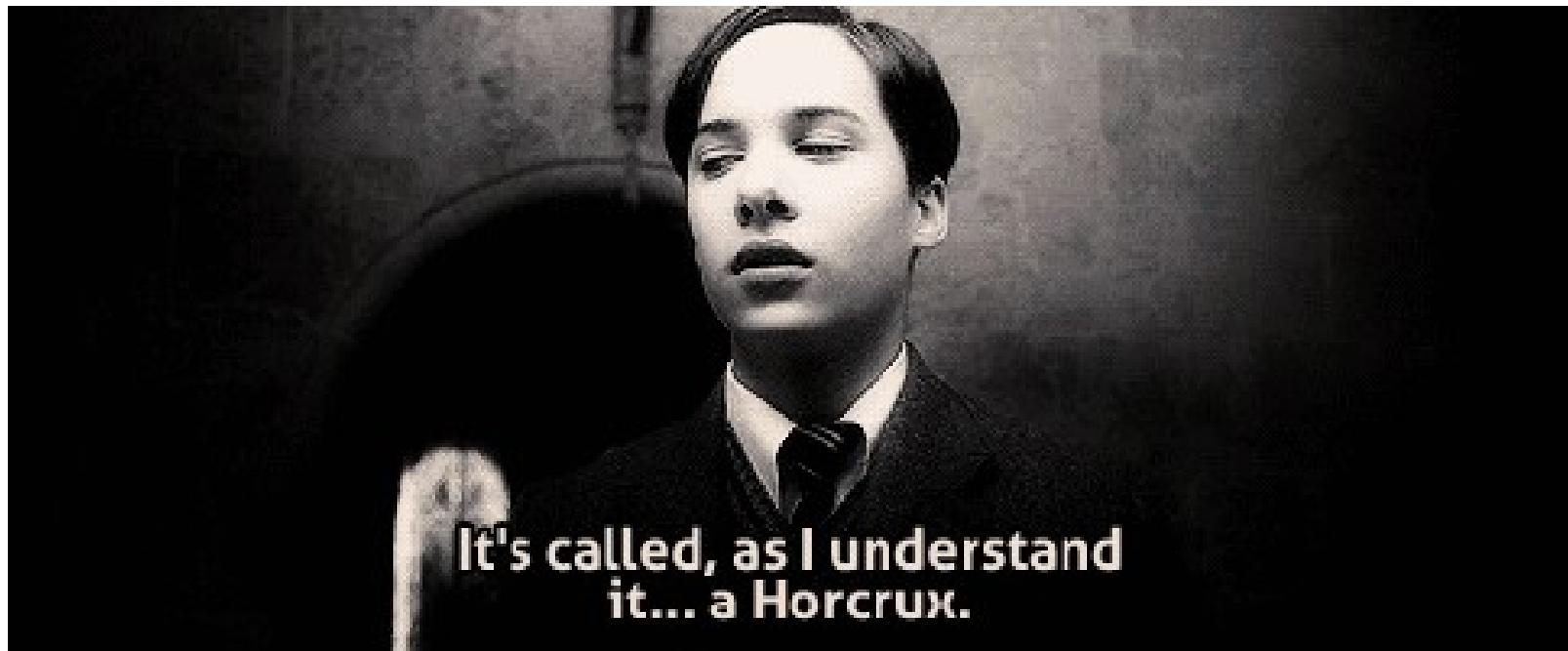


MLHEP2017

Day 5.1

How you *actually do it* :)





Large-scale recognition



CIFAR



- 60k images
 - 10 classes (left)
 - 32x32 RGB
 - subclasses
- | | |
|-----------------|---|
| aquatic mammals | beaver, dolphin, otter, seal, whale |
| fish | aquarium fish, flatfish, ray, shark, trout |
| flowers | orchids, poppies, roses, sunflowers, tulips |
| food containers | bottles, bowls, cans, cups, plates |

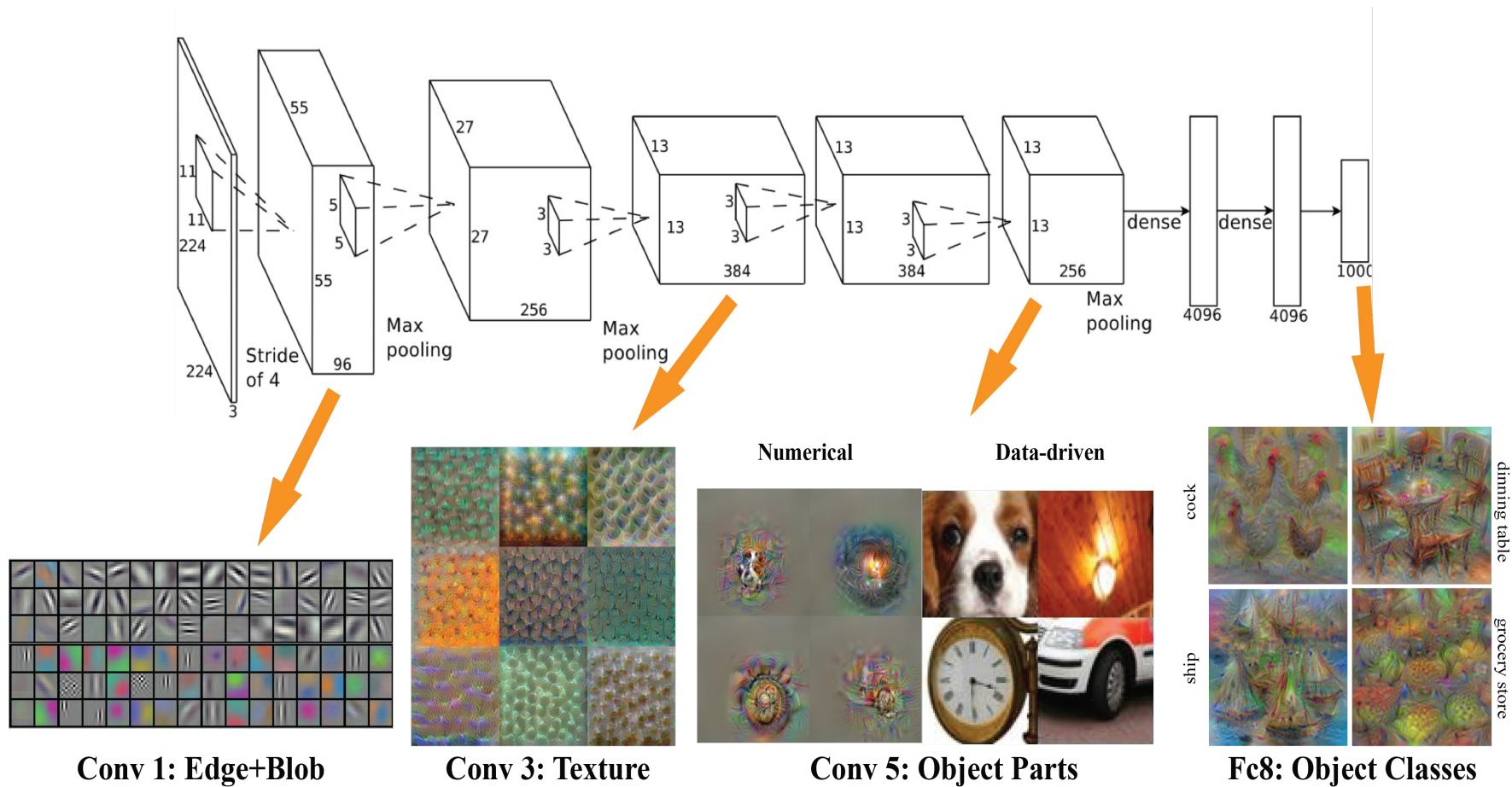
The only problem: you only have 5k images
e.g. transport vs military aircrafts

Ideas?

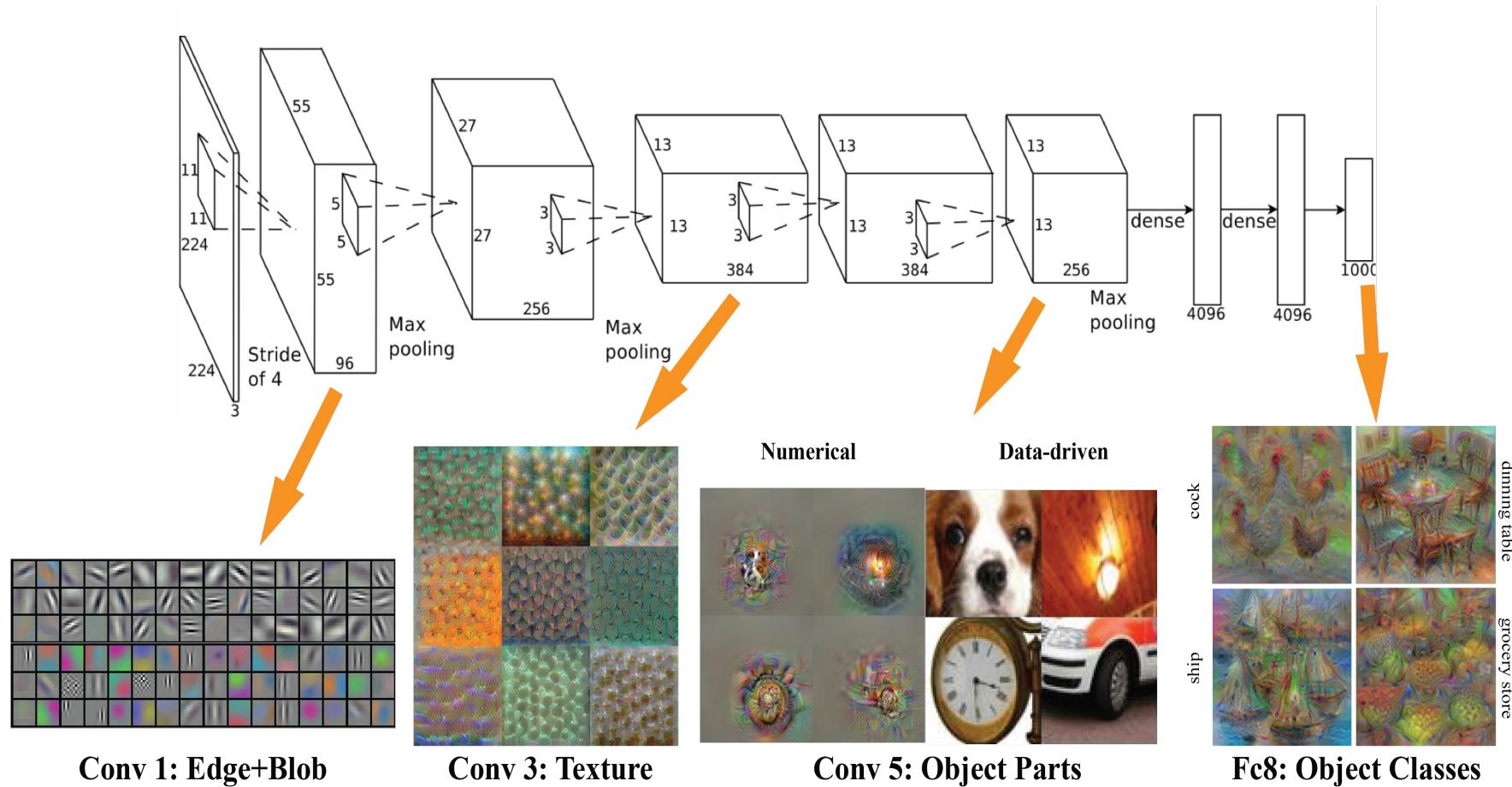
Regular solutions

- Regularize really hard
- Super small network
- Data augmentation
- Whatever

Feature learning



Feature learning



Idea: let's pre-train network on a larger dataset

Pre-training

- 1. Train a network on large dataset

cifar X

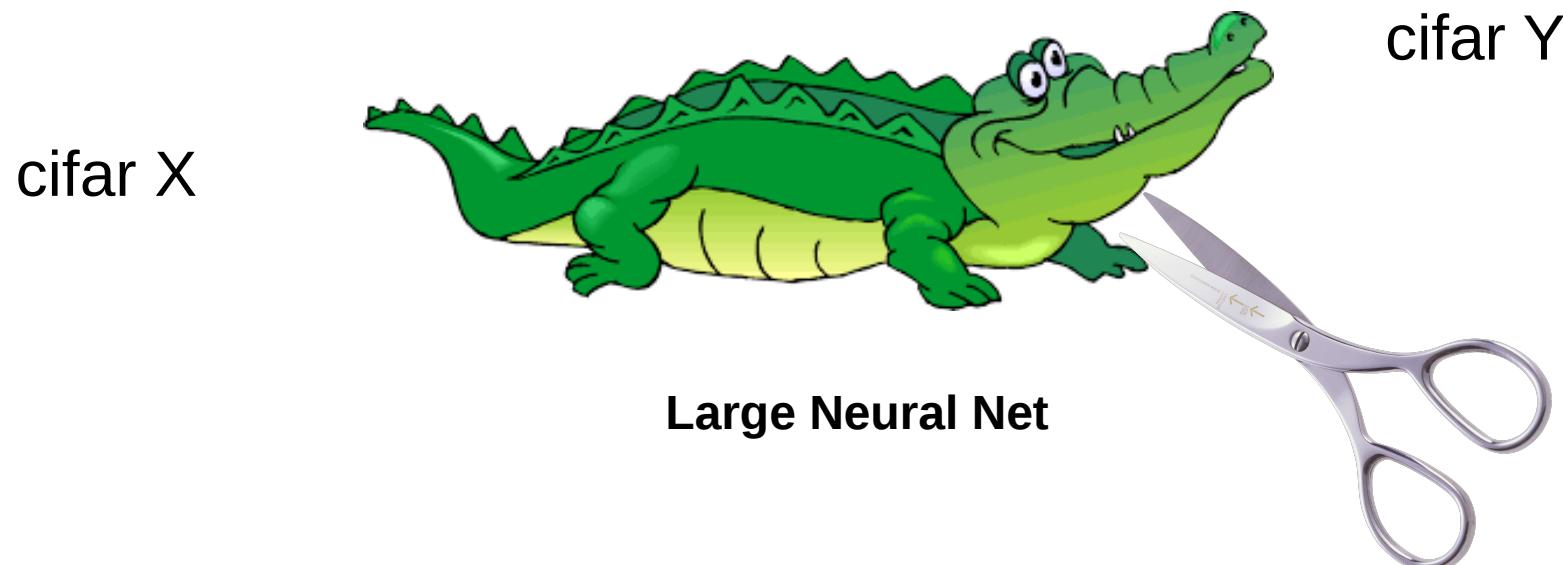


cifar Y

Large Neural Net

Pre-training

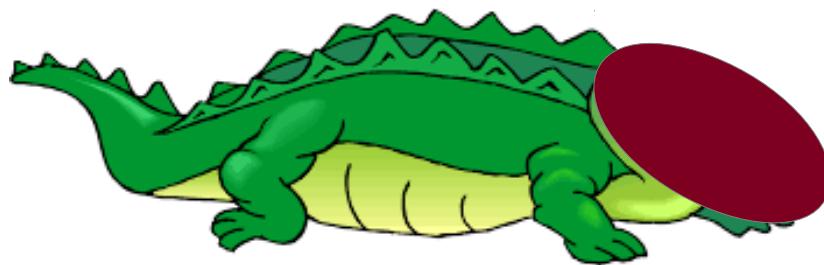
- 1. Train a network on large dataset
- 2. Take some intermediate layer



Pre-training

- 1. Train a network on large dataset
- 2. Take some intermediate layer

cifar X

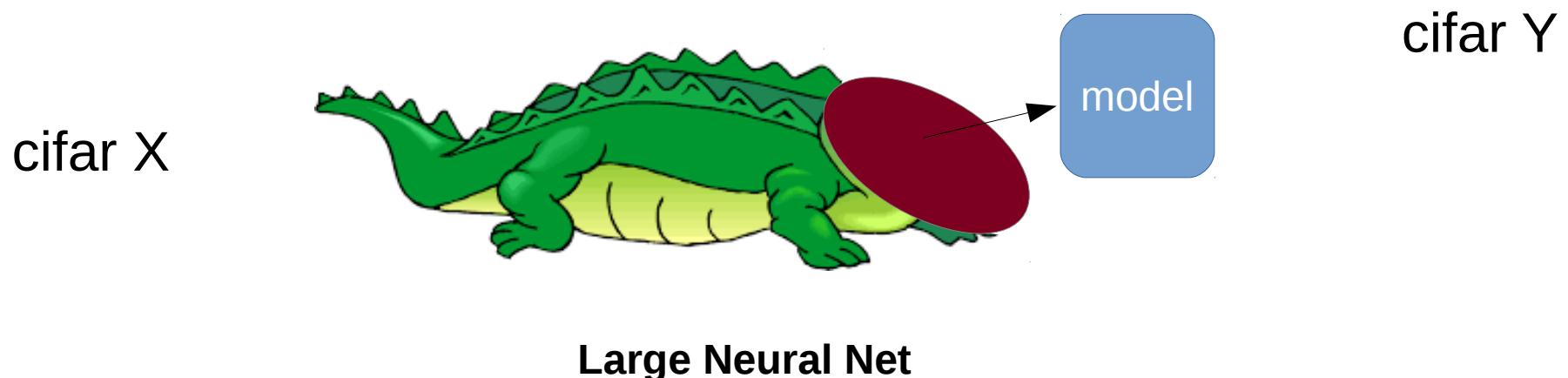


cifar Y

Large Neural Net

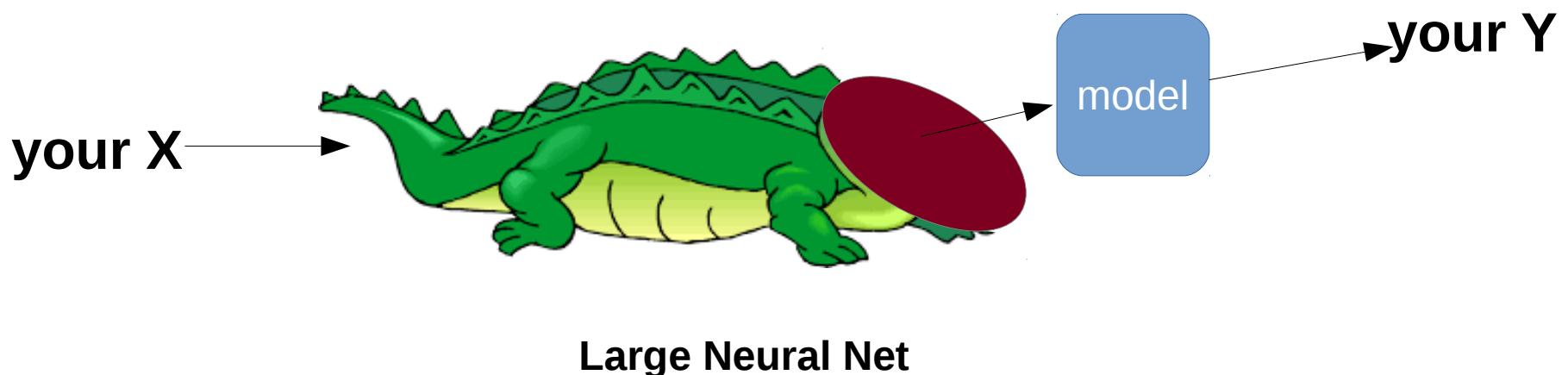
Pre-training

- 1. Train a network on large dataset
- 2. Take some intermediate layer
- 3. Build model on top of it



Pre-training

- 1. Train a network on large dataset
- 2. Take some intermediate layer
- 3. Build model on top of it
- 4. Train model for your objective



CIFAR



- 60k images
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- | | |
|-----------------|---|
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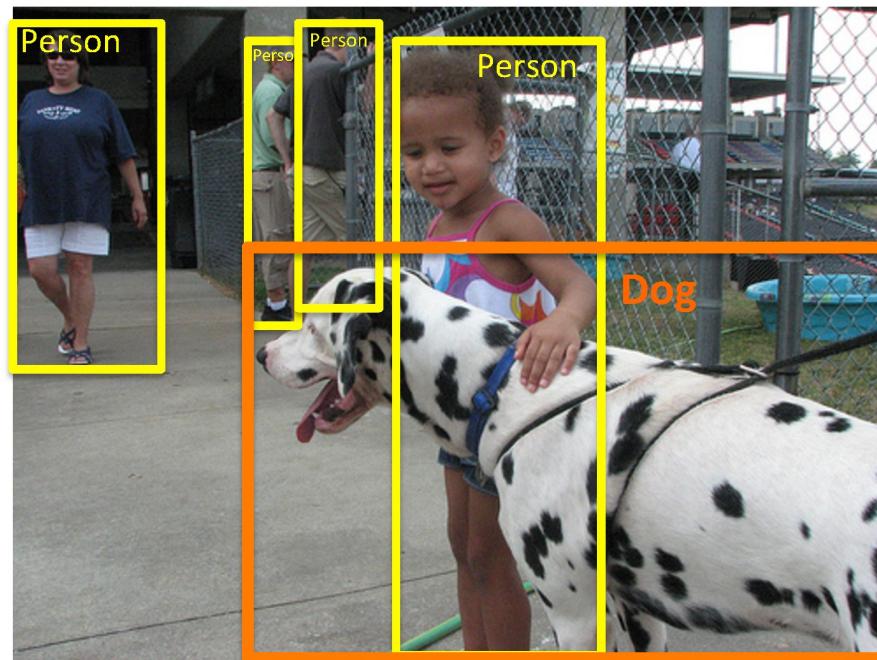
Pfft... weakling

IMAGENET Large Scale Visual Recognition Challenge (ILSVRC) 2010-2014

200 object classes
1000 object classes

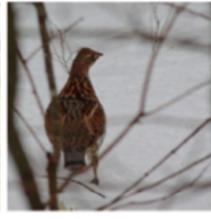
456,567 images
1,431,167 images

DET
CLS-LOC

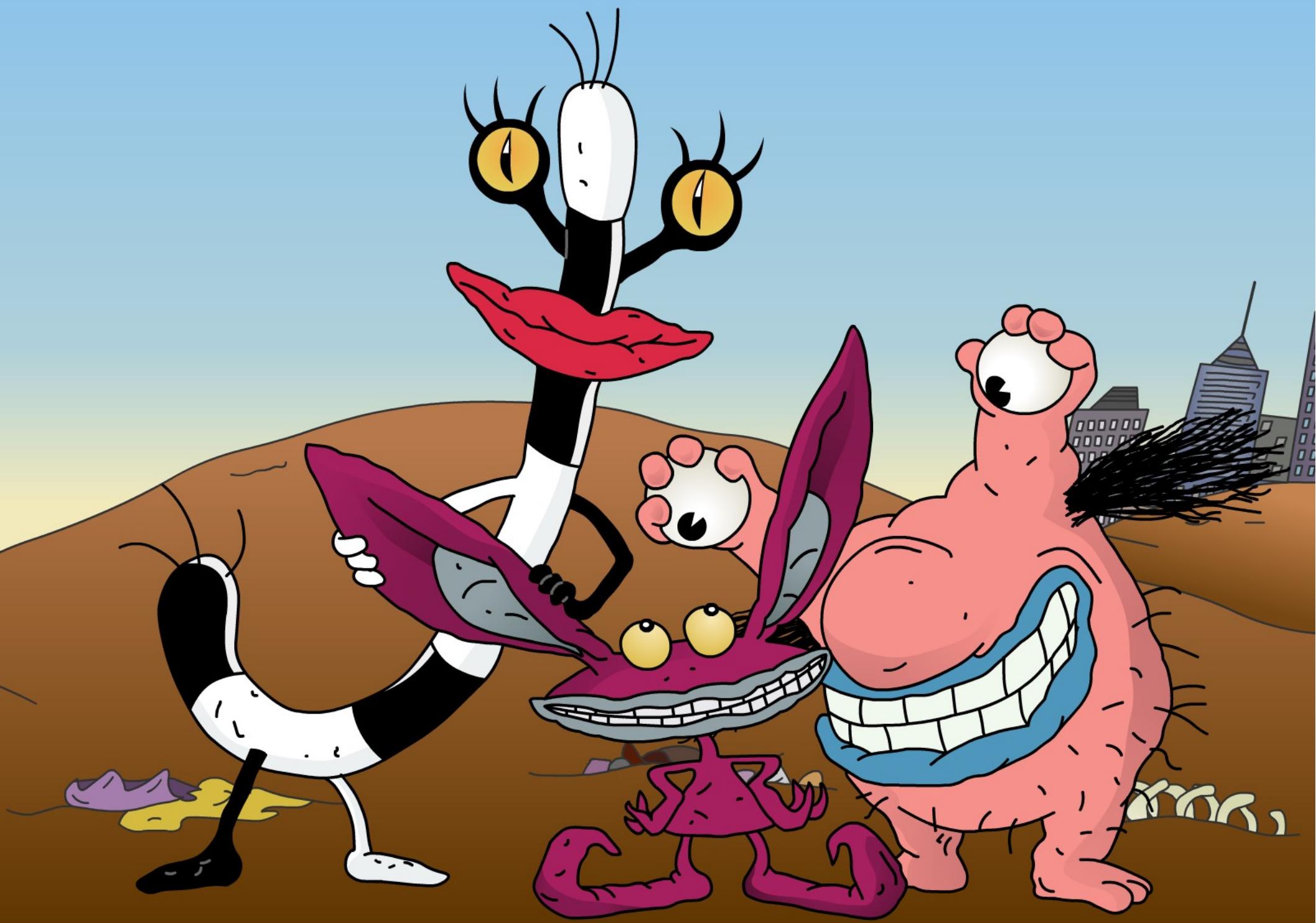


<http://image-net.org/challenges/LSVRC/>

Variety of object classes in ILSVRC

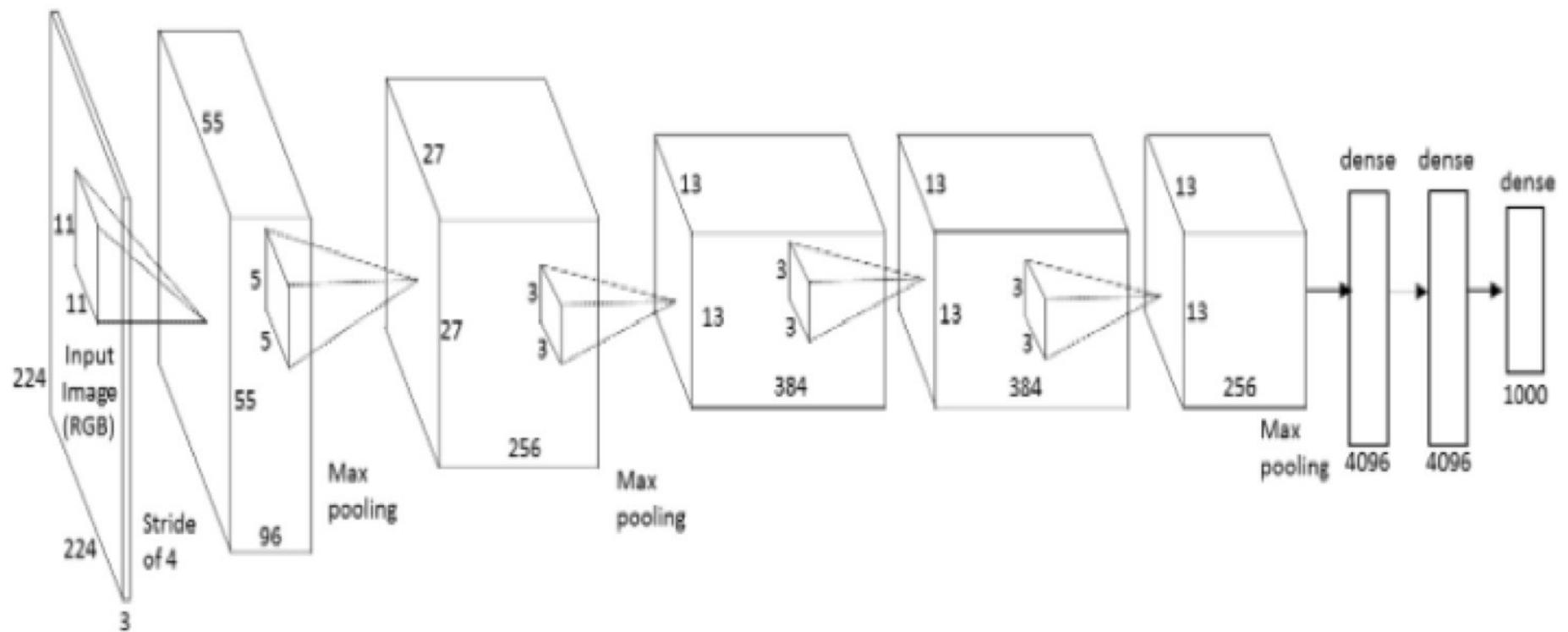
	DET	CLS-LOC				
birds						
bottles						
cars						

What kind of network will handle that?



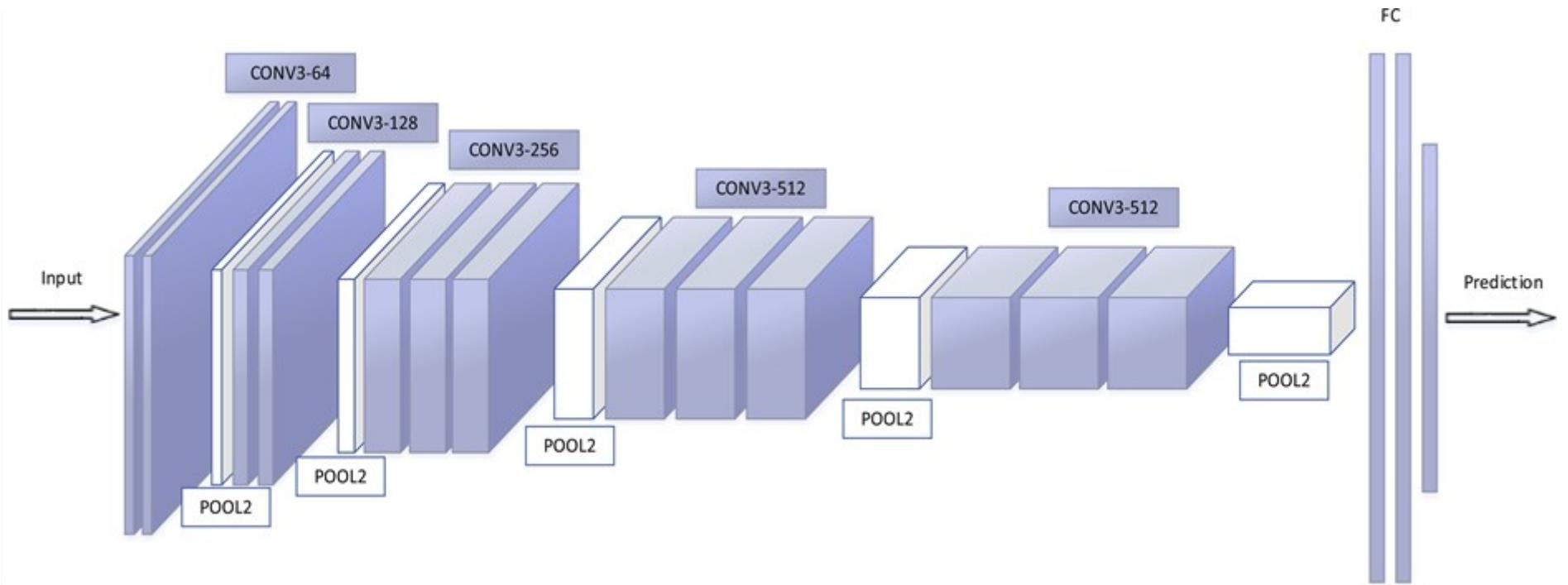
BY JAVIER 2006

Alexnet



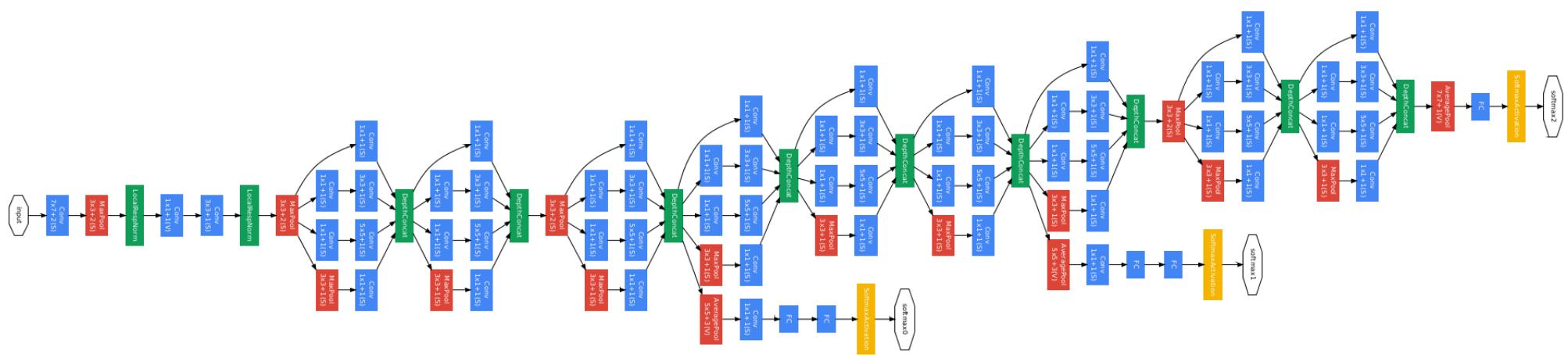
(Krizhevsky et al.)

VGG



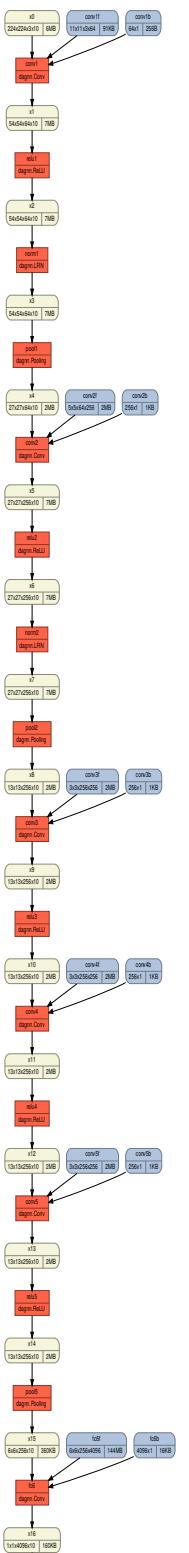
Karen Simonyan and Andrew Zisserman

Googlenet (inception)

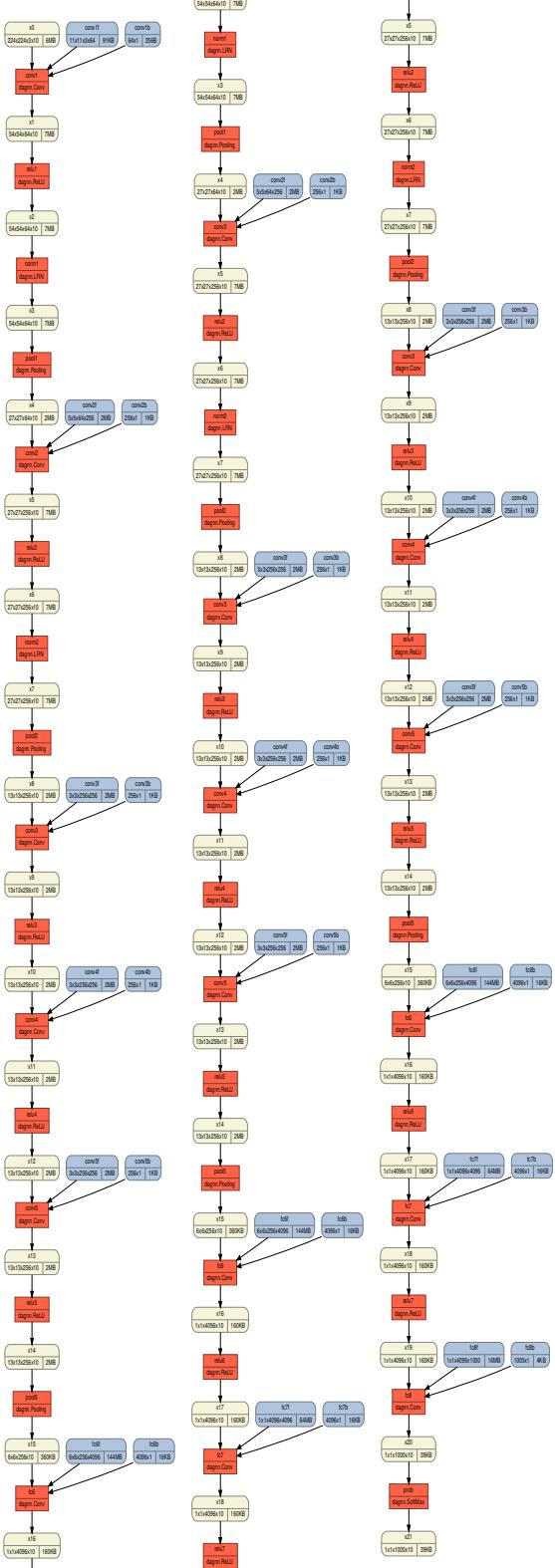


Szegedy et al

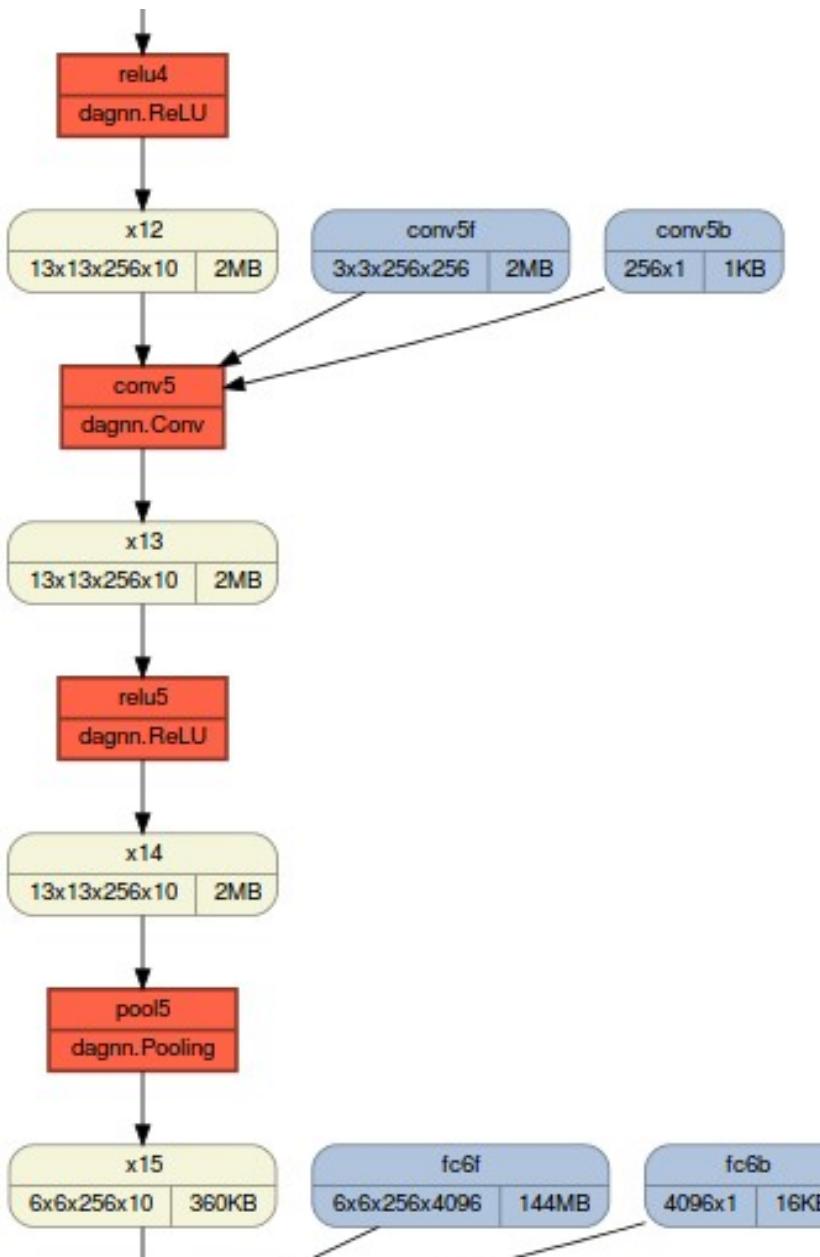
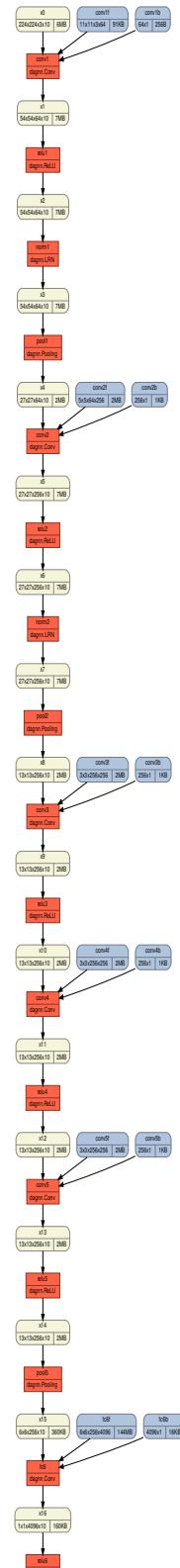
ResNet-152



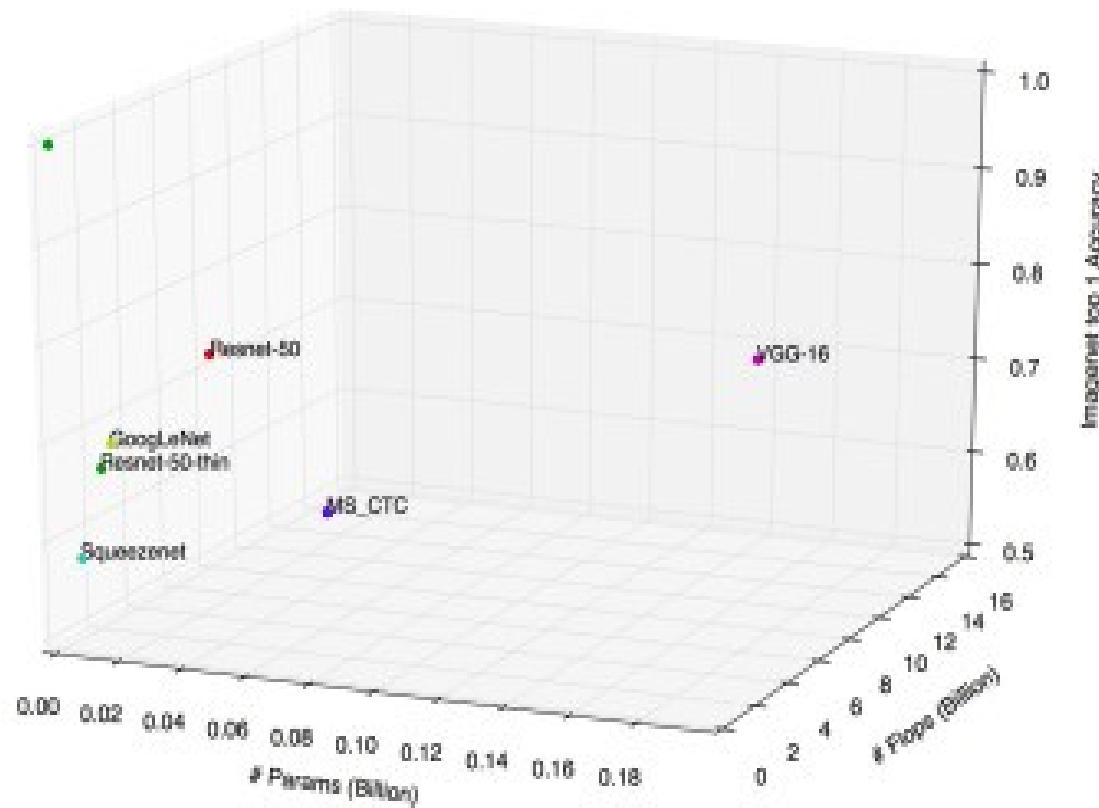
ResNet-152



ResNet-152



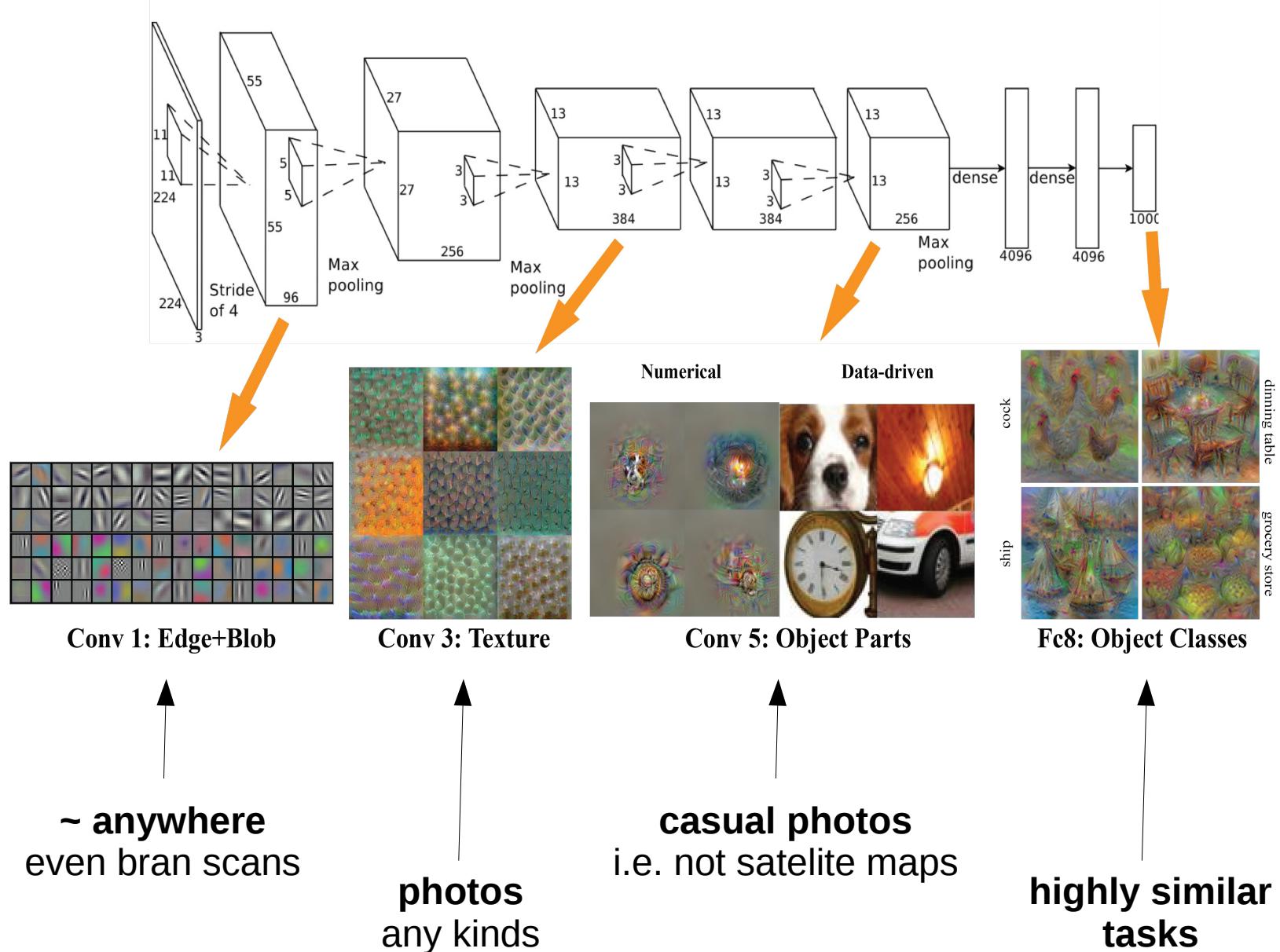
Monster stats



Can we use them?*

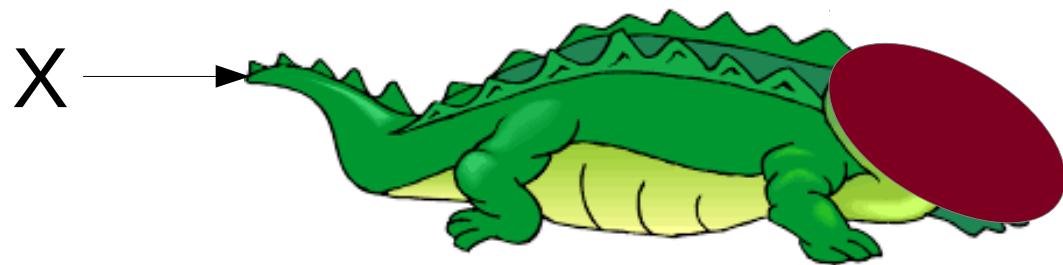
*for aircraft problem

Can we use them?



Fine-tuning

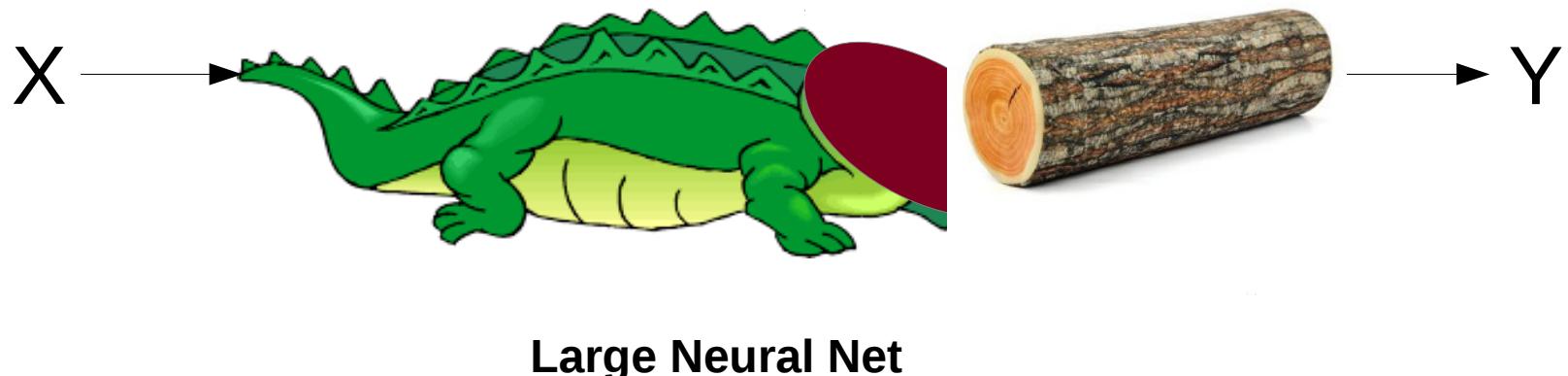
- Chop off “head”



Large Neural Net

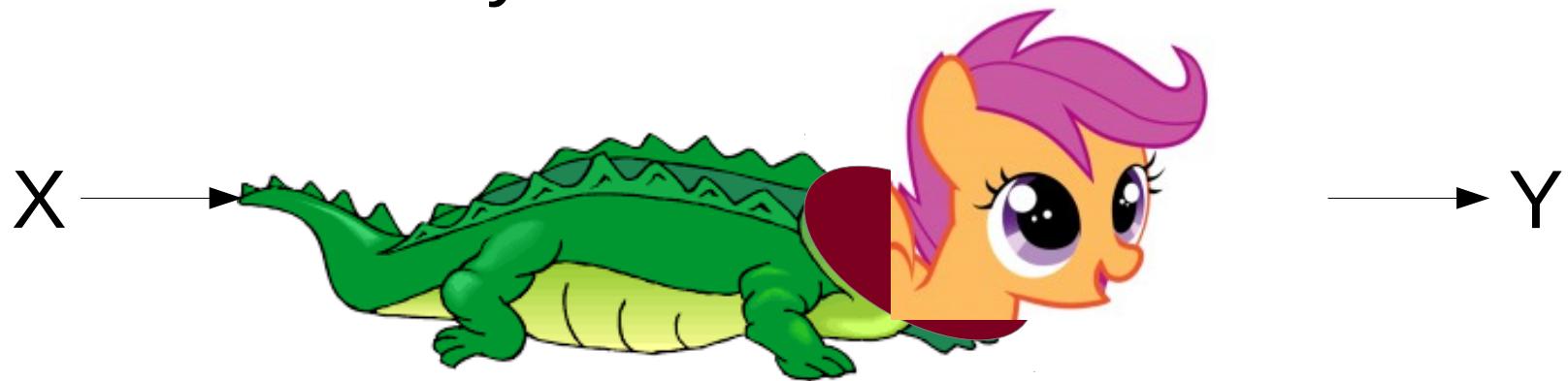
Reusing features

- Chop off “head”
- use “neck” as feature extractor
- Train ANY classifier
 - even random forest will do

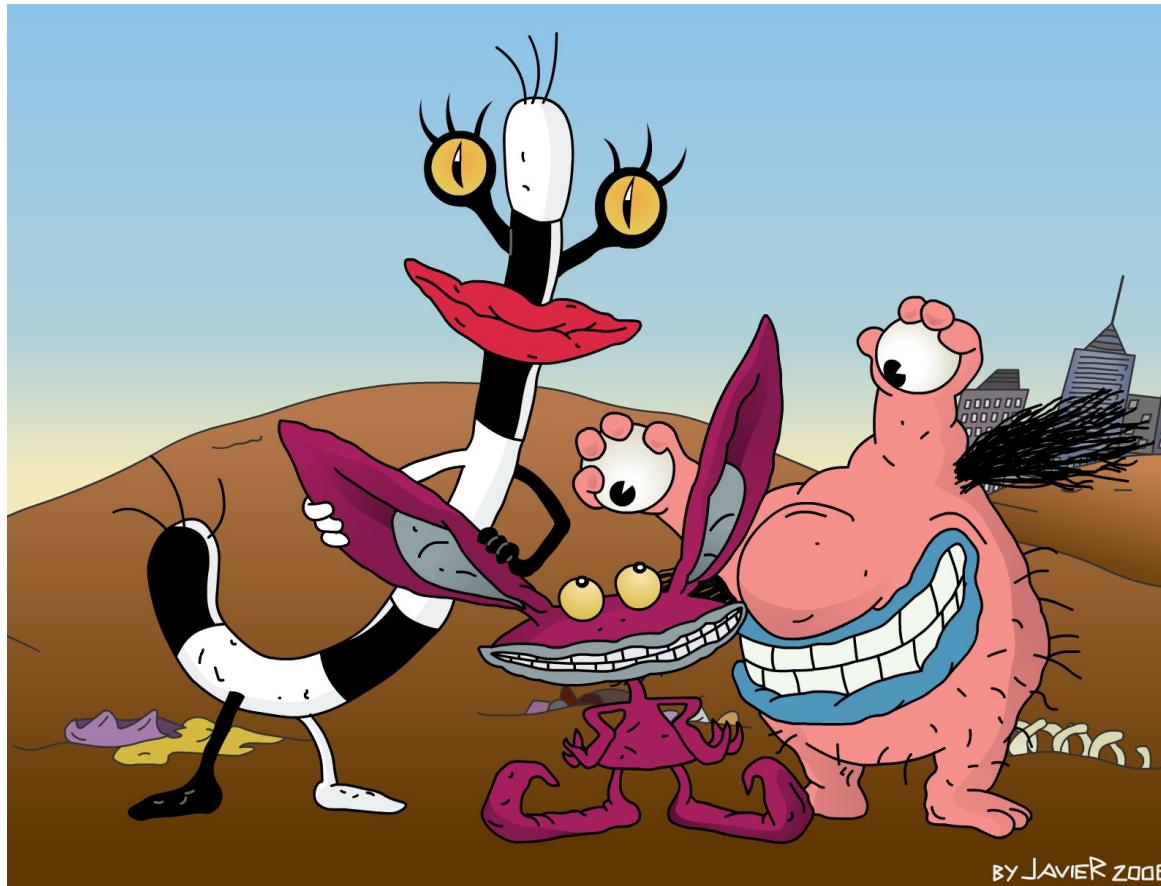


Fine-tuning

- Chop off “head”
- “freeze” body (consider constant)
- Build new neural network in it's place
- Train “head” only for several iterations
- Un-freeze body and train **full network**



Large Neural Net



Come at me bro!