

# CS176: TEXTURE SYNTHESIS

---

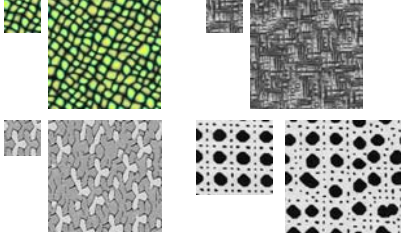
CS 176 WINTER 2011

1

## TEXTURE SYNTHESIS

---

Given a texture, create more



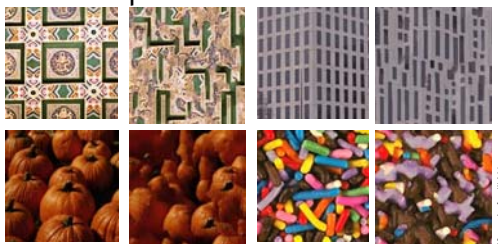
CS 176 WINTER 2011

All examples from Wei & Levoy

## TEXTURE SYNTHESIS

---

Don't expect too much



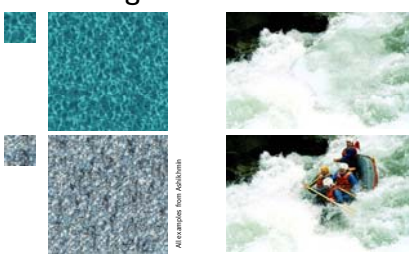
CS 176 WINTER 2011

3

## TEXTURE SYNTHESIS

---

And amazing successes



CS 176 WINTER 2011

All examples from Wei & Levoy

## HOW DOES IT WORK?

---

**Big idea**

- statistical assumptions:
  - Markov random field model
  - stationarity and ergodicity
- find pixels with similar neighbors
  - scanline order (causal neighborhood)
- implementation: exhaustive search

---


CS 176 WINTER 2011

5

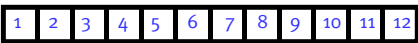
## IN A NUTSHELL

---

Find most similar neighborhood



- high dimensional point/vector




---

CS 176 WINTER 2011

6

## DETAILS

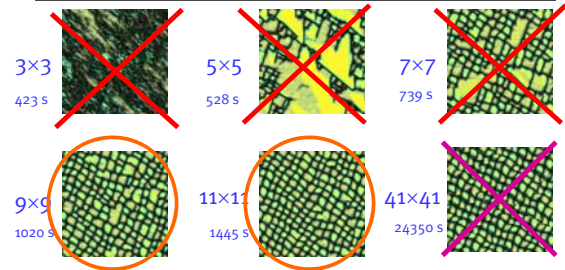
### Choices

- neighborhood size
- hierarchy
- distance measure
- acceleration structures
- cut search space

CS 176 WINTER 2011

7

## NEIGHBORHOOD SIZE

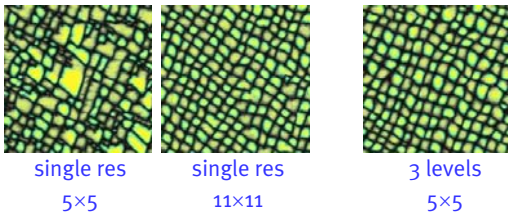


CS 176 WINTER 2011

8

## HIERARCHICAL APPROACH

### Smaller neighborhoods ok



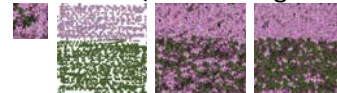
CS 176 WINTER 2011

9

## APPLICATIONS

### What are instances of synthesis?

- repair (inpainting)
- image editing
- extrapolation
- user control (introducing bias)



CS 176 WINTER 2011

10

## RESOURCES

### Papers

- Wei & Levoy
  - Fast Texture Synthesis using TSVQ
- Ashikhmin
  - Synthesizing Natural Textures
- check their web pages

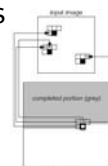
CS 176 WINTER 2011

11

## ENHANCEMENTS

### Additional ideas

- store coordinates not values
  - better for upsampling
  - upsample, jitter, correct
- multiple passes
  - parallel subpasses
- search only shifted pixel nghbd.

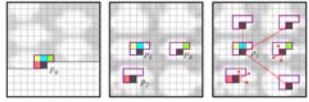


CS 176 WINTER 2011

12

## ENHANCEMENTS

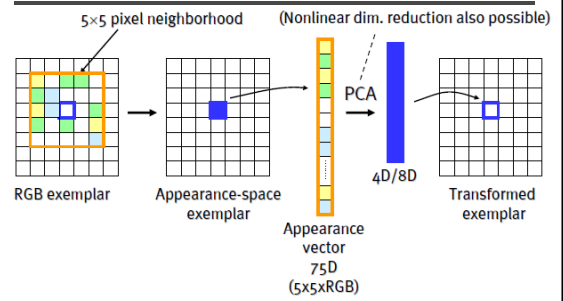
- Tong et al.: k-way coherence search
  - preprocess exemplar with nearest list
- Lefebvre+Hoppe: appearance space
  - distance to features as addl. data
  - PCA on neighborhoods



CS 176 WINTER 2011

13

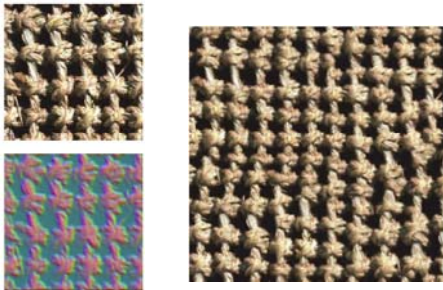
## TRANSFORMED EXEMPLAR



CS 176 WINTER 2011

14

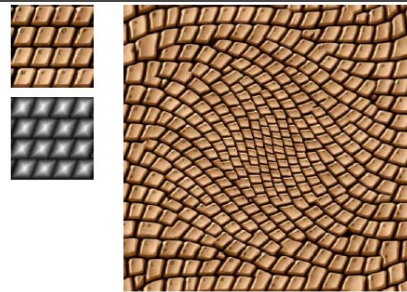
## EXAMPLE FOR 75D TO 3D



CS 176 WINTER 2011

15

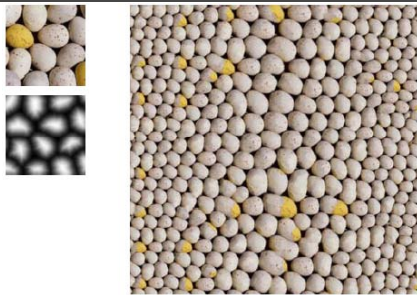
## RESULTS



CS 176 WINTER 2011

16

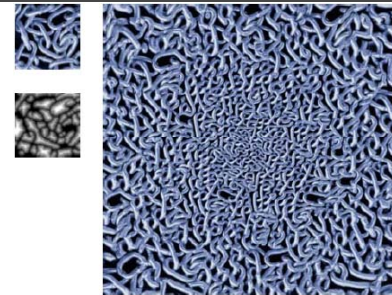
## RESULTS



CS 176 WINTER 2011

17

## RESULTS



CS 176 WINTER 2011

18