DECISION SUPPORT SYSTEM FOR VARIABLE SPEED REGULATION

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VARIABLE SPEED REGULATION

Installed in Sweden at 20 roads

Results are:

• Less accidents
• Lower speeds
• Improved accessibility
VARIABLE SPEED REGULATION IN SWEDEN

Traffic situations addressed are:
• Intersections
• Dense traffic and cue's
• Unprotected Traficant's
• Dangerous road conditions
VARIABLE SPEED REGULATION RESULTS

- Traficant’s have better compliance of variable speed limits compared to fixed speed limits
- Low variable speed limits are well accepted
- 70% to 90% states that the system is reliable
- 80% states that they are more observant of road conditions when variable speed limits are in use

Swedish transport administration publication 2008:14
WHY THE NEED OF IMPROVED VARIABLE SPEED LIMIT SYSTEMS

Current systems:
• Implements a road weather model, that uses neighboring monitoring stations

Proposed system:
• Utilize probability functions for certain events

Advantages:
• Uncertainties are taken into consideration
• Smooth speed update
A Dynamic Bayesian Network for variable speed limits
INITIAL CONDITIONS

Initial probabilities at t=1 for intermediate nodes

Frost at t=1

<table>
<thead>
<tr>
<th>Area</th>
<th>Friction</th>
<th>Norrland</th>
<th>Gotaland</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>True</td>
<td>0.8</td>
<td>0.3</td>
<td>0.6</td>
</tr>
<tr>
<td>False</td>
<td>0.2</td>
<td>0.7</td>
<td>0.4</td>
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</tbody>
</table>

Ice at t=1

<table>
<thead>
<tr>
<th>Area</th>
<th>Friction</th>
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<th>Gotaland</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>True</td>
<td>0.9</td>
<td>0.4</td>
<td>0.6</td>
</tr>
<tr>
<td>False</td>
<td>0.1</td>
<td>0.6</td>
<td>0.4</td>
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Traffic at t=1

<table>
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<tr>
<th>[Self] [t-1]</th>
<th>Dense</th>
<th>Sparse</th>
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</thead>
<tbody>
<tr>
<td>True</td>
<td>0.4</td>
<td>0.2</td>
</tr>
<tr>
<td>False</td>
<td>0.6</td>
<td>0.8</td>
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</table>
Evidence nodes

Figure 6. Evidence for the road temperature sensor node *RoadTemp*.

Figure 7. Evidence for the traffic intensity observation node *Traffic*.

Figure 4. Evidence for the humidity sensor node *Humid*.

Figure 5. Evidence for the precipitation sensor node *Precip*.

Figure 2. Evidence for the air temperature sensor node *AirTemp*.

Figure 3. Evidence for the de-icing observation node *Deicing*.

Intermediate nodes

Figure 8. Intermediate probability trajectories from the chance node *Frost*.

Figure 9. Intermediate probability trajectories from the chance node *Ice*.

Figure 10. Intermediate probability trajectories from the chance node *Friction*.
RESULTING SPEED LIMIT RECOMMENDATION

A smooth speed regulation recommendation

Uncertainties are taken in consideration
FUTURE WORK

• Use weather models and forecasts in Dynamic Bayesian Network
• Integrate DBN in existing weather controlled models
• Perform field tests
• Evaluate DBN influence of performance increase in variable speed limit systems
THANK YOU FOR YOUR ATTENTION

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