Project Introduction

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Project Background/Motivation

- Motivated by the paper “Learning To Detect Unseen Object Classes by Between-Class Attribute Transfer” by Lampert et al. at CVPR 2009

- Problem: Given a set of object classes to train our system from, can we recognize objects from classes we’ve never seen before?

- For example, given images from the classes “otter” and “polar bear” to train from. Can we recognize an image of a “zebra”? 
Project Background/Motivation

- Solution: Cascade the known and unknown classes with a layer of semantic attributes to relate them.

(b) Direct attribute prediction (DAP)
Project Background/Motivation

- Attributes are known and assigned beforehand.
- Example Attributes:

```
other
black: yes
white: no
brown: yes
stripes: no
water: yes
eats fish: yes

polar bear
black: no
white: yes
brown: no
stripes: no
water: yes
eats fish: yes

zebra
black: yes
white: yes
brown: no
stripes: yes
water: no
eats fish: no
```
Project Background/Motivation

- Total of 50 animal object classes, 85 attributes
- Split the animals into two sets, 40 training classes, and 10 test classes
- Using this framework, trained classifiers to determine if an image has a given attribute
- Mapping these attributes to animals, able to determine which animal these attributes correspond to
- Accuracy of approximately 40.5% for multi-class recognition
Project Outline

- Extend upon Lampert’s idea of semantic attributes
- Lampert made available his “Animals with Attributes” dataset and attributes
- Consists of 30475 images with at minimum 92 images per class
- Class-attribute matrix designating the strength of each attribute for each class
Project Outline

- Small subset of class-attribute matrix
Project Outline

- From a representation point of view, idea is to model the idea of attribute classifiers with a Multi-Layer Perceptron (MLP).
- The hidden nodes represent the attribute classifiers.
- Each hidden node represents the classifier for an arbitrary attribute that divides the object classes.
Project Outline

Multi-Layer Perceptron:

- Input values
- Input layer
- Weight matrix 1
- Hidden layer
- Weight matrix 2
- Output layer
- Output values
Project Outline

- Use the idea of attributes to assist in multiple “one-shot recognition” cases
- One-shot recognition refers to being able to recognize a new object class with just one training image
- This isn’t easy, since we don’t have a set of training examples to train our system on
- Some previous work by Fei-Fei Li (Stanford) and Andrew Ng (Stanford)
Project Outline

- Solution: transfer learning, which is transferring learnt parameters from an unrelated classification problem to our problem at hand
- Our idea is to train a system to know it only has few examples to learn from, and use this framework to optimize and choose attributes that can best classify objects
- Hope that with a system trained in this manner, it can perform competitive one-shot recognition
Progress so far

- This week, read a large amount of papers and literature related to learning semantic attributes, one-shot recognition, and transfer learning
- Implemented a very preliminary version of the method used in Lampert’s paper using MLPs and Netlab
- Not working very well, classification of ~91% for the training set, and ~15% for test images taken from the training set
- Learned a lot about MLPs
Next steps

☐ Figure out the math behind optimization idea Marshall has for training the system

☐ Implement idea and test it on the “Animals with Attributes” dataset provided by Lampert

☐ Compare the classification accuracy with Lampert’s accuracy, as well as accuracies obtained by other one-shot recognition systems (Fei-Fei Li, Andrew Ng)