Improving convergence of quasi dynamic assignment models - poster

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Improving convergence of quasi dynamic assignment models

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Research objective

For application in a strategic context, assignment models need to converge to a stable state. Besides poor convergence, dynamic models lack the tractability, scalability and low input and computational requirements that are needed in this context. Therefore, in this research we use the quasi dynamic assignment model STAQ, that combines tractability, scalability and low input and computational requirements of static with the realism of dynamic models and try to improve its rate of convergence.

Methods used

Network Loading Model: STAQ

<table>
<thead>
<tr>
<th>Static</th>
<th>STAQ 1st order DTA</th>
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<tbody>
<tr>
<td>Link model: Travel time function</td>
<td>Fundamental diagram</td>
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<tr>
<td>Node model: None</td>
<td>Explicit node model</td>
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<tr>
<td>Demand: Stationary</td>
<td>Time varying</td>
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<td>Time periods: Single</td>
<td>Multiple</td>
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Route Choice Model: Multinomial Logit

Convergence Metric: Stochastic Duality Gap

Straightforward extension of deterministic duality gap, but will go to 0 when using MNL route choice model

Tested averaging schemes:

MSA: method of successive averages (1/i)
SRA: Self regulating average (Liu et al 2009)

Stepsizes: MSA vs SRA

Diverging iterations: decrease stepsize
Converging iterations: maintain stepsize

Proposed enhancements:

SRA od specific
SRA normalize mu based on maxcost:

Mu per OD pair: normalization (max vs min cost)

Results

Test networks:

Independent network:

Dependent network:

Spillback network:

Dependent network:

Convergence:

Gaps MSA vs SRA (test networks)

Gaps enhanced methods (test networks)

Realistic Network:

Den Bosch / Oss region (PM peak)

148 zones, 7005 nodes, 15200 links, 25000 routes

Conclusions

Capacity and storage constraints may cause route cost functions to become:
1. over-sensitive causing an 'instable phase' during the first iterations;
2. strongly inseparable when sharing (spillback from) a bottleneck.
Both properties are also existent in pure DTA models and lead to poor convergence.
Ad 1: SRA outperforms MSA, but only when higher precision user equilibrium is needed. For lower precision the 'instable phase' needs to be shortened, which can be done by normalizing the scale factor of the route choice model to the largest route cost.
Ad 2: SRA-ODspecific outperforms SRA, but only when inseparability of routes is taken into account: OD pairs should be clustered based on level of inseparability.
High precision (DG<1E-05) is not needed for strategic application (finding is in line with literature on static traffic assignment models, i.e.: Boyce, Ralevic and Bar Gera 2004).