

Applied Data Science: Spatial Data Analysis and Simulation Modeling

Intro, 31/08/2020, Simon Scheider

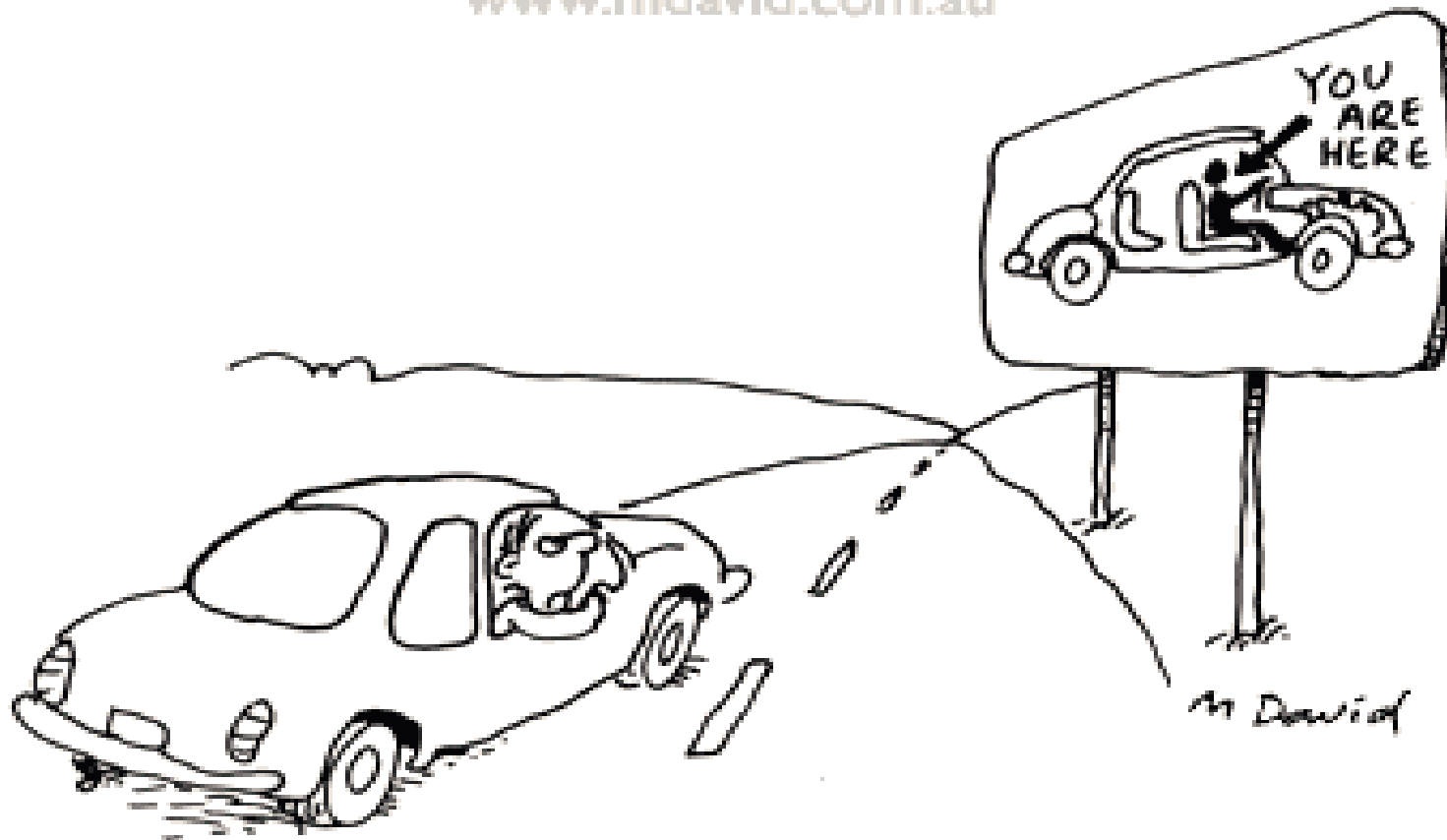
Department of Human Geography and Spatial Planning



What is special about spatial data?

What's wrong with this street sign? ...

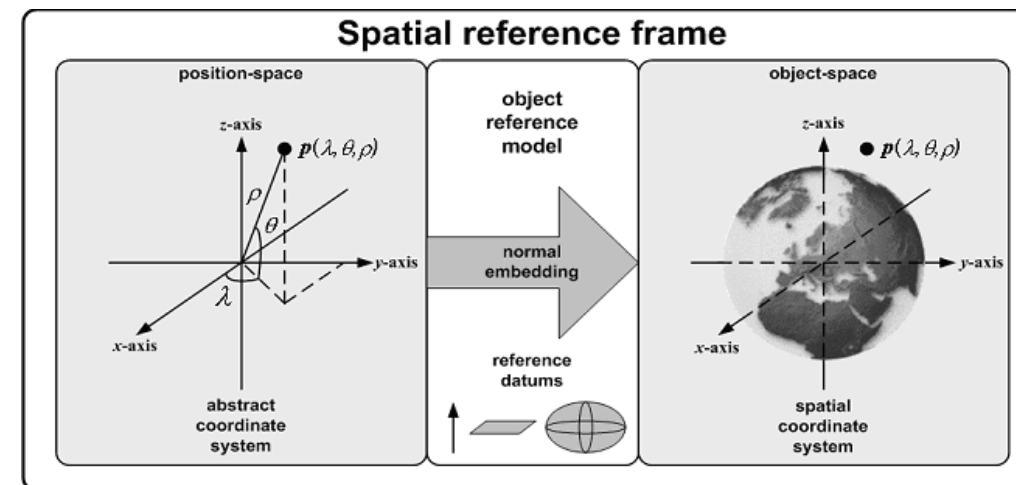
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Spatial reference systems (SRS)

... it uses the wrong reference system (scale).
SRS localize places dependent on scale.

- The bikes in front of the house
- Would the leftmost person in the first row please raise their hand?
- The lecture is in room THEATRON in the Educatorium of the University Utrecht
- How far is Berlin from East London?





What is special about spatial data (analysis)?



Spatial reference systems (metadata, geometric transformations) and measurement scales (levels, types)



Concepts of spatial data quality

- spatial resolution and scale
- spatial accuracy and completeness



Core concepts of spatial information (field, object, event, network)



Spatial data types and databases



Spatial analytic functions (data transformations)

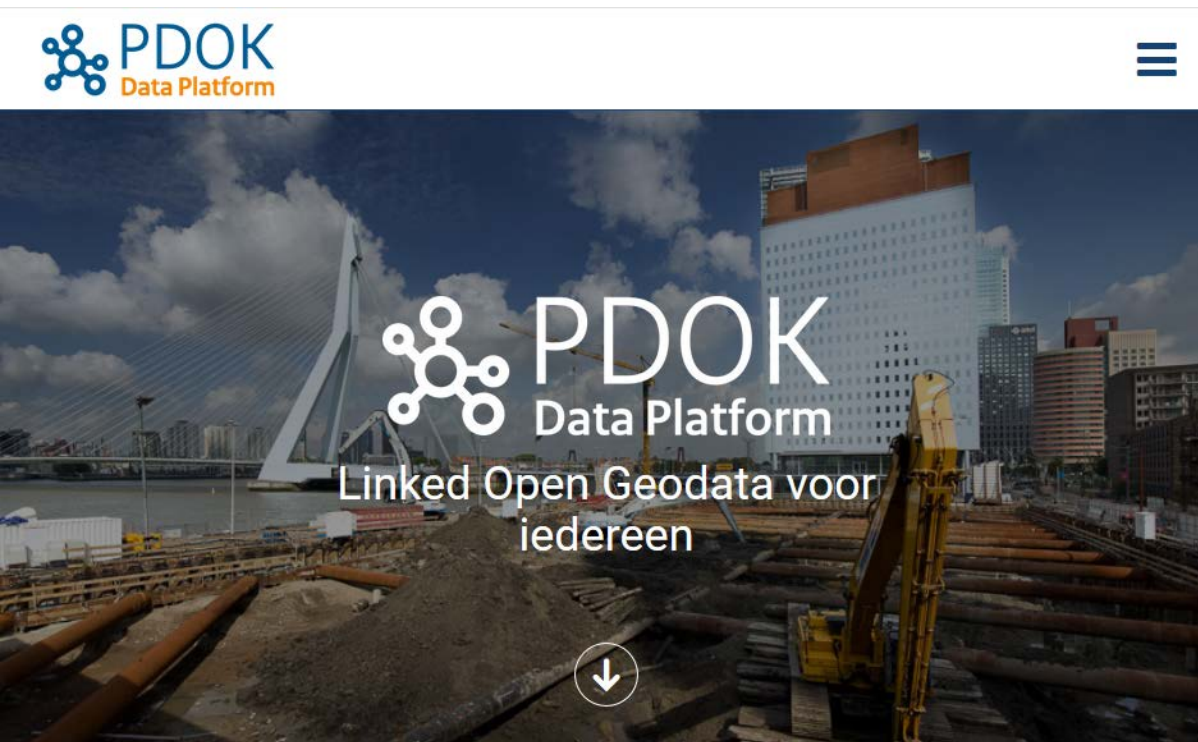


Enables spatial simulation to assess possible scenarios in space



-> provides a basis for designing ML models and predicting features

Linked (geo)data and (geo)social media



OpenStreetMap
The Free Wiki World Map

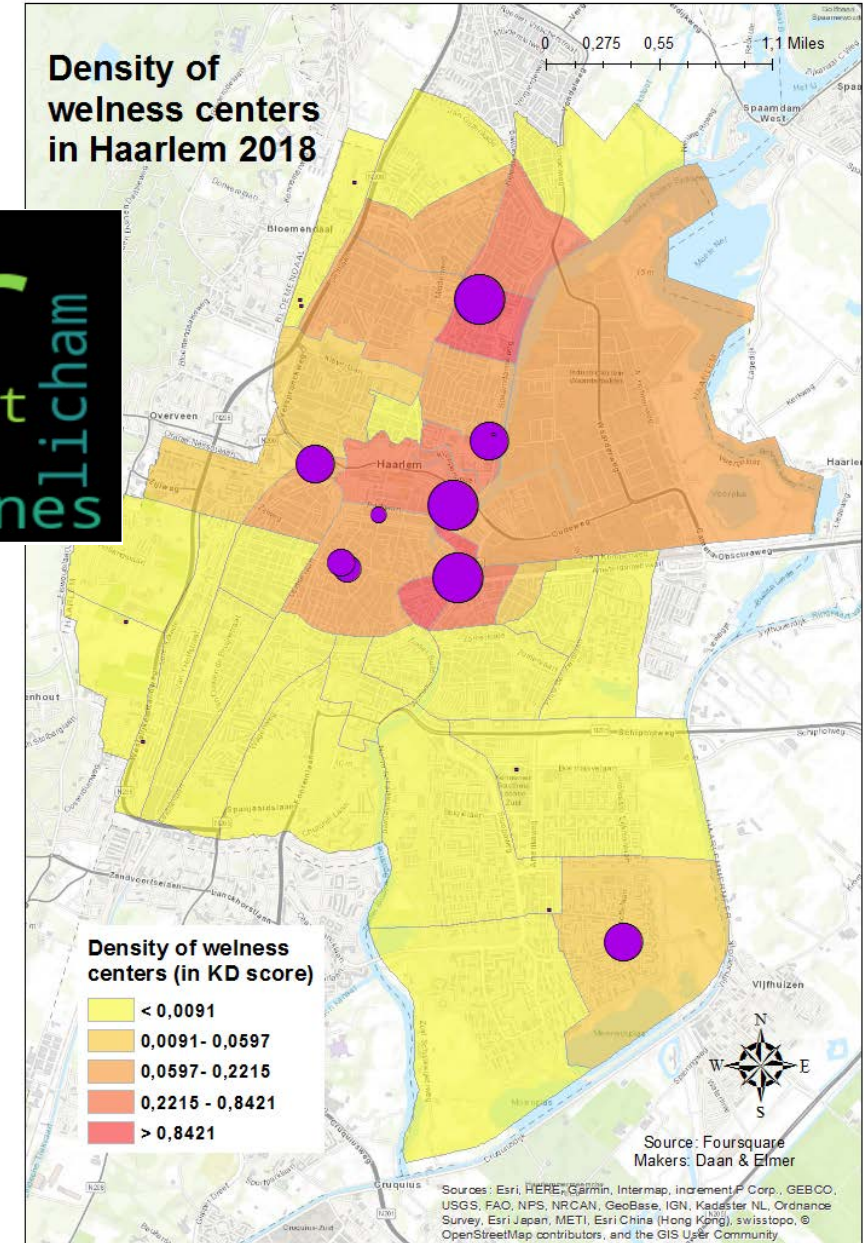
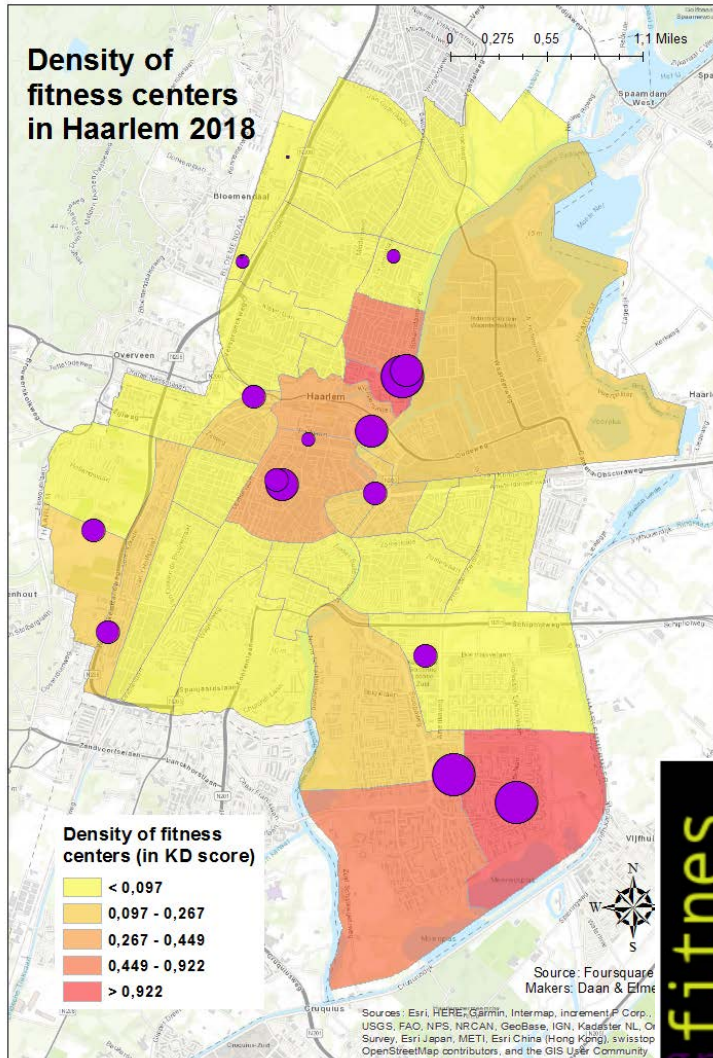


bing™
LOCAL

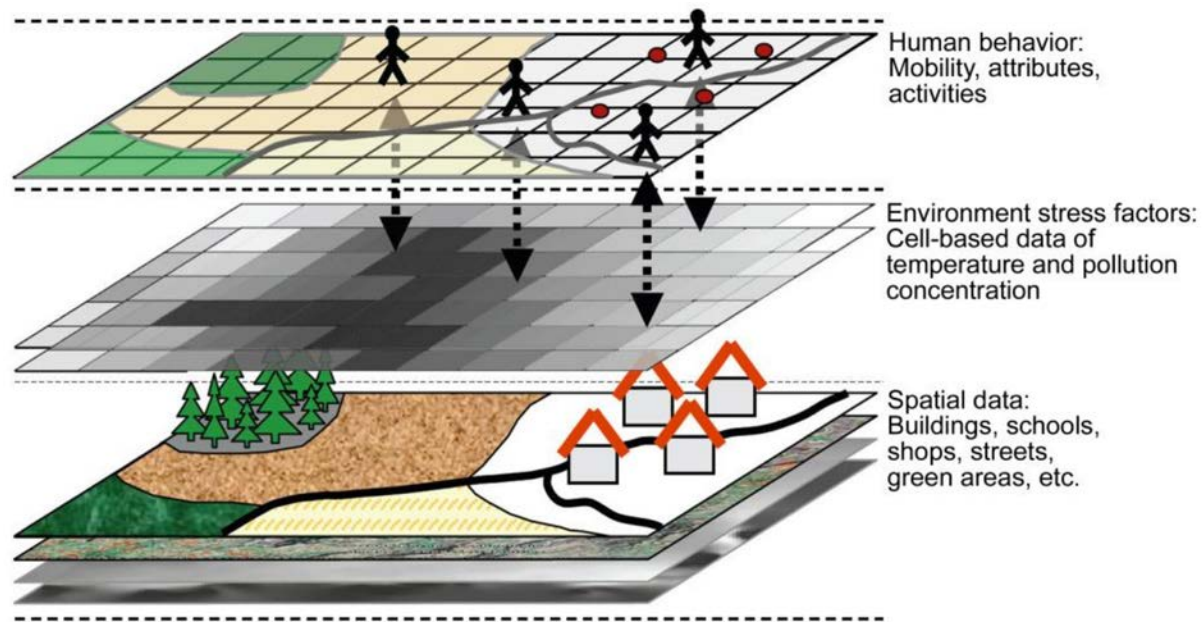
foursquare



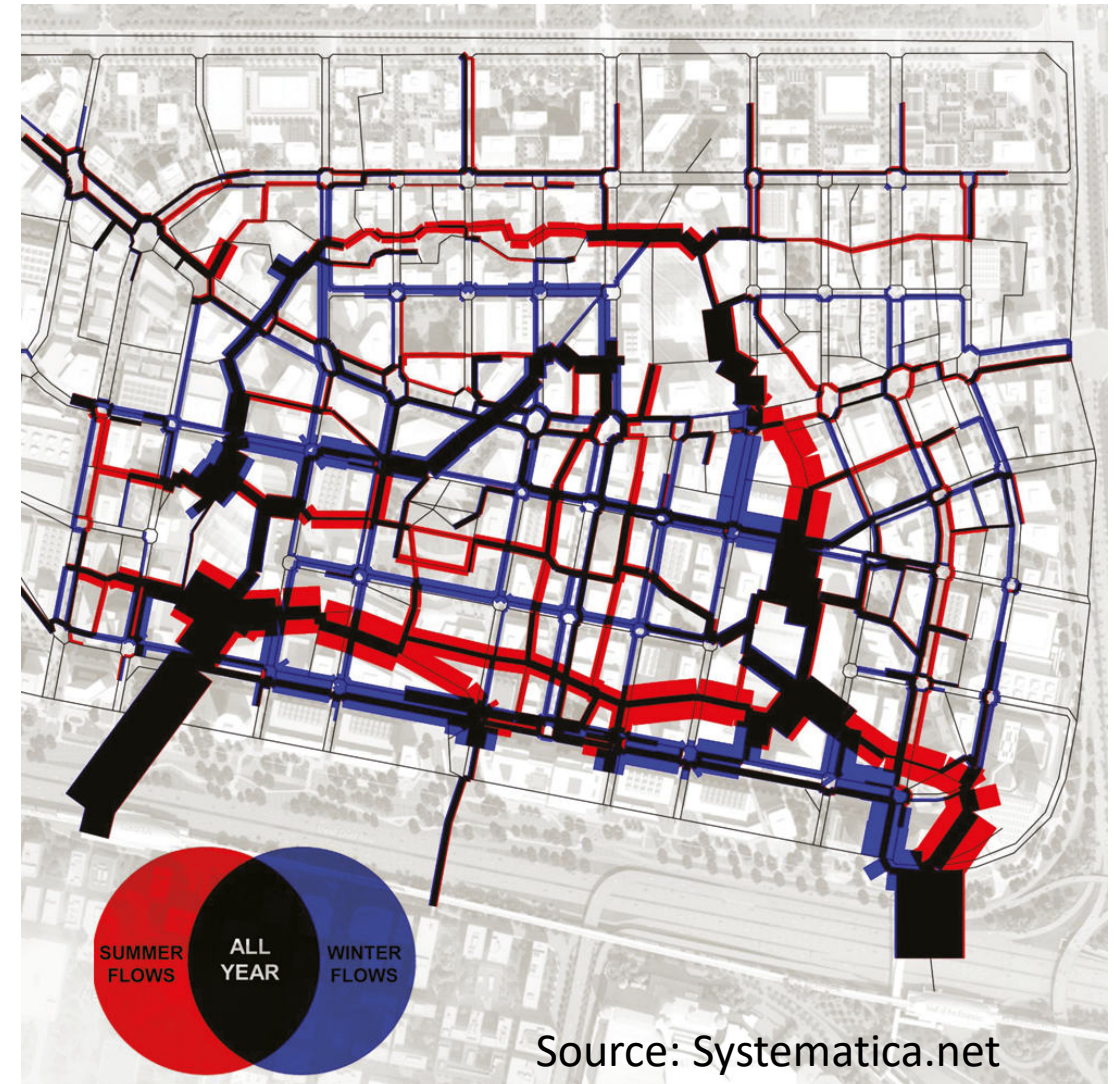
Example 1: Urban topics for classifying POIs in Foursquare



Example 2: Agent-based modeling in space: Pedestrian walkability



Source: Young, Hoffmann et al *Urban Sci.* 2018



Course outline and learning goals

Part A: Foundations of geo-spatial data analysis (week 1 - 4)

- Geodata sources
 - Reference systems and transformations; geodata quality
 - Online geodata sources
- Core concepts, geodata types, and spatial databases
- Basic geospatial transformation and analysis methods
 - Overlay and aggregation
 - Distance-based analysis
 - Spatial network analysis

Part B: Spatial Simulation and System Modeling (weeks 5 - 8)

- Field-based simulation modelling
- Agent-based simulation modelling
- Stochastic modelling & uncertainty analysis
- Model calibration & data assimilation

Course assessments

Ungraded: computer practicals (submission of results mandatory)

Graded:

1. *Short paper assignments*, criteria apply to academic research papers
2. *Written open book exam on theory*
3. *Case study report* (~4 pages), criteria for academic research papers

The case study is performed in groups on a topic of your choice (e.g. walkability) during the last two weeks of the course

The short paper assignments are individual on a topic of your choice

Questions?

Burrough, P. A., McDonnell, R., McDonnell, R. A., & Lloyd, C. D. (2015). *Principles of geographical information systems*. Oxford university press.

Chrisman, N. (1997). *Exploring geographic information systems*. Wiley.

Crooks, A., Malleson, N., Manley, E., Heppenstal, A.(2019). *Agent-Based Modelling and Geographical Information Systems: A Practical Primer*. Sage.