Supplementary file for: Inferring Analogous Attributes

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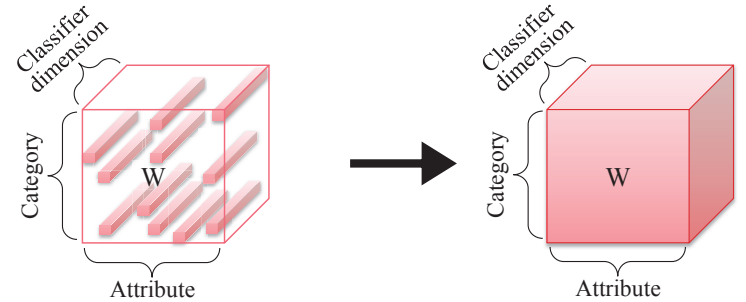
1. Inferring analogous attributes with tensor factorization

Figure 1 illustrates the tensor $\mathbf{W}$ composed of observed classifiers and the desired complete $\mathbf{W}$, which we obtain via the inference procedure described in Sec 3.3 in the paper. Each red rectangle in (a) is a category-sensitive attribute for an object+attribute combination. Figure 2 illustrates the decomposition $\mathbf{W} \approx \sum_{k=1}^{K} O^k \circ A^k \circ C^k$ described in Sec 3.3. Note that in Figure 3 of the paper, we use the latent object features O to analyze the analogous attributes.



(a) The tensor $\mathbf{W}$ is composed of classifiers for which we observed training images.

(b) We infer missing classifiers with tensor completion.

Figure 1. The 3D object-attribute tensor $\mathbf{W}$.

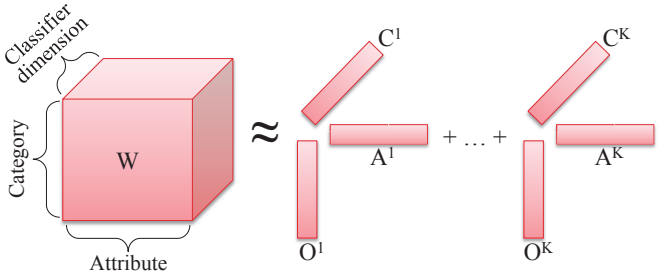


Figure 2. Illustration of tensor decomposition in $\mathbf{W} \approx \sum_{k=1}^{K} O^k \circ A^k \circ C^k$.

2. Naive category-sensitive attributes

As described in Sec 3.1, the naive way to learn category-sensitive attributes is using only in-category examples (i.e., no importance weighting). However, we find this approach is weak in practice since the number of available training examples is often very few. See Table 1 for the comparison.

	Datasets		Trained explicitly		
	# Categ (N)	# Attr (M)	Category-sensitive (Ours)	Universal	Category-sensitive (naive)
ImageNet	384	25	**0.7304**	0.7143	0.6388
SUN	280	59	**0.6505**	0.6343	0.6052

Table 1. Accuracy (mAP) of attribute prediction by our proposed category-sensitive attribute, universal attribute, and the naive category-sensitive attribute. Numbers are mAP over all category and attribute combinations for the 2 datasets.

3. Semantic subsets

Figure 3 illustrates the semantic subsets we test in Sec 4.4 of the paper. We first restrict the tensor to closely related objects. Then we restrict it to closely related attributes. Red: restrict the tensor to dog related categories. Blue: restrict the tensor to color related attributes.

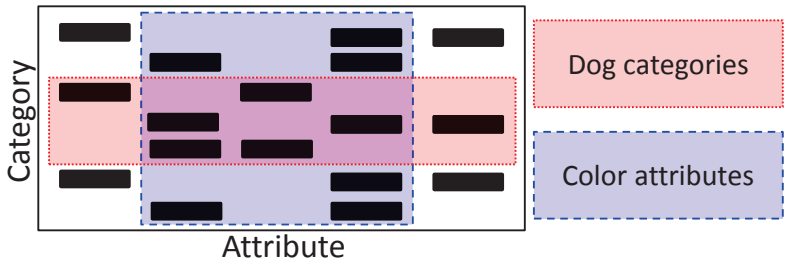


Figure 3. Illustration of semantic subsets.

- Dog related categories: puppy, cur, courser, basset, beagle, bloodhound, bluetick, coonhound, dachshund, foxhound, redbone, wolfhound, whippet, otterhound, Scottish deerhound, staghound, bullterrier, wirehair, Australian terrier, schnauzer, retriever, vizsla, English setter, clumber, Sussex spaniel, kuvasz, schipperke, groenendael, malinois, briard, komondor, collie, pinscher, mastiff, bulldog, Great Dane, Saint Bernard, basenji, pug, keeshond, corgi, poodle.
- Color related attributes: black, blue, brown, gray, green, orange, pink, red, violet, white, yellow.