Quantifying the Ambient Population using Big Data and Agent-Based Modelling

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http://surf.leeds.ac.uk/

ECTQG 2017, York, 11 September 2017
Ambient population

Not (only) where people live...

But where they are throughout the day
Quantifying the ambient population

1. Simulating urban flows

2. Agent behaviour and activities

3. ABM calibration
Photos show high streets insanely crowded in rush for the last presents

Jen Mills for Metro.co.uk  Sunday 20 Dec 2015 2:52 pm

It's happened... There are just FIVE days left until Christmas and you'll
Applications

**Crime risk:** more people, more crime?

**Air pollution risk:** more people, more people affected

**Transportation:** which mode? Optimising public transport
Footfall model

- By Nick Malleson & Molly Asher
- Leeds City Centre footfall cameras
  - Counts per hour
  - Since 2007/2009
  - Publicly available [https://datamillnorth.org/](https://datamillnorth.org/)

- Aims:
  - Understand drivers
  - Predict

- Machine learning
  - Random forest algorithm

Explanatory variables:
- weather
- day of week
- time of day
- holidays / seasons
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Intensities

- Time intensity
- Background intensity

Other behavioural framework?

PECS (Schmidt, 2000; Urban, 2000)

» Physical needs
» Emotional states
» Cognition
» Social status

Differentiate for seasons / weather... (~ footfall model)
Individual agents that move around to do these activities:

- Being home
- Working
- Shopping
- Eating outside
  (Leisure)

To do...

- Households
  » Children / Schools
Intensities and activities

Activities for agent 10597

- WorkActivity
- ShopActivity
- SleepActivity
- LunchActivity

Total Intensity vs. Time

0 200 400 600 800
Time
Study area

- Leeds
- Otley
- Bradford
Locations

- Census
- OSM
Model in action…

Scala

GeoMason

Agents

Buildings
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Calibration

Agent-Based Simulation of a Social System

Data assimilation
Model state adjusted in response to new data

Model State

New data generated

New data generated

Data produced heterogeneously through real-time observational data streams (social media, mobile call data records, vehicle traffic counters, etc.)

Time
Calibration: data

Census

Footfall

Smart card

Twitter

Apps

Phones
Wifi sensors
Wifi sensors
Thank you!

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