Agent-Based Transport Simulation: Modelling Future Mobility

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41 PUBLICATIONS  149 CITATIONS

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Agent-based transport simulation
Modelling Future Mobility

Land Transport Authority
Future Mobility Symposium

Dr. Alexander Erath
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Multi Agent Transport Simulation
MATSim Singapore
Data platform architecture

Data hosted on spatial database.

Various data sets integrated and cross-referenced.

Strict separation of data and code.

All newly created code shared among project partners under GPLv2 on GitHub.

If available and relevant, Open Source Software Tools are used.
Population synthesis with Bayesian Networks

A new Bayesian Network based hierarchichal population synthesis methodology.

The new procedure allows to account for hierarchy of households and persons.

For populating a new scenario, the planner only needs to define the relevant control totals for a new zone, e.g. expected number of people by dwell type x age

Synthetic Population for MATSim Singapore

Live demo
Evaluating Future Mobility Solutions with MATSim

**Electric vehicles (EV)**
Agent-based transport simulation allows to track each vehicle’s battery level and charging state. This allows to simulate electricity demand, analyse how EV can contribute to a Smart Grid and how people might react to fluctuating energy prices.

**ERP 2**
MATSim allows to account for taste heterogeneity among travellers. Therefore it is ideally suited to evaluate different pricing strategies. Researchers at the FCL are currently developing tools that allow to identify optimal pricing strategies.

**Shared AVs**
The new technology has the potential to be a game changer for urban transport. Agent-based models are ideally tailored to evaluate the impact of autonomous cars for different stages of its market introduction, e.g.:

How different penetration rates increase road capacity? How can autonomous cars replace public transport?


Chakirov, Artem (forthcoming). ‘Urban Mobility Pricing with Heterogeneous Users’Diss., Singapore ETH Centre and Eidgenössische Technische Hochschule ETH Zürich,

MATSim applications beyond mobility

**Emission modelling**
Since MATSim is modelling individual vehicle with full temporal dynamics, it is ideally suited to be generate noise and pollution emission data. At the same time MATSim also can be used for exposure analysis. Coupled with relevant dispersion modelling tools it is a very powerful solution to test noise and vehicle emission mitigation strategies.

**Disease spreading**
Agent-based simulation is the tool of choice to model the spreading of contagious diseases. Knowing the collocation of people while traveling, working and spending leisure time, MATSim Singapore can be applied to test prevention strategies on a nation-wide scale.

**Accessibility analysis**
The basic unit of spatial analysis in MATSim Singapore is the individual building. For each building, MATSim models the number and type of activities people perform. This allows to quantify the potential for commercial activities and to assess the need for public amenities nearby.

Source: Hatzopoulou et al. (2012) Quantifying the effects of land-use and socio-economics on the generation of traffic emissions and individual exposure to air pollution at a metropolitan scale, IATBR 2101, Toronto.


The potential of data driven transport planning
Turning Big Data into Smart Data

Data → Models → Simulation → Insight
Validation

Bus speed

Transfer times

Trip duration (Bus)

Journey duration all modes

Simulating and evaluating a line split

https://vimeo.com/117976373
Reliability before and after line split

Before line split

After line split

Stop number

Time of day

Occupancy

0

128

Stop number

Time of day
The next step: engaging mobile phone data

Cell tower transaction data is a very rich data source to understand human mobility behavior, in particular in cities.

We will explore how we can use such data to make agent-transport models more scalable, responsive and accurate.
MATSim is a collaborative effort

MATSim is an open source software under active development in various universities and spin-off with model implementation around the world.

Detail documentation available at [www.matsim.org](http://www.matsim.org)

Code repository at [https://github.com/matsim-org](https://github.com/matsim-org)
Engaging Mobility @ FCL

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Thank you.

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