**Association vs. Categorization**

**Goal:** Given unlabeled image, recognize objects inside the image by associating generated segments with previously seen object exemplars (see last Figure)

**Segment**

**Exemplar representation**

**Background:** Exemplar Theory from Psychology (Medin & Schaffer 1978, Nosofsky 1986, Krushke 1992) states that categories are represented in terms of remembered objects. When looking at a new object, similarity between all exemplars is computed.

13,905 objects from **LabelMe** w/ 171 unique labels

**Similarity Occurs at Different Levels**

- Similar Shape
- Similar Texture
- Similar Color

**Idea:** Represent each exemplar with features that encode shape, color, texture, and absolute position

**Measuring Object Similarity**

**Approach:** Measure L2 distance between corresponding features to obtain **Elementary Distances**, then combine them using positive weights (a.k.a distance function)

\[ D_{i}(z) = w_{i} \cdot d_{z,i} \]

**Distance Function Learning**

**Goal:** Learn a different distance function per-exemplar; distance functions are learned independently

**Distance function \( \Rightarrow \) linear decision boundary in 14-D “distance” space**

**Visualizing Distance Functions**

**Segment Labeling Task**

**Evaluate:** Given perfect segment, determine object identity with single nearest neighbor

**Recognition in Real Images**

**Problem:** Objects are never presented one at a time, they are embedded inside images! If we only knew which pixels belonged to separate objects...

**Multiple Segments**

**Approach:** Generate multiple segmentations per image (Hoiem 2005, Russell 2006) and also consider pairs/triplets of contiguous segments (Malisiewicz 2007)

**Our Contributions**

1. Posing Recognition as Association
2. Learning Object Similarity Per Exemplar
3. Recognition-Based Object Segmentation

**Toward Image Parsing**

Greedy add most confident association while removing inconsistent (OS>5) associations

**Results**

**Test-set:** 159 Outdoor Images from single folder of LabelMe

**Evaluate:** Recognition-Based Object Segmentation; each generated object “hypothesis” is a bottom-up segment and its list of associating exemplars

**Idea:** Association confidence score favors more associations and smaller distances; we vary this threshold to look at precision-recall

\[ s(S, E) = 1 - \sum_{i \in E} d_{i}(S) \]

**Correct if OS>5 and labels match**

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