

Texture

Issues

1. Analysis
 - Determining if textures are similar
2. Synthesis
 - Creating textures from other textures
 - Painting
3. Segmentation
4. Shape

What is Texture?

- Repeats with variation
- Must separate what repeats and what stays the same
- Model as repeated trials of a random process
 - Probability distribution stays the same
 - Each trial is different

How to Compare Textures

- Simplest comparison is SSD
- View histograms
 - Test probability samples drawn from same distribution
- Chi squared distance between histograms

$$\chi^2(h_i, h_j) = \frac{1}{2} \sum_{m=0}^k \frac{[h_i(m) - h_j(m)]^2}{[h_i(m) + h_j(m)]}$$

Gabor Filters

- Filters at different scales and spatial frequencies

Markov Model

- Captures local dependencies
 - Each pixel depends on neighborhood

Markov Random Field

- Generalization of Markov chains to two or more dimensions
- First Order MRF
 - Probability that pixel X takes a certain value given the values of neighbors A, B, C, D

$$P(X|A, B, C, D) = \frac{1}{Z} \exp\left(-\sum_i \psi_i(X_i)\right)$$

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Texture Synthesis

- Given texture, apply it to another space

Synthesizing One Pixel

- Find $P(x|\text{neighbors})$
- Find all windows in image that match the neighborhood
 - Consider only pixels in neighborhood that are already filled in
- To synthesize \mathbf{x}
 - Pick one matching window at random
 - Assign \mathbf{x} to be the center of that window
- Increasing window size -> Better results