Microsimulating Choices of Different Agent Types: Shoppers and Retailers

A. Horni and F. Ciari

INTRODUCTION

MATSim – A Co-Evolutionary Algorithm

- Agents iteratively replan their daily schedules until system reaches relaxed state. Choice dimensions: time, route and destination choice.
- Movement is microsimulated (execution)
- Utility function $U = U_{\text{travel}} + U_{\text{activity performing}}$ with $U = V + \epsilon$ (discrete choice framework) used for scoring.

Shoppers’ Destination Choice [1]

<table>
<thead>
<tr>
<th>choice = max $U$ on the fly re-generation of $\epsilon_{pq}$ with p: person q: alternative</th>
</tr>
</thead>
</table>

Retailers’ Location Choice [2]

- Market support analysis
- Max. accessibility for potential customers

$$\min \sum_{n} \frac{m \sum{l c_{ik}}}{m}$$

c = generalized costs

Transport System Equilibrium

- Central to transport planning and economics
- Costs are not fully determined thus they are subject to choice uncertainty

DISCUSSION

Approximate Calculation of Travel Times

- $\text{err}_{\text{tot}} = W_0 \text{err}_{\beta} + W_1 \text{err}_{\gamma} + W_2 \text{err}_{\beta\gamma}$
- If $(W_0 = \text{small}) \rightarrow \text{tt can be approximated}$
- Equilibrium concept is approximate itself

Existence, Uniqueness and Stability of Equilibrium

- Microsimulations are a sampling tool [3]. Drawing from error terms of utility function $\rightarrow$ results are distributions and have to be given together with measures of spread.
- What does existence, uniqueness and stability mean in this stochastic setting?
- No tools available yet for microsimulations (as for aggregate models).

Behavioral Basis of Equilibrium

- Is equilibrium ever achieved under uncertainty (changing environment)?
  - count data show large temporal variability
  - few empirical data

- Path from non-equilibrium to equilibrium states often not modeled with behavioral models.

Combined Equilibrium: Normative or Behavioral Model?

- Iteratively find a point where shopping location (for shoppers) and store location (for retailers) are stable.
- The two processes have different time scales, their representation in the simulation is therefore problematic $\rightarrow$ what does the combined equilibrium represent?
- How to model retailer location choice heuristics?

PROBLEM

Computation Times

Goal: Switzerland overnight run (7.5 M agents)
Now: 2 Days for Zurich region (70 K agents) x retailer location choice → very slow!

Foundation and Attributes of (Combined) Equilibrium

Few conceptual and empirical knowledge about transport microsimulation equilibrium/equilibria

REFERENCES

