

Transfer Learning for Classification of Nighttime Images

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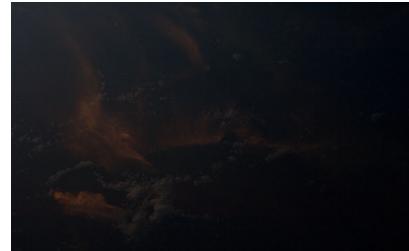
Images from the International Space Station



astronaut



aurora



black



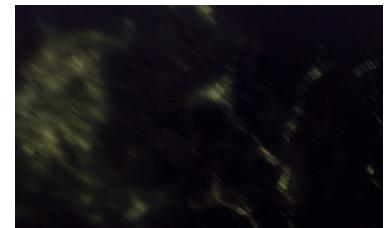
city



none



stars



unknown

Classification



astronaut

aurora

black

city

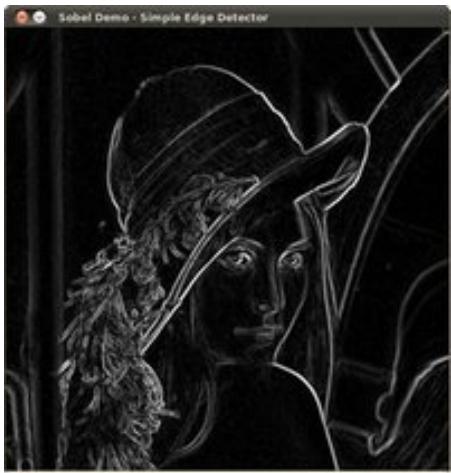
?

none

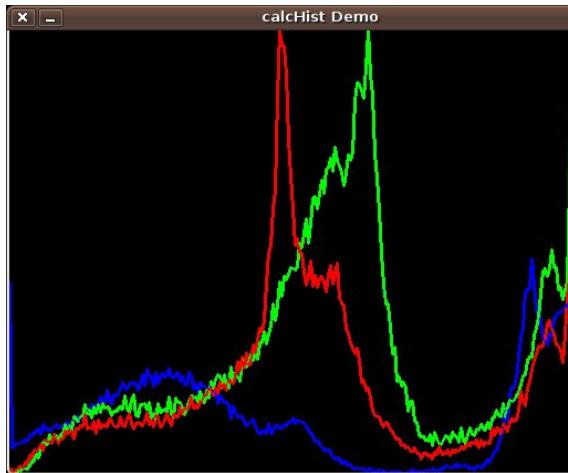
stars

unknown

Image Features



Edge Detection



Color Histogram



Pixel Segmentation

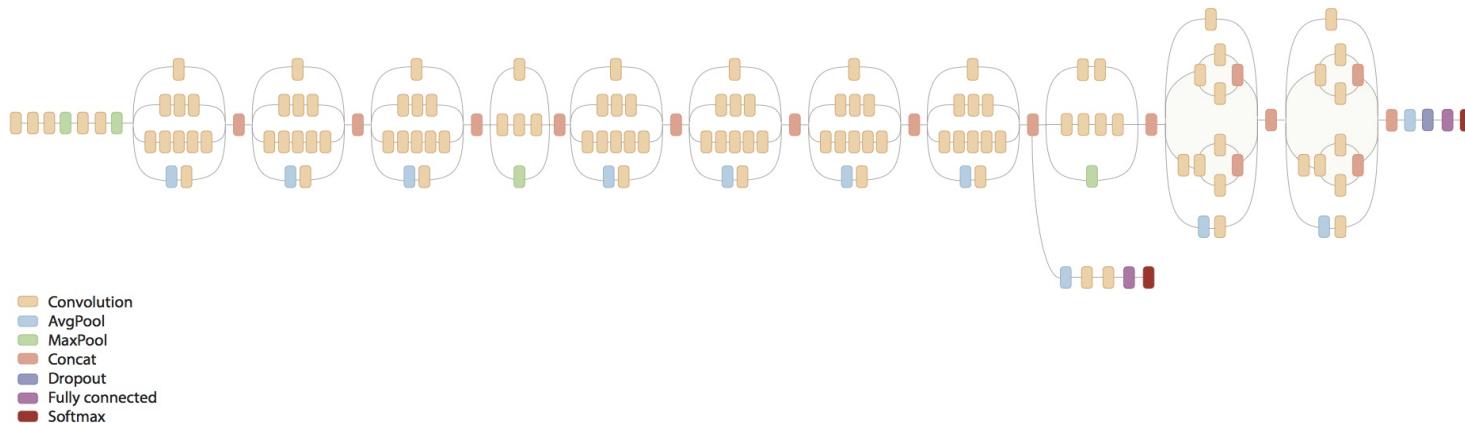


Convolutional Neural Networks

How to train?

- Google Inception-v3
- Pre-trained on ImageNet

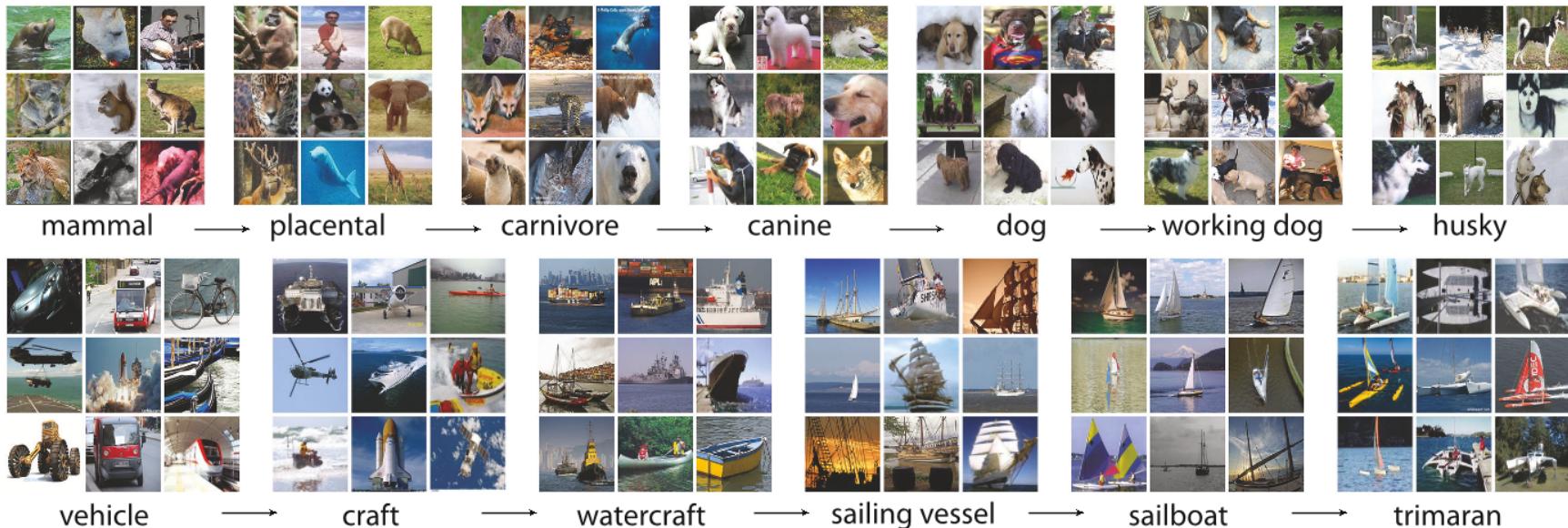
<http://download.tensorflow.org/models/image/imagenet/inception-v3-2016-03-01.tar.gz>



Source: <https://research.googleblog.com/2016/03/train-your-own-image-classifier-with.html>

IMAGENET

1,000,000 images, 1,000 categories



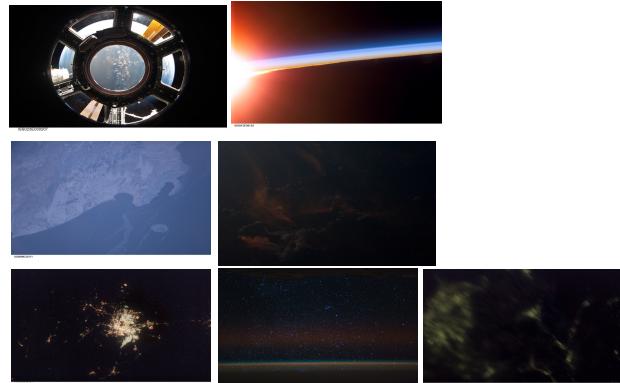
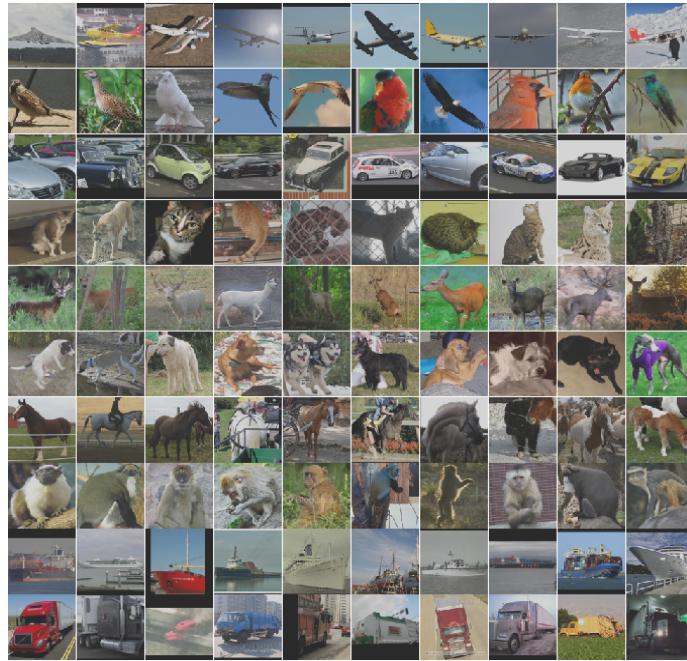
A snapshot of two root-to-leaf branches of ImageNet: the top row is from the mammal subtree; the bottom row is from the vehicle subtree. For each synset, 9 randomly sampled images are presented.

Why use a pre-trained model?

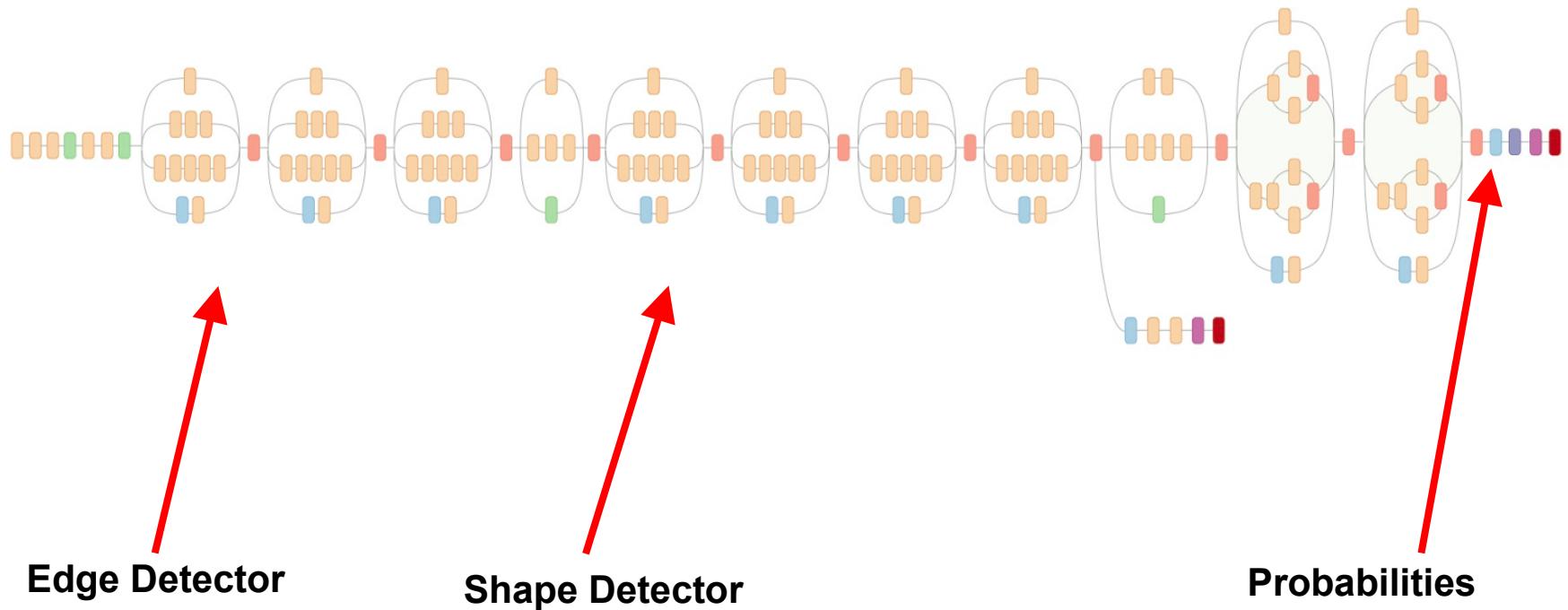
- It's faster (it's pre-trained)
- It's cheaper (no need for multiple GPUs)
- It generalizes (avoid overfitting)



Transfer Learning



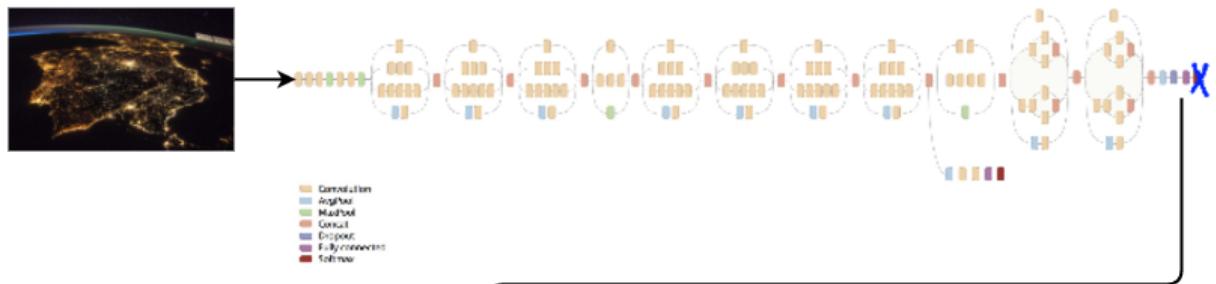
Structure of the Network



Edge Detector

Shape Detector

Probabilities



- Replace last softmax layer
- Fine-tune whole network

Softmax Layer	Class Index / Name
0.00	0 astronaut
0.00	1 aurora
0.00	2 black
0.95	3 city
0.00	4 none
0.05	5 stars
0.00	6 unknown

Performance

- 85% accuracy on the test set for single-crop prediction
- about 1 second per image