Interactively Building a Discriminative Vocabulary of Nameable Attributes

Devi Parikh (TTIC) and Kristen Grauman (UT Austin)

1. Main Idea

Motivation:

Attributes are most useful if they are:

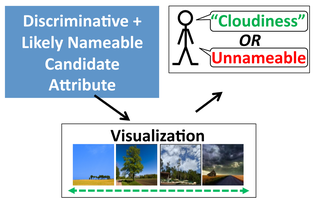
Discriminative:
- Can be learnt in available feature space
- Can effectively classify object categories

Nameable:
- Allow for transfer learning (zero-shot)
- Allow for generating descriptions

Approach	Discriminative	Nameable
Hand-generated	Maybe not	Yes
Mining the web	Maybe not	Yes
Automatic splits	Yes	Maybe not
Proposed	Yes	Yes

Main idea:

Interactive approach to efficiently discover attributes with *both* qualities.

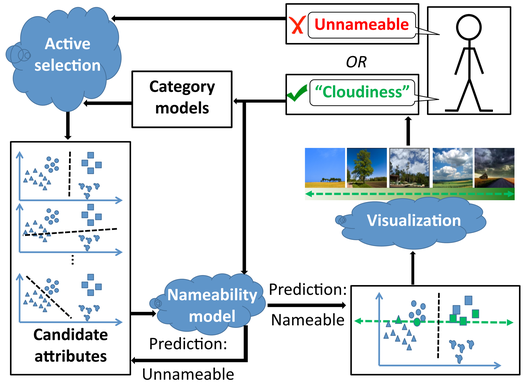


Key new insights:

✧ Predict "nameability" to prioritize candidate splits in feature space

✧ Visualization of candidate attributes

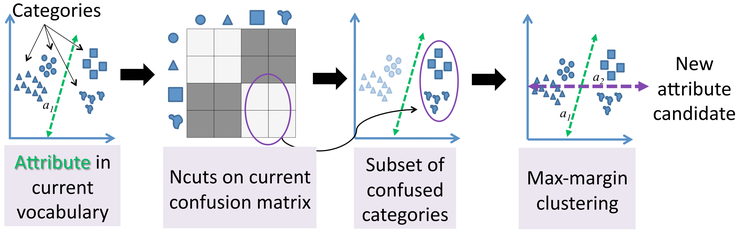
2. Approach Overview



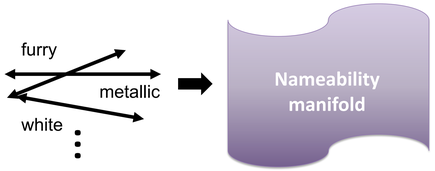
Attribute = binary classifier in visual feature space
Category = multi-class classifier on attribute predictions

3. Approach Details

Active selection of discriminative attribute candidates



Nameability model to prioritize candidates



Hypothesis:
There is structure in the visual properties people can name.

Idea:
Capture by learning manifold over *classifiers* for attributes known to be nameable

Visualization of selected attribute hypothesis

4. Data Collection: Is This Attribute Nameable?

~25,000 responses, 162 subjects

Subjects similarly confident about nameability 97% of time.

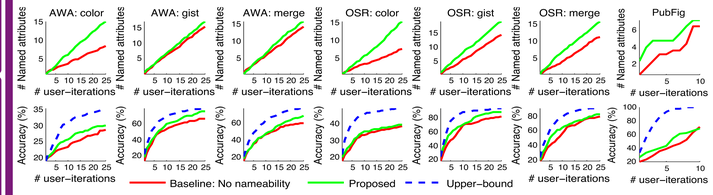
❖ Outdoor Scene Recognition OSR:
- 8 classes, gist & color histogram

❖ Animals with Attributes AWA:
- 8 classes, gist & color histogram

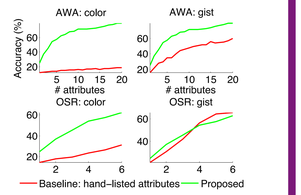
❖ Male Celebrity PubFig:
- 6 classes, gist on parts

5. Comparison to Existing Strategies

More named attributes *and* higher categorization accuracy compared to *purely discriminative* baseline



More discriminative than *hand-generated* list



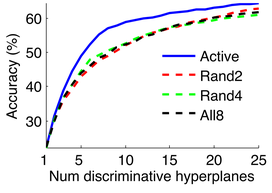
❖ **Expert attributes:** OSR [Oliva et al. 01]: natural, open, perspective, size, diagonal plane, depth; [Lampert et al. 09]: longneck, strong, gray, swims, stripes, hibernate, toughskin, patches, tail, coastal, paws, spots, etc.

❖ **Discovered attributes:** OSR [color]: coastal, warmth, slope, outdoor, snow, vegetative; [gist]: directional, rocks, serene, rural, paved, close up, rocky; AWA [color]: dotted, black, attacking, monocolor; [gist]: bright, thick fur, short-neck, fearful, rough

6. Evaluating Individual Components

Description with discovered attributes

Active approach discovers useful splits more quickly



Structure exists in nameability space, allowing for prediction