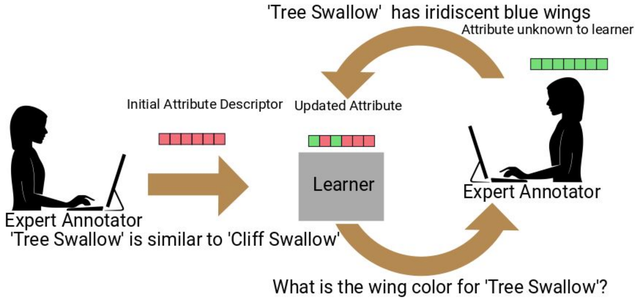
Field-Guide Inspired Zero-Shot Learning

Utkarsh Mall Bharath Hariharan Kavita Bala
Cornell University

Cornell Bowers C·IS College of Computing and Information Science
2021 ICCV OCTOBER 11-17 VIRTUAL

Contributions



Reducing the annotation cost for zero-shot learning.

- A new **field-guide-inspired** interactive ZSL approach.
- **New query strategies**, to actively query expert attributes to rapidly train the learner.

Problem

Zero-shot learning is not really “zero-shot”.
100s of annotations are required for each class.
Can this annotation cost be reduced?

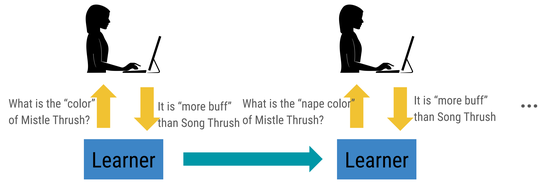
Field-guides

English Name: Mistle Thrush
Scientific Name: *Turdus viscivorus*
Description:

1. Plain greyish brown backs and neatly round-spotted underparts
2. Larger than the Song Thrush but the breast has much less buff

Field-guide authors do not describe all the attributes for a novel category.

Interface

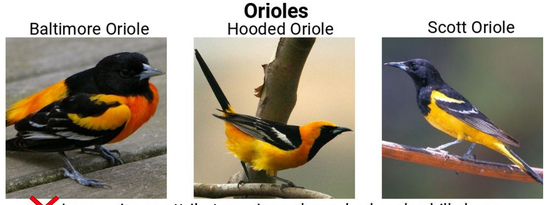


Instead of letting annotators choose attributes to label, the learner chooses the useful attributes first.

Querying Policy

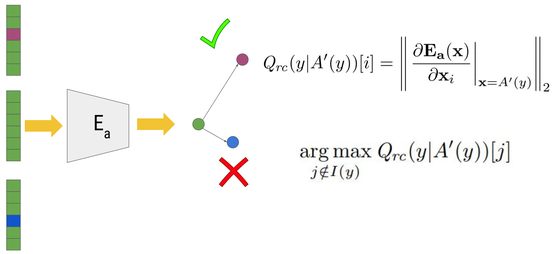
1. Sibling-variance:
   - Select attributes with higher variance in a taxonomy branch.
   - Requires taxonomy for base classes.

Orioles



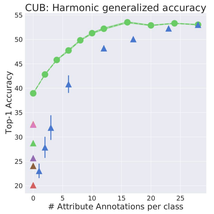
Low variance attributes: wings shape, body color, bill shape
High variance attribute: nape color

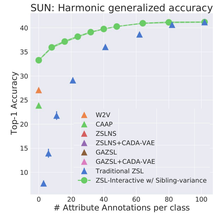
2. Representation-change:
   - Select attribute resulting in most change in latent representation locally



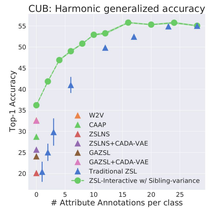
Results

Field-guide way of annotations is better than traditional ZSL and unsupervised ZSL.

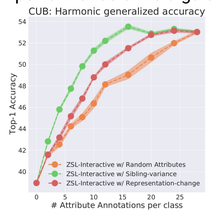




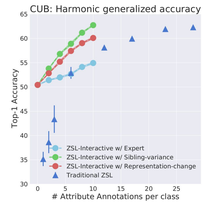
Generalized to other ZSL models Such as TF-VAEGAN



Both querying policies improve the performance of field-guide

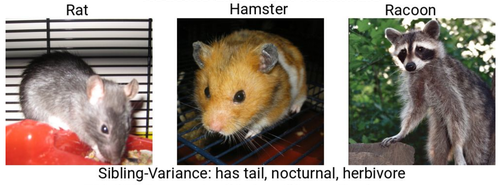


Querying policies are better than human experts.



Attributes asked by our querying policy are logical.

Rodents and small mammals

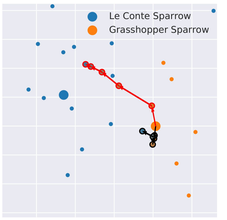


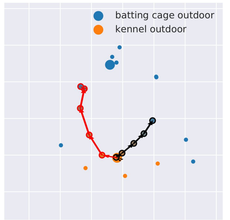
Sibling-Variance: has tail, nocturnal, herbivore
Total-Variance: size (big/small), aquatic, has paws

Swallows

Sibling-Variance: throat color, crown color, forehead color
Total-Variance: bill length, throat color, overall shape

Sibling-variance creates more accurate attributes quicker.





Take-away

- With **only 35%** of total annotations, one can get full model performance on SUN and CUB. Saving more than **32 hours!** of expert annotation cost on CUB.
- Field-guide annotation interface are **more efficient** and **practical** to use with experts.
- **Learner oriented** querying policies lead to better performance.

Future Work

- Policies that can choose different number of attributes.
- Bridging the gap between attribute understanding of humans and machines.
- Policies leveraging already selected attributes.

Acknowledgment

This work was funded by TCS, NSF (1900783) and DARPA LwLL program (HR001118S0044).