Graphics Courses this Spring

- 15-505: Animation Art and Technology, Hodgins/Duesing
- 15-493: Computer Game Programming, Hodgins/??? (lead developer on a game)

Texture Synthesis

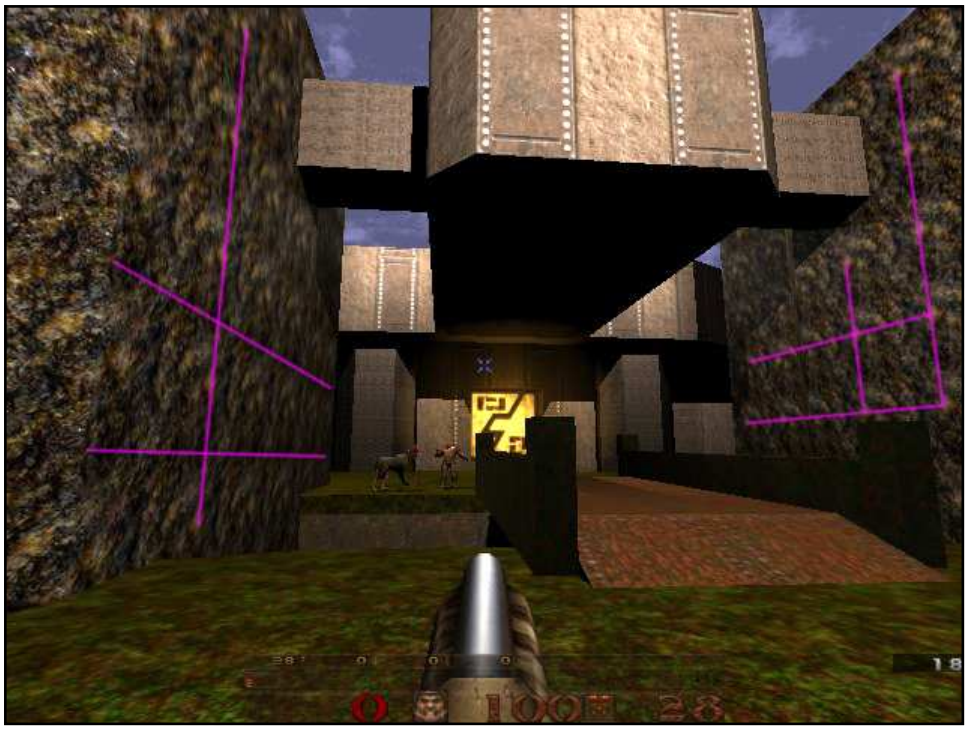
Thanks to James Hays

Problem Statement


23
100
92


3:12
SPECTATOR

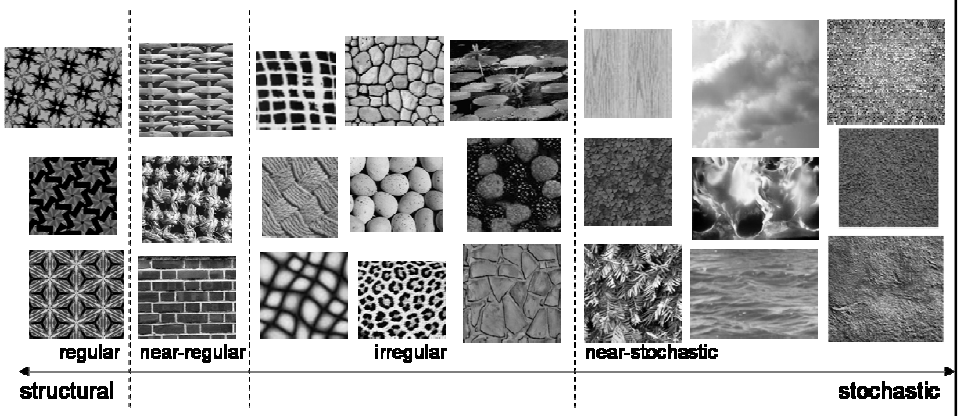

SEUL** connected
3:12
SPECTATOR



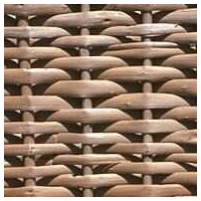
Problem Statement

- No easy fix
- Limited by texture memory and artist man hours

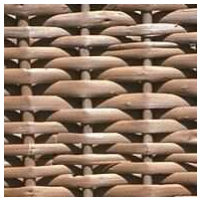
Texture Spectrum

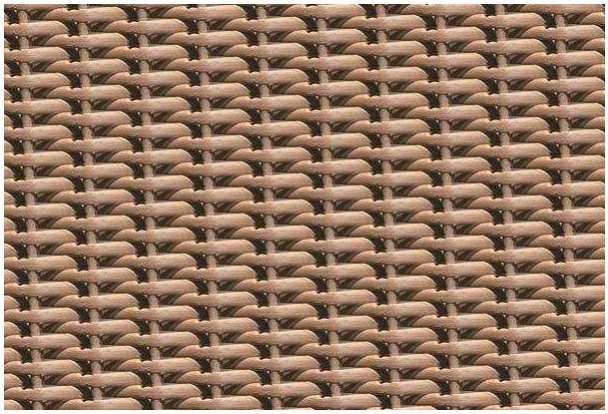


Real world texture



Tiling





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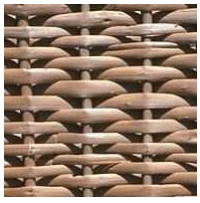
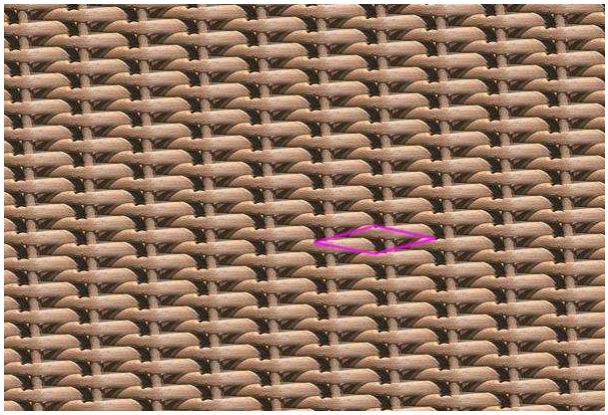
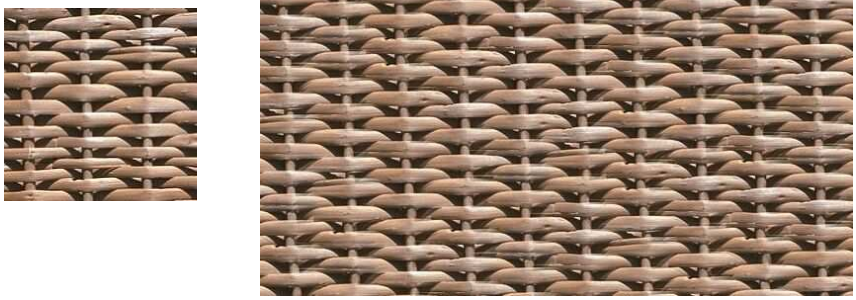
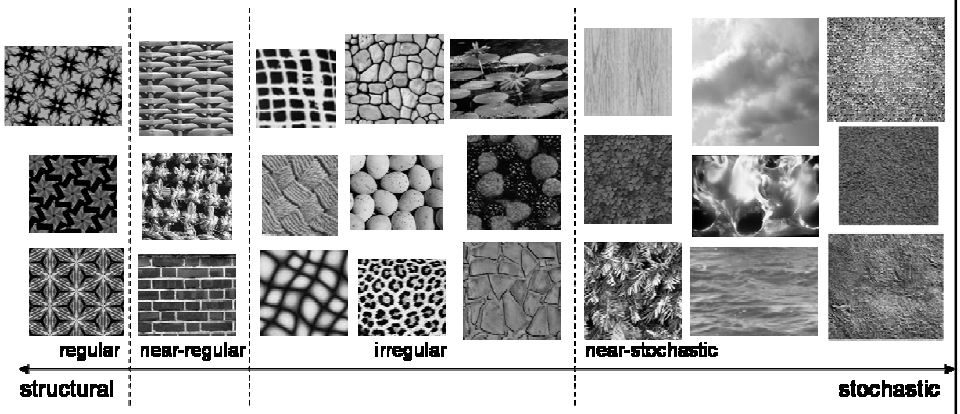




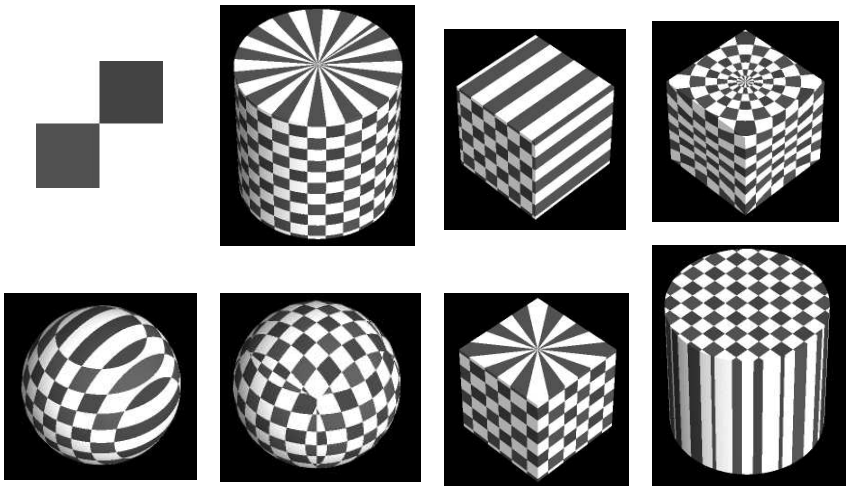
Texture Synthesis Result

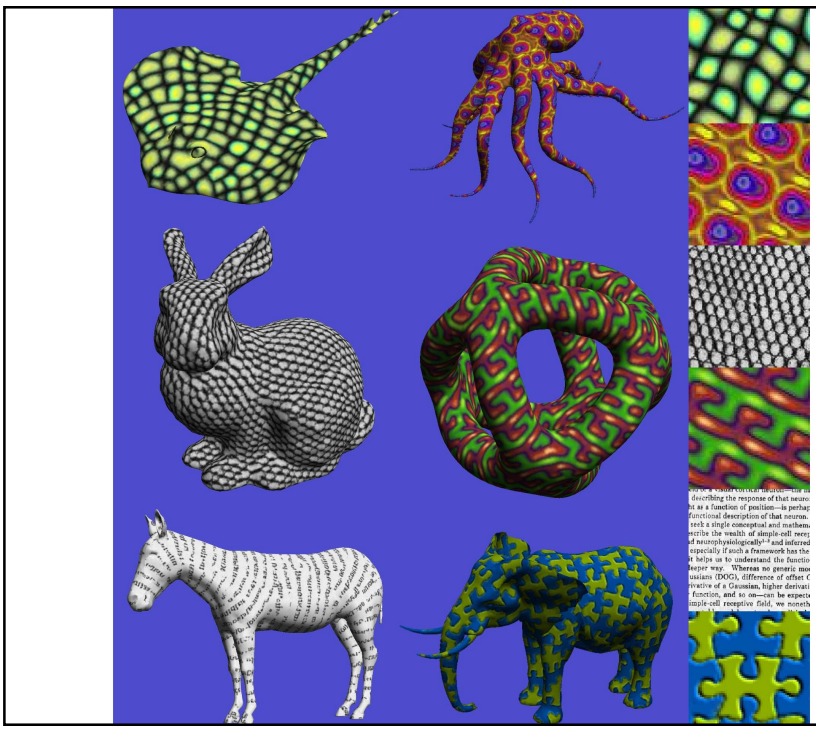


Texture Spectrum



Another Justification



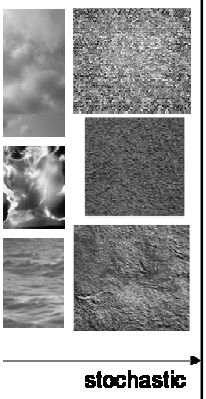



(a)
(b)
(c)
(d)
(e)

Approaches

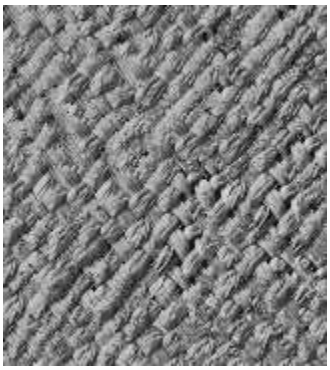
- First approach – toy with some noise image until it matches the statistics of the input image.

Texture Spectrum

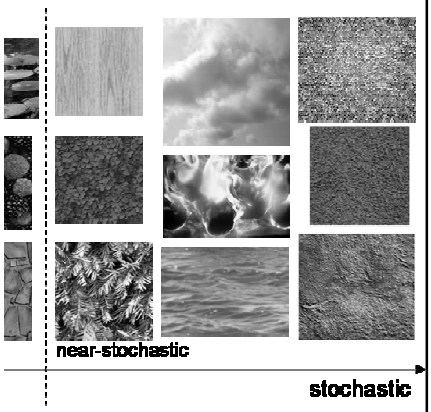


Approaches

- Newer approach – Copy pixels directly from the input. Search instead of model.



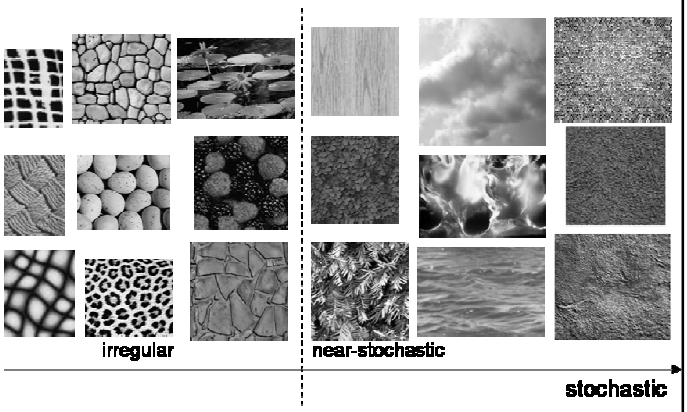
Texture Spectrum



Approaches

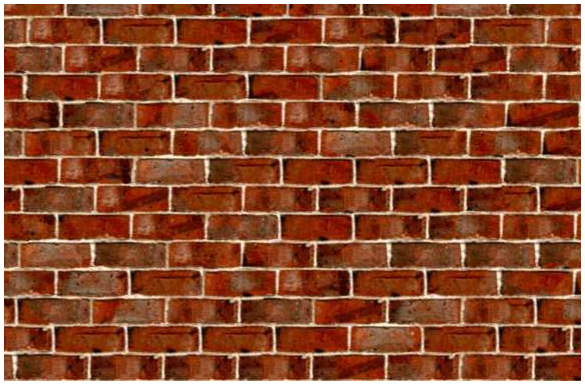
- Newest approach – Copy patches directly from the input and worry about stitching them together

Texture Spectrum

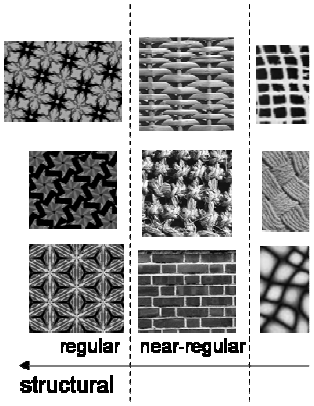


Approaches

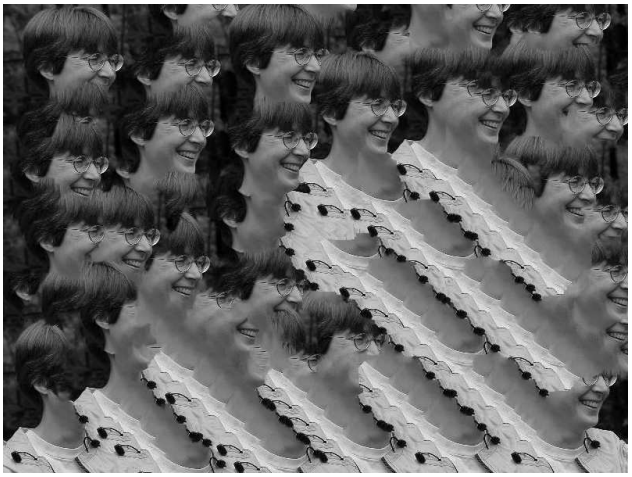
- Newest approach – Copy patches directly from the input and worry about stitching them together while enforcing periodicity.



Texture Spectrum



Limitations



Neighborhood Based Methods

- This is what you will be implementing for homework 4.

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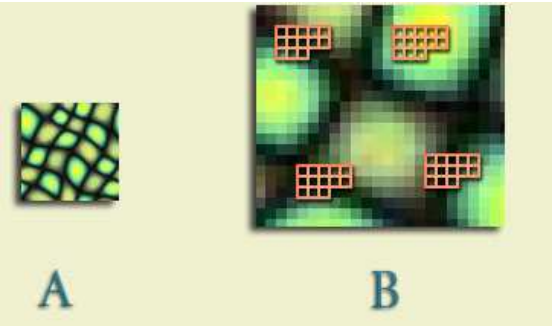

Neighborhood Based Methods

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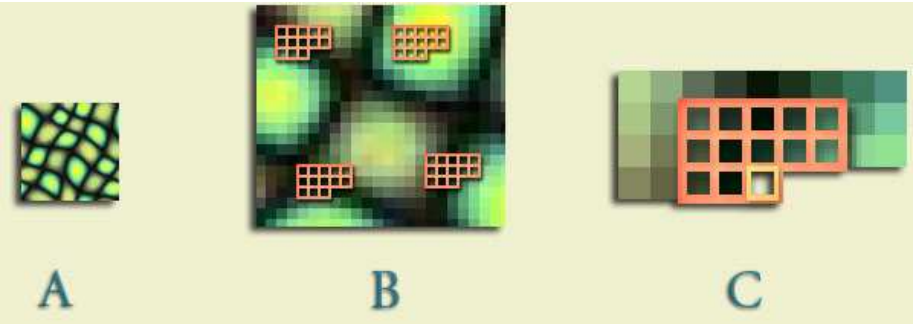


Neighborhood Based Methods

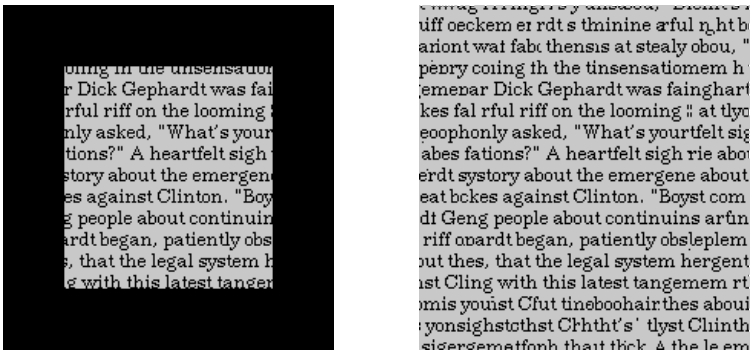
- There is one significant parameter

Neighborhood Based Methods

- Several meaningful extensions
  - Hole filling
  - Coherence Parameter
  - Targeted Synthesis
  - Multiresolution Synthesis
  - Analogy Based Synthesis
  - Acceleration
  - Your Brilliant Idea

Neighborhood Based Methods

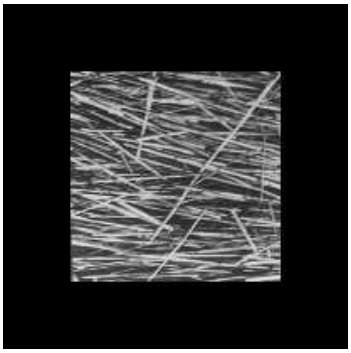
- Hole filling

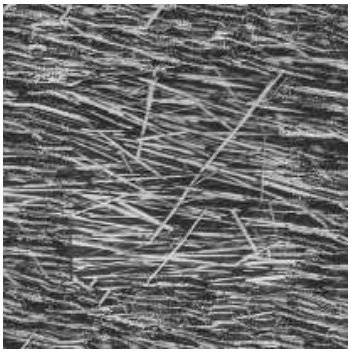


Efros and Leung, ‘99

Neighborhood Based Methods

- Hole filling





Efros and Leung, ‘99

Neighborhood Based Methods

- Coherence Parameter

With C.P.

Without

With C.P.

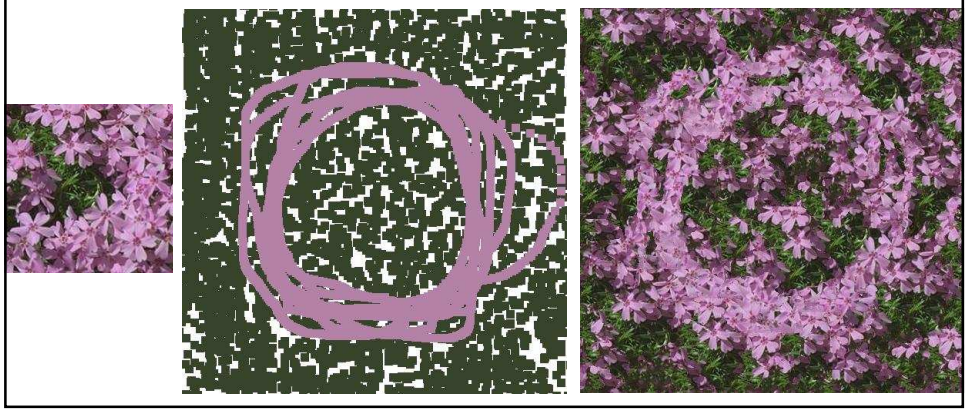
Without

Ashikhmin, 2001

Neighborhood Based Methods

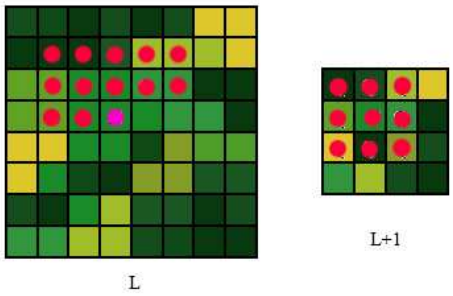
- Coherence Parameter
  - Targeted Synthesis

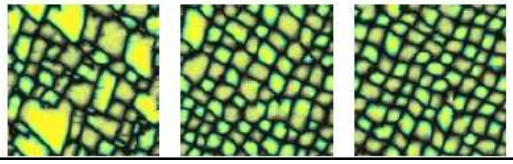
Ashikhmin, 2001



Neighborhood Based Methods

- Multiresolution Synthesis





Wei and Levoy, 2000

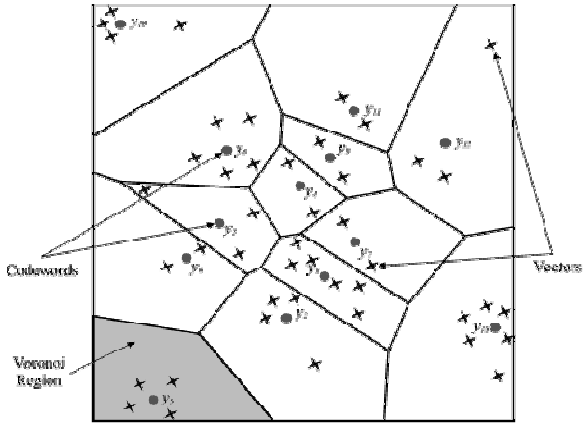
Neighborhood Based Methods

- Analogy Based Synthesis

Hertzmann, Jacobs, Oliver, Curless, and Salesin, 2001.

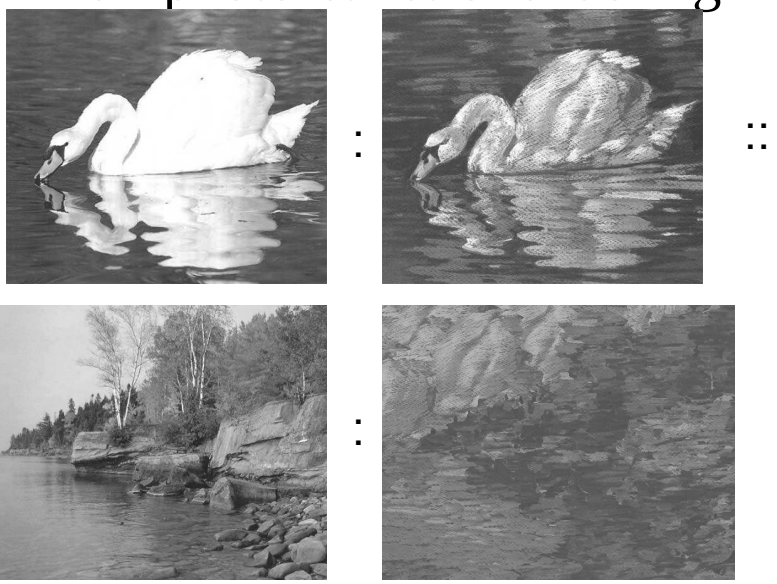
Neighborhood Based Methods

- Acceleration – vector quantization



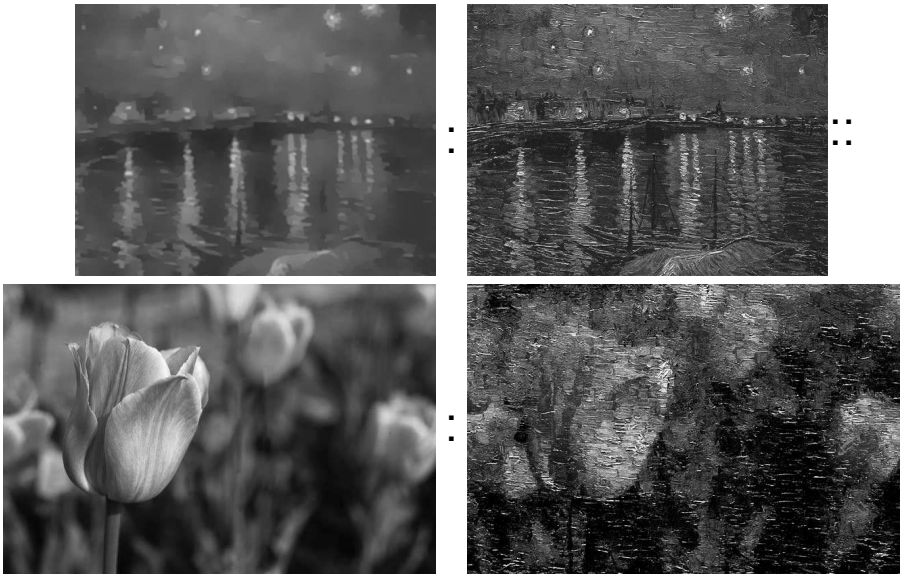
Hertzmann, Jacobs, Oliver, Curless, and Salesin, 2001.

Non-photorealistic rendering



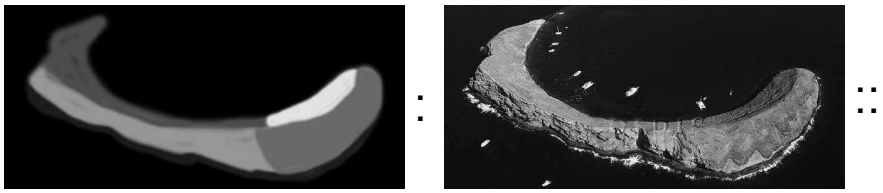
Hertzmann, Jacobs, Oliver, Curless, and Salesin, 2001.

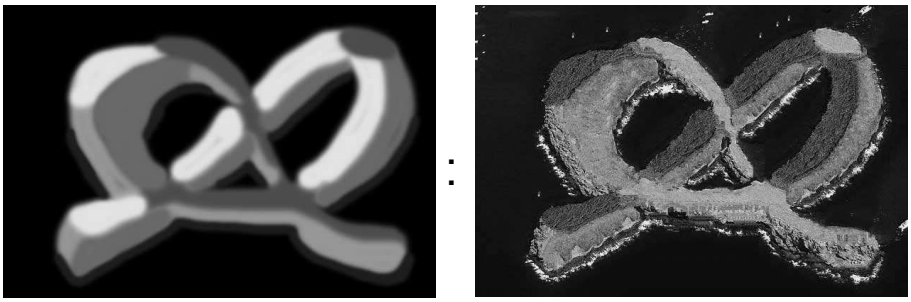
Non-photorealistic Rendering



Hertzmann, Jacobs, Oliver, Curless, and Salesin, 2001.

Paint by numbers





Hertzmann, Jacobs, Oliver, Curless, and Salesin, 2001.

Colorization

Perspective synthesis

Kwatra et al., 2003

Perspective synthesis

Kwatra et al., 2003

Rotation invariant synthesis

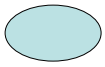
Kwatra et al., 2003

Movies

Wei and Levoy, 2000

More neat stuff

Near Regular Manipulation



Liu, Lin, and Hays, 2004