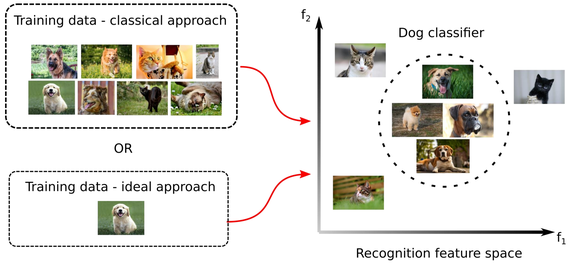
CLEAR: Cumulative LEARning for One Shot One Class Image Recognition

Jedrzej Kozerawski, Matthew Turk

Four Eyes Lab ● University of California, Santa Barbara ● {jkozerawski, mturk}@ucsb.edu

Objective

Learn to recognize novel object categories from only a single positive example and no negative examples.



Motivation

Currently accurate object recognition requires many examples, both positive and negative.

People understand how to recognize a novel object based on:

- What this object is (and not what it is not)
- Overall lifetime experience (for context)

The question is: How can we mimic such human perception abilities?

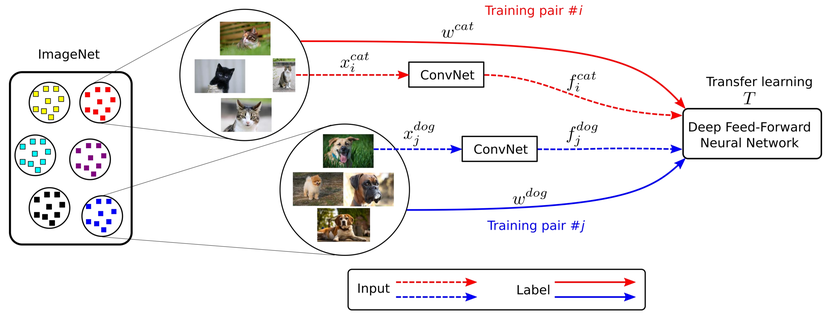
One Shot One Class

Data availability		Positives		
		Many	*One*	*Zero*
Negatives	*Many*	Recognition	One Shot	Zero Shot
	None	One Class	**One Shot One Class**	Zero Shot One Class

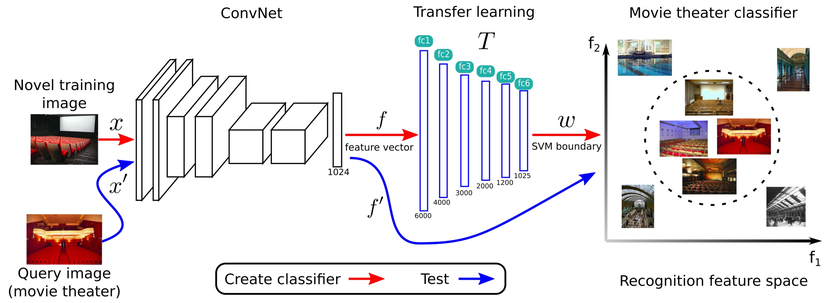
One-Shot One-Class seeks to classify novel instances based on a single positive training example, with no explicit negative examples

Proposed approach

Idea: Infer parameters of a weak classifier from a single image.
How: Train DNN to do regression using pairs {image, classifier parameters}



Test: Create a classifier for a novel category using one, unseen image. Next use CNN as a feature extractor and classify query images using newly created classifier.



Results

We have trained our model with the data from the ImageNet ILSVRC 2012 challenge and then tested it on five different datasets:

- Caltech 256
- Caltech-UCSD-Birds 200 2011
- Flowers 102
- MIT Indoor Scene Recognition 67
- SUN attributes

The F1 score and MAP results for three of them are available below:

Method	Caltech-256		Flowers 102		MIT Indoor 67	
	F1	MAP	F1	MAP	F1	MAP
Threshold	0.008	0.0004	0.0029	0.03	0.0001	0.001
Chance	0.008	0.005	0.019	0.013	0.029	0.019
One-Class SVM	0.011	0.061	0.016	0.068	0.003	0.025
CLEAR [ours]	**0.176**	**0.364**	**0.087**	**0.193**	**0.111**	**0.209**

Larger values are better

Conclusions

- This work addressed a novel problem of a One Shot One Class classification
- Our proposed approach shows that it is possible to learn weak classifiers from only a single positive example and no negative examples
- Further work is necessary to overcome the class granularity problem (understand the breadth of a category from a single example)