Wie weiter mit Verkehrsmodellen?

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Juli 2012
What do we need?
Integration of land use (optimisation)

$\Delta$Population
$\Delta$growth
$\Delta$Prices
$\Delta$Climat

Travel and land use model

Impacts and Mass flows

Space/mass optimisation

GIS$^3$

Grammars landscape
Grammars urban design
Grammars infrastructure
Regulation/laws
Sustainability

$\Delta$Population
$\Delta$growth
$\Delta$Prices
$\Delta$Climat
Thinking about equilibrium

SUE ....
(1) The journey times on all the routes actually used are equal, and less than those which would be experienced by a single vehicle on any unused route.

(2) The average journey time is a minimum.
“Activity based approach”
Key points of the critique of equilibrium approaches

- Travel is derived demand, with some exceptions
- The travellers are constrained by their commitments and mobility tool ownership
- Travellers aren’t in equilibrium
- Travellers don’t know all alternatives
- Travellers don’t plan their whole day (week) in advance
Processes suggested for personal daily dynamics

Activity repertoire (t) → Activity repertoire (t+1)

Activity calendar (t) → Activity schedule (t) → Rescheduling, Execution

Scheduling

Physiological needs
Commitments
Desires
Pending activities

Unexecuted activities

Updates, Innovations

Networks, Opportunities

Mental map (t) → Mental map (t+1)

SUE ....
Thinking about SUE and best response
Learning approach of the generic one-day transport model

Competition for slots on networks and in facilities

\[ k(t,r,j)_{i,n} \]

Mental map

Activity scheduling

\[ q_i \equiv (t,r,j)_{i,n} \]
Equilibrium search in „ABM“ & assignment combinations

Initial schedules

OD aggregation

Assignment

\[ q_i \equiv p(t,r,j)_{i,n} \]

\[ Q_{ij,t} \]

\[ k(t,r,j)_Q \]

Distribution of schedules
Equilibrium search in supernetworks

Rule-based
Initial schedules

Super-network

\( Q_{ij,t} \)

Shortest Paths & adaptation

Assignment

\( k(t,r,j)_Q \)
Equilibrium search in MATSim

Initial schedules

Simulation of flows on networks and to facilities

\[ k(t,r,j)_{i,n} \]

Score (utility) calculation

\[ U_i(t,r,j)_{i,n} \]

\[ q_i \equiv (t,r,j)_{i,n} \]

(Optimal) Replanning (inc. connection)
Stochastic user equilibrium
Daganzo and Sheffi’s (1977) define it for the aggregate case:

“In a SUE network, no user believes he can improve his travel time by unilaterally changing routes.”
In SUE for flows $q'_{rij}$

$$q'_{rij} = q'_{ij} \times P(r), \text{ for all } r, i \text{ and } j$$

$$P(r) = f(k'_{rij}(q_{rij}))$$

with a suitable

$f()$ Choice model

$k()$ definition of the generalised costs $k'_{rij}$
SUE for agent-based simulation

Flötteröd and Nagel (2009) define it:

“An agent-based SUE [. . . ] is defined as a system state where agents draw from a stationary choice distribution such that the resulting distribution of traffic conditions re-generates that choice distribution. [. . . ] It implies that every agent considers a whole choice of (possibly suboptimal) plans and selects one of these plans probabilistically.”
Meister (2011) operationalizes it as:

“...An agent-based SUE is defined as a system state where the number of agents which perceive that they can improve their state is minimized, given a dynamic environment where a constant share of all agents [continues to] change their plans”.
2.5. Equilibration with standard parameters

The value of $\text{pct}_{SUE,\text{min}}$ of 97.5% is chosen arbitrarily.

- The learning rate parameter $\alpha$ is set to 1.0—meaning that the new score of a re-evaluated plan equals the score of its most recent simulation and does not depend on its previous score values.

In addition to the variation of $\beta_{score}$—Section 2.6 studies how the agent based SUE condition is influenced by this parameter.

2.5.1 Results

The development of $\text{pct}_{SUE}$ across the iterations is depicted in the upper half of Fig. 2. The averages of the scores of the executed plans—the worst and the best plans are displayed in the lower half for the common visual inspection.

At different numbers of iterations—$\text{pct}_{SUE}$ exceeds $\text{pct}_{SUE,\text{min}}$ for the various strategies—and for all agents combined:

- $\text{pct}_{SUE,\text{all}}$ denotes the percentage of all agents combined for which the SUE condition is fulfilled.
- $\text{pct}_{SUE,\text{select}}$ denotes this percentage of those agents who selected one of their existing plans according to Eq. 0.2.
- $\text{pct}_{SUE,\text{router}}$ and $\text{pct}_{SUE,\text{tam}}$ denote the percentages of those agents who generated the plan via replanning with the router or the time allocation mutator.

In the following a closer look is taken at the iterations in which each of the $\text{pct}_{SUE,*}$ exceeds $\text{pct}_{SUE,\text{min}}$. In the cases of all percentages except $\text{pct}_{SUE,\text{all}}$—the interpretation...
MATSim today
MATSim: A GNU public licence software project

Main partners
- TU Berlin (Prof. Nagel)
- ETH Zürich and FCL Singapore
- senezon (Dr. Balmer, Rieser)

Coordination via:
- User meeting
- Developer meeting

Help for new users
- Tutorials
- www.matsim.org
Activity scheduling with Vickrey-style utility function

Number and type of activities
Sequence of activities

- Start and duration of activity
- Composition of the group undertaking the activity
- Expenditure division
- Location of the activity

- Movement between sequential locations
  - Location of access and egress from the mean of transport
    - Parking type
  - Vehicle/means of transport
  - Route/service
  - Group travelling together
  - Expenditure division
Current Vickrey-type utility function

\[ U_{plan} = \sum_{i=1}^{n} U_{act,i} + \sum_{i=2}^{n} U_{trav,i-1,i} \]

\[ U_{act,i} = U_{dur,i} + U_{late.ar,i} \]
**MATSim framework:**

- **Demand**
  - Facilities
  - Initial demand
  - Special Matrices

- **Supply**
  - Network
  - PT schedule
  - Turning restric.
  - Capacities
  - ERP
  - Traffic lights

- Executive flow:
  - Execution
  - Scoring
  - Replanning

- Additional elements:
  - Plan scoring model
  - HITS

- Relaxed state
Network node matching tool
Simulation: MATSim 1.0 demand on MATSim 2.0 network
Thinking about SUE (2)
Basics: Traffic DUE and SUE

- Search or add a shortest path to the set of paths considered
- Allocate flows among the set of paths considered
- Check if chosen convergence criterion is met
Basics: Traffic DUE and SUE

- Search or add a shortest path *given the current generalised cost estimate* to the set of paths considered
- Allocate flows among the the set of paths considered
- Check if chosen convergence criterion is met
Basics: ABM scheduling SUE

• Enumerate all possible schedules
• Allocate flows randomly among the set of schedules
• Execute the schedules without within-day replanning
• Check if chosen convergence criterion is met
Basics: ABM scheduling SUE

- Construct all schedules considered relevant
- Allocate flows randomly among the set of schedules
- Execute the schedules without within-day replanning
- Check if chosen convergence criterion is met
Activity scheduling with some **best response** modules

- Number and type of activities
- Sequence of activities

  - Start and duration of activity
  - Composition of the group undertaking the activity
  - Expenditure division
  - Location of the activity

- Movement between sequential locations

  - Location of access and egress from the mean of transport
    - Parking type and location
  - Vehicle/means of transport
  - Route/service
  - Group travelling together
  - Expenditure division
Scheduling SUE with MATSim (tomorrow)

• For all agents:
  • Find dissatisfied agent
  • Construct a best schedule **given the current generalised cost estimate and agent specific tastes** to add to the set of schedules already considered.
  • Rescore existing schedules
  • Select best schedule

• Execute schedule with congestion feedback

• Check if convergence criterion is met
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Questions?

- www.matsim.org
- www.ivt.ethz.ch