Active Agent Based Approaches to Automated Generalisation

Kelvin Haire

(KelvinH@lsl.co.uk), Laser-Scan Ltd, Cambridge, UK.

August 2001
KMS Denmark

- Requirement is 1:50K mapping from 1:10K database.
- Using a mixture of ‘procedural’ process methods and Agent based process methods.
- Using Agents to generalise buildings.
- Production in 2001.
KMS - Urban Areas
Urban Areas

- Pre-processing removes unwanted buildings.
- A process method run on each urban area will:
  - Construct a meso-agent to control the urban area.
  - Initialise each building as a micro-agent.
  - Trigger the meso-agent.
  - Destroy the meso-agent.
- The constraints determine that:
  - Buildings are deleted, symbolised, scaled or simplified.
  - Buildings must not overlap one another or nearby roads, and must remain inside their meso-controlled area.
  - Buildings can be displaced, deleted or aggregated.
KMS - Rural Areas
Rural areas

- Pre-processing partitions the rural areas and identifies farms.
- A process method run on each partition area will:
  - Identify clusters of rural buildings and buildings belonging to farms.
  - Construct a meso-agent to control each farm or rural cluster.
  - Initialise each of the individual buildings as micro-agents
  - Construct a high-level meso-agent to control the entire rural area.
  - Trigger the high-level meso-agent.
  - Destroy the meso-agents.
- The constraints determine that:
  - Individual buildings are deleted, symbolised, scaled or simplified.
  - Building do not overlap each other or nearby roads.
  - Buildings within a farm retain their relative positions.
  - Individual farms or rural clusters do not overlap.
  - Buildings can be displaced, deleted or aggregated.
Different Possible Approaches

<table>
<thead>
<tr>
<th>Polygon scaling</th>
<th>Change elongation</th>
<th>Enlarge to rectangle</th>
<th>Simplify</th>
<th>Simplify to rectangle</th>
<th>Enlarge width</th>
<th>Rotate</th>
<th>Squaring</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Polygon scaling" /></td>
<td><img src="image2" alt="Change elongation" /></td>
<td><img src="image3" alt="Enlarge to rectangle" /></td>
<td><img src="image4" alt="Simplify" /></td>
<td><img src="image5" alt="Simplify to rectangle" /></td>
<td><img src="image6" alt="Enlarge width" /></td>
<td><img src="image7" alt="Rotate" /></td>
<td><img src="image8" alt="Squaring" /></td>
</tr>
<tr>
<td><img src="image1" alt="Polygon scaling" /></td>
<td><img src="image2" alt="Change elongation" /></td>
<td><img src="image3" alt="Enlarge to rectangle" /></td>
<td><img src="image4" alt="Simplify" /></td>
<td><img src="image5" alt="Simplify to rectangle" /></td>
<td><img src="image6" alt="Enlarge width" /></td>
<td><img src="image7" alt="Rotate" /></td>
<td><img src="image8" alt="Squaring" /></td>
</tr>
<tr>
<td><img src="image1" alt="Polygon scaling" /></td>
<td><img src="image2" alt="Change elongation" /></td>
<td><img src="image3" alt="Enlarge to rectangle" /></td>
<td><img src="image4" alt="Simplify" /></td>
<td><img src="image5" alt="Simplify to rectangle" /></td>
<td><img src="image6" alt="Enlarge width" /></td>
<td><img src="image7" alt="Rotate" /></td>
<td><img src="image8" alt="Squaring" /></td>
</tr>
</tbody>
</table>
Meso-agents (Districts) and Micro-agents (Buildings)
Agents for Generalisation

• Behaviour is implemented as methods:
  – Measures characterise the situation
    • width, area, distance, shape, orientation
  – Constraints act as goals
    • Within object (self-intersection, minimum size).
    • Between objects (overlap conflicts, continuity).
  – Algorithms are tools to improve happiness
    • squaring, enlarging, filtering, typifying, displacing

• Loop through sequence:
  – Characterise, Propose, Act, Assess, (Keep?)
Process Methods

• Special methods used for ‘batch’ type processing of objects satisfying certain criteria.
• Use baseclasses inherited by the objects.
• Useful for generalisation.
• Several can be placed together in a sequence.
P2 Detailed view (cycling)

GI:JE Display Applet (AGENT Generalisation Demonstration)
P2 Ungeneralised view

GI:JE Display Applet (AGENT Generalisation Demonstration)
P2 Generalised view (Driving)

GI:JE Display Applet (AGENT Generalisation Demonstration)
P2 Zoomed view (Driving)

GI:JE Display Applet (AGENT Generalisation Demonstration)
CamMap

- Building generalisation as zoom
  - Switch to pre-prepared alternative
  - Simplified outlines of buildings

Zoomed in - Based on OS Landline

Zoomed out - Based on OS 10K Raster
Conclusions

• Active Agents allow complex contextual generalisation operations to be automated.
• Agents can be incorporated into a system along with other procedural operations.
• Process methods allow large data sets to be generalised using a mixture of procedural and Agent based approaches.
• Display methods allow generalisation results to be displayed according to scale.