Source: UN World Urbanization Prospects: 2011 Revision

Smart city: Application of IoT

Challenges

- Climate change
- Energy consumption and pollution
- Increased traffic and congestion

Solution

- Data availability
- Networked technologies

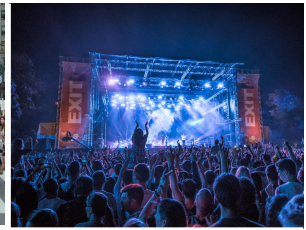
From data to application

Examples

- Congestion and pedestrian movements
- Reconstructing actual itineraries

Congestion and pedestrian movements

Congestion



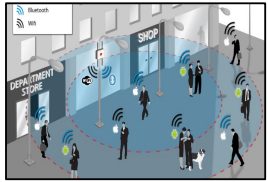
Research challenges

- Understand, describe and predict
- Optimization of current infrastructure and operations
- Efficient planning and management of future pedestrian facilities

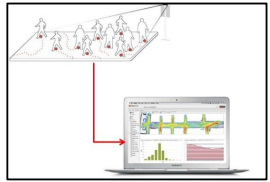
Data sources

Survey

Counts



Wireless technologies



Automated detection and tracking

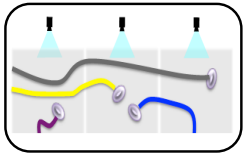
Models and applications

STRATEGIC	TACTICAL	OPERATIONAL	APPLICATION
Departure time choice	Activity scheduling	Walking behavior	Level of service
Activity pattern choice	Route choice		Design and planning
			Guidance
			Control

Example: Lausanne train station

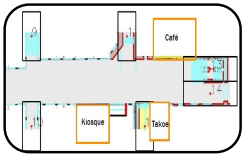
Data sources

Pedestrian trajectories



Timetables

Infrastructure data



<u>Pedestrian type</u>
Arriving
Departing
Transferring
Non-passengers

<u>Period</u>
Peak
Off-peak

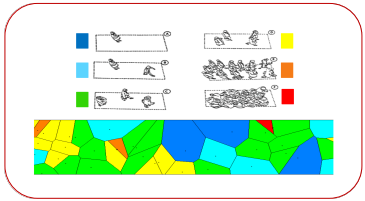
<u>Walking pattern</u>
Group
Alone

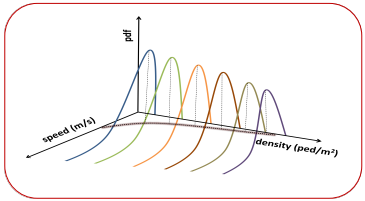
<u>Time to departure</u>

<u>OD distance</u>

Data-driven models for pedestrian movements

Models

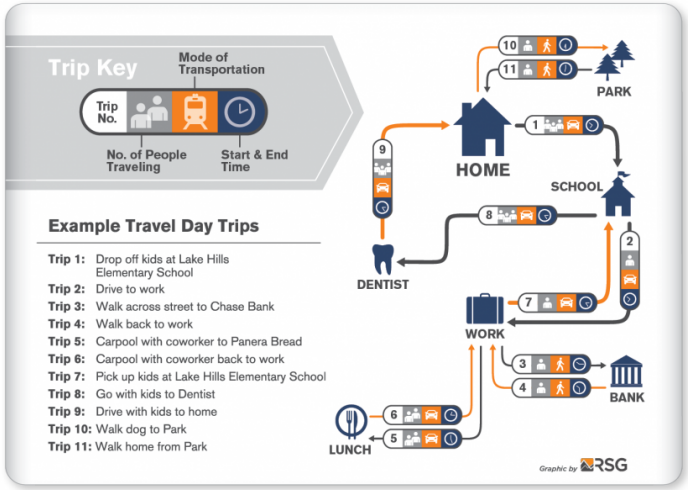




Application domains

Reconstructing actual itineraries

Traditional data sources: Travel surveys



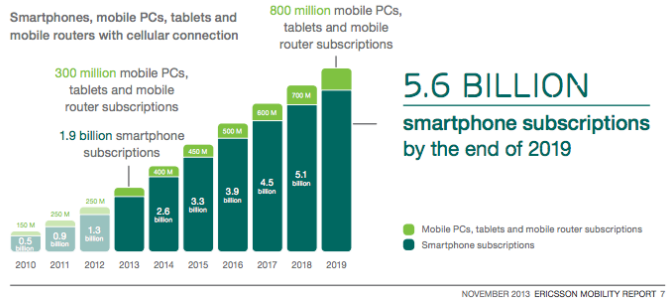
Drawbacks:

Biased response

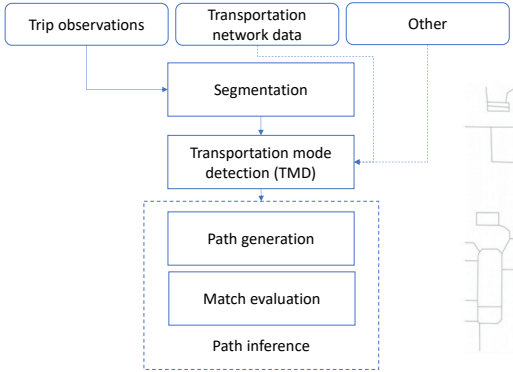
No response

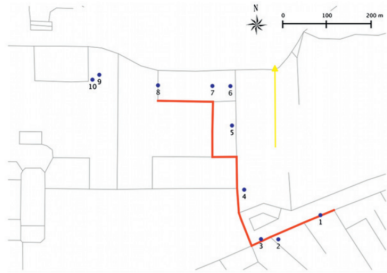
Erroneous reporting

Modern data sources: Smartphones

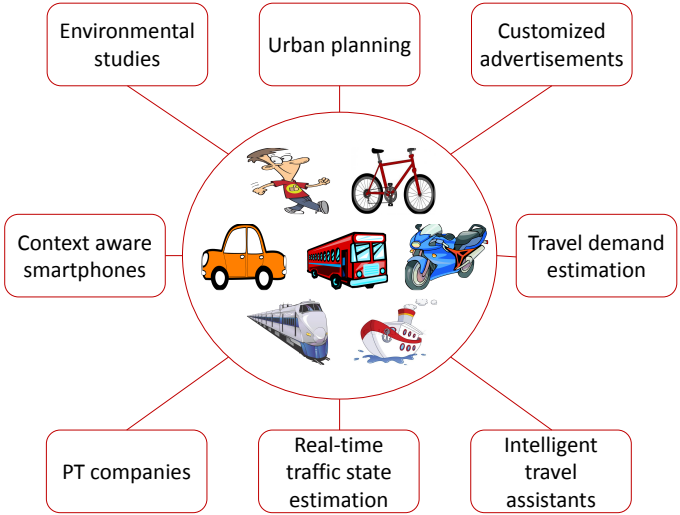


Path inference

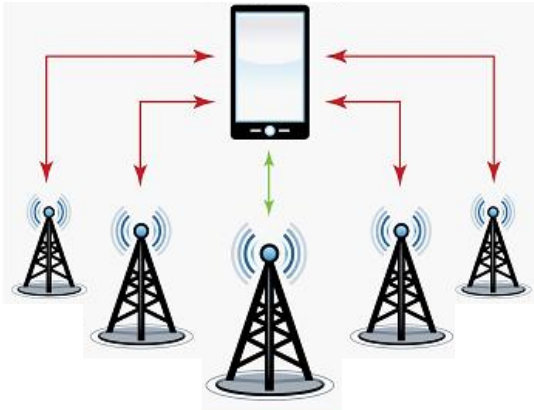




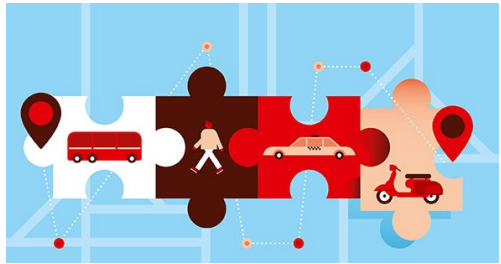
Applications



Example: Telecommunication traces



Telecommunication traces and path inference



Issues

- Low frequency in some areas
- Inaccuracy due to technological constraints
- Weaker signal in some areas
- Map matching algorithms do not work with this data

Conclusions

Strengths

- Pervasive & non intrusive

Opportunities

- From data to applications

Weaknesses

- Data $\neq$ information $\neq$ decisions
- Big data $\neq$ useful data

Threats

- Privacy & biases

Thank you

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