Image Segmentation CS828 Spring '12

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1   January 25th First Class

Definition: Segmentation (for this class):

- About low level vision in general

- Requires a lot of knowledge about th eworld, high level understanding, quite challenging.

- So we're going to focus on simpler segmentation that doesn't require that much knowledge about the world: Uniform surfaces, smooth shape. Still there will be varietion in intensity.

- Want to find uniform region in things (texture, color, motion, smoothness), not necessarily world property. Removed from true segmentation of objects but still useful.

- Image is an 2D geometric structure. Segmentation is clustering that takes advantage of this structure. Based on the assumption that near-by pixels have the same intensity.

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We're going to look at

1. Diffusion

2. Anisotropic diffusion

3. Graph based algorithms: message passing, thinking of an image as a graph, every pixel is a node in a graph, edges to neighbors → Markov Random FIeld. Gives us a probablistic way to express the state of a node in relation to its neighbors. Usually NP-hard, but graph-cut and belief propagation algorithms still work. The biggest issue is when the number of labels is big.

4. Conditional Random Fields, a general version of MRF

5. Normalized Cut: form a graph

6. Wavelets

Math

- Fourier transforms

- Convolution

- Diffusion

- Wavelets

- Level sets

- Riemannian Geometry

Current Research

- Bilateral filtering (by Morel)

- Texture Segmentation

- Cosegmentation

- Affinity propagation

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Workload

1. Reports (6 out of 8 papers):Be critical when reading papers, even if the paper is good, what is the really important. Learn to recognize, have a taste. (10%)

2. Presentations: 3 presentations per day, 15 min per paper 10 min each to discuss paper (15%)

3. a take home midterm, Final all on lecture material (50%)

4. Problem set/Project (25%)

2 January 30th Class 2

2.1 Perceptual Grouping

- Putting pieces to preceive as a whole.

- Depends on the prior knowledge/statistics about the world.

History

- Behaviorists dominated in early 20th century, wanted to make psychology scientific, focused on quantifyiable things.

- Rejected anything introspective or mind building internal representations.

- AI, computers, chomsky killed behaviorists.

- Gestalt movement claimed visual system perceived world as a objects and surfaces, as a whole and not as raw atomic stimulus/intensities.

Edges/Cues

- Knowing the role of edges is critical to how we perceive an image