Artistic Vision: Painterly Rendering Using Computer Vision Techniques

By Bruce Gooch, Greg Coombe and Peter Shirley
NPAR 2002

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Organization

- **GOAL**
- Introduction
- Algorithm
- Results
- User-control
- Vision techniques
- Future work

GOAL

- To produce a painting like image composed of strokes

Key Point: Economy of Brush Strokes.

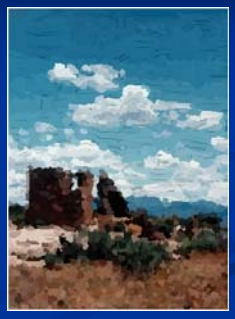

Fig 1: Bruce et al.

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Introduction

Two basic approaches to painting:

1. Low Level – Simulate the characteristics of artistic medium. E.g. gravity, fluid flow, diffusion.
2. High Level – Simulates the artistic process. e.g Haeberli, Litwinowicz.

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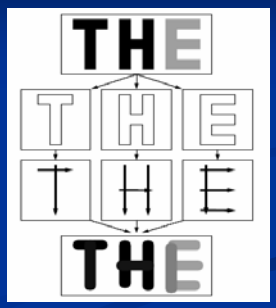
Algorithm

- Segment an image
- Decompose the segments into brush strokes.
- Render brush strokes.



Algorithm

- **Segmentation & Smoothing**
- Medial Axis Computation
  - Distance Transform
  - Thinning Algorithm
- Form Tokens
- Group Tokens
  - Moments
  - Search Cones

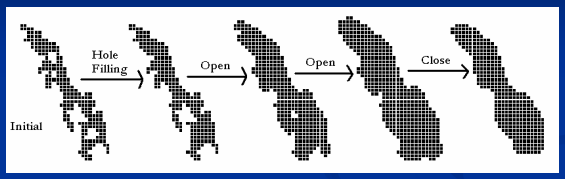
Segmentation

- Region based Segmentation – Grouping neighboring pixels of similar intensity.

12 levels

72 levels

Smoothing



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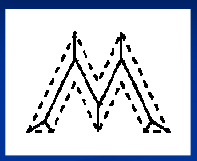
Medial Axis Computation

- Medial Axis can be thought as the "skeleton" of an object.
- Gives Scale and rotation invariance.



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Distance Transform

Source [1]

This gives us a set of points which are farthest from the boundary.

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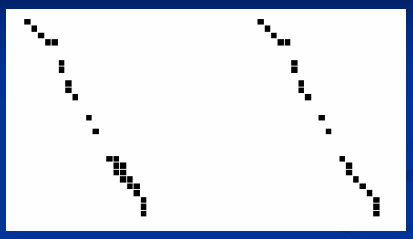
Thinning Algorithm

Source [1]



- Makes sure every pixel has at most 3 neighbors.

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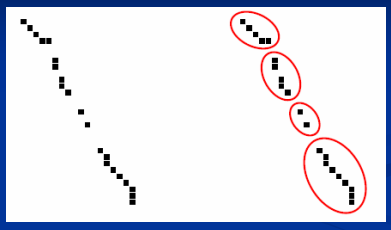
Form Tokens



Source [1]

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Grouping Tokens - Moments

Source [1]

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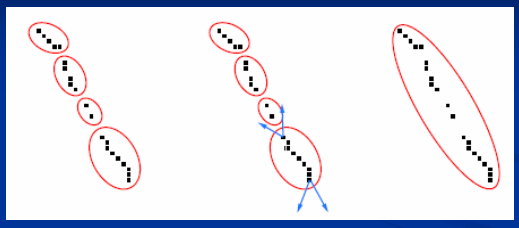
Grouping Tokens – Search Cones



Source [1]

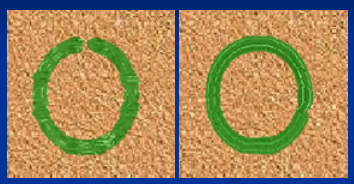
Brush Stroke

Filbert Brush

→ Taper-on - Circular
→Taper-off - parabolic

Source [1]

Stroke Grouping



63 Strokes 1 Stroke

Source [2]

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Results

Source [2]

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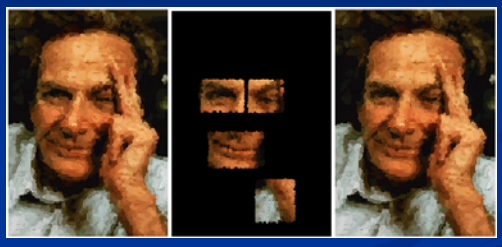
What can user control?

- Segmentation levels
- **Enhancement levels**
- Brush Artifact levels
- Under-painting and Alpha Blending

User Directed Enhancement



Source [1]

What can user control?

- Segmentation levels
- Enhancement levels
- **Brush Artifact levels**
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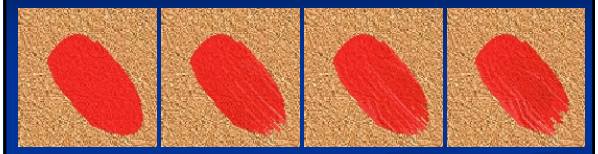
Brush Artifacts



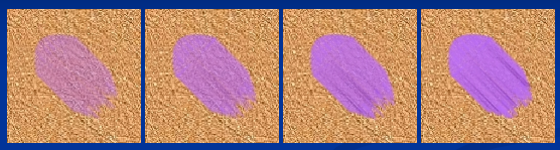
10 percent | 40 percent | 70 percent | 100 percent

Source [2]

What can user control?

- Segmentation levels
- Enhancement levels
- Brush Artifact levels
- **Under-painting and Alpha Blending**

Under-painting and Alpha Blending



Alpha 15 | Alpha 25 | Alpha 35 | Alpha 45

Source [2]

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Computer Vision Techniques

- The goal of Computer vision is to process images acquired with cameras in order to produce a representation of objects in the world.
- Authors use depth from Stereo

Using Depth

3D - Model

Depth Map

Painting w/o Depth Map

Painting with Depth Map

Source [1]

Another Depth Example

3D - Model

Depth Map

Painting w/o Depth Map

Painting with Depth Map

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Future Work

- Artistic Techniques.
- Extend to animated sequences.
- Use better segmentation.
- Better computation of medial axis.

Painting by Rabinowitz [3]

References

- [1] "Artistic Vision: Painterly Rendering Using Computer Vision Techniques", Bruce Gooch, Greg Coombe and Peter Shirley. NPAR 2002
- [2] http://www.cs.utah.edu/npr/ArtisticVision
- [3] http://www.newyorkartists.net/Rabinowitz/Paintings.html
- [4] http://homepages.inf.ed.ac.uk/rbf/HIPR2/skeleton.htm

Questions?