Interactive Example-based Hatching

Moritz Gerl and Tobias Isenberg

Expressive 2013 Journal Talks

credits: Moritz Gerl
Motivation

[Hertzmann and Zorin, 2000]
Motivation

[Roessler and Kobbelt, 2000]
Motivation

[Zander et al., 2004]
Motivation

[Zander et al., 2004]
Example-based Hatching
Input to Learning
Input to Learning
Input to Learning
Input to Learning
Input to Learning
Learning Regions
Learning Regions
Learning Regions
Example Features (18 in total)
Example Features (18 in total)

ambient occlusion
Example Features (18 in total)
Example Features (18 in total)
Example Features (18 in total)
Example Features (18 in total)
Training the Classifier

(Relevance Vector Machines, one-vs-one strategy for voting and Radial Basis Function Kernels)
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Training the Classifier

(Relevance Vector Machines, one-vs-one strategy for voting and Radial Basis Function Kernels)
Regions — Synthesis
Learning Directions: Stroke Detection
Learning Directions: Stroke Detection
Learning Directions: Stroke Projection
Learning Directions: Stroke Projection
Learning Directions: Stroke Projection
Learning Directions: Stroke Projection
Learning Directions: Stroke Projection
Learning Directions: Derive Direction Field
Learning Directions: Derive Direction Field
Learning Directions: Learn Function

(Kernel Ridge Regression using Radial Basis Function Kernels)
Learning Directions: Learn Function

(Kernel Ridge Regression using Radial Basis Function Kernels)
Learning Directions: Learn Function

(Kernel Ridge Regression using Radial Basis Function Kernels)
Learning Directions: Learn Function

(Kernel Ridge Regression using Radial Basis Function Kernels)
Directions — Synthesis
Distances — Learning
Distances — Learning
Distances — Learning
Distances — Learning

(Kernel Ridge Regression using Radial Basis Function Kernels)
Distances – Learning

(Kernel Ridge Regression using Radial Basis Function Kernels)
Distances — Synthesis
Distances – Synthesis
Stroke Rendering
Stroke Rendering
Stroke Rendering
Stroke Rendering
Stroke Rendering
Stroke Rendering
Stroke Rendering
Stroke Rendering
Stroke Rendering
Stroke Rendering
Stroke Rendering
Stroke Rendering
Stroke Rendering
Synthesis - Summary
Synthesis - Summary
Synthesis - Summary
Synthesis - Summary
Automatic vs. Semi-automatic
Automatic vs. Semi-automatic

fully automatic
Automatic vs. Semi-automatic

fully automatic  

semi-automatic, human input
Automatic vs. Semi-automatic
Automatic vs. Semi-automatic

fully automatic
Automatic vs. Semi-automatic

[Diagram showing two different shapes, labeled as fully automatic and semi-automatic, human input]
Interaction

interaction
results
different example
Results

see two hq examples in the Expressive Visual Showcase
Animation
Limitations

- Fully automatic style transfer is inaccurate
- Interaction is required
- Interaction time of 5–10 hours

→ improve machine learning
Ideas for Improvement

- Use a larger set of features
- Use more advanced machine learning methods
- Use more examples for learning
- Extend interaction capabilities
Comparison to [Kalogerakis et al. 2012]

"Learning Hatching for Pen-and-Ink Illustration of Surfaces"
## Comparison to [Kalogerakis et al. 2012]

<table>
<thead>
<tr>
<th>our technique</th>
<th>[Kalogerakis et al. 2012]</th>
</tr>
</thead>
<tbody>
<tr>
<td>analytic representations of drawing elements</td>
<td>pixel-based</td>
</tr>
<tr>
<td>interactive</td>
<td>static result</td>
</tr>
<tr>
<td>faster synthesis (20 sec)</td>
<td>slower synthesis (30 min)</td>
</tr>
</tbody>
</table>
Comparison to [Kalogerakis et al. 2012]

<table>
<thead>
<tr>
<th>our technique</th>
<th>[Kalogerakis et al. 2012]</th>
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<tbody>
<tr>
<td>less accurate style transfer</td>
<td>accurate style transfer</td>
</tr>
<tr>
<td>limited # of features (18)</td>
<td>many features (1204)</td>
</tr>
<tr>
<td>fixed viewpoint</td>
<td>arbitrary viewpoint</td>
</tr>
<tr>
<td>interactive input possible</td>
<td>automatic</td>
</tr>
</tbody>
</table>
Conclusion

- Combine interactive and example-based functionalities
- Twofold influence of human virtuosity on the rendering result (interactive and through the examples)

→ improvement of aesthetic quality
Conclusion

- Learning and reproduction of a complex drawing style
- Improved automatic style transfer would be beneficial
- Interactivity is attractive for creatives as well as for people with no background in hatching
thanks – questions?

http://tobias.isenberg.cc/VideosAndDemos/Gerl2013IEH