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*

$$P(X|A, B, C, D) = \begin{array}{|c|c|c|} \hline & A & \\ \hline D & X & B \\ \hline & C & \\ \hline \end{array}$$

Texture Synthesis

- Given texture, apply it to another space

Synthesizing One Pixel

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