What kind of doggo is my pupper?

Using deep learning to identify dog breeds

Michael Dyer

Pupper

Doggo

About Me:

- Background in neuroscience
- Bad at identifying dog breeds

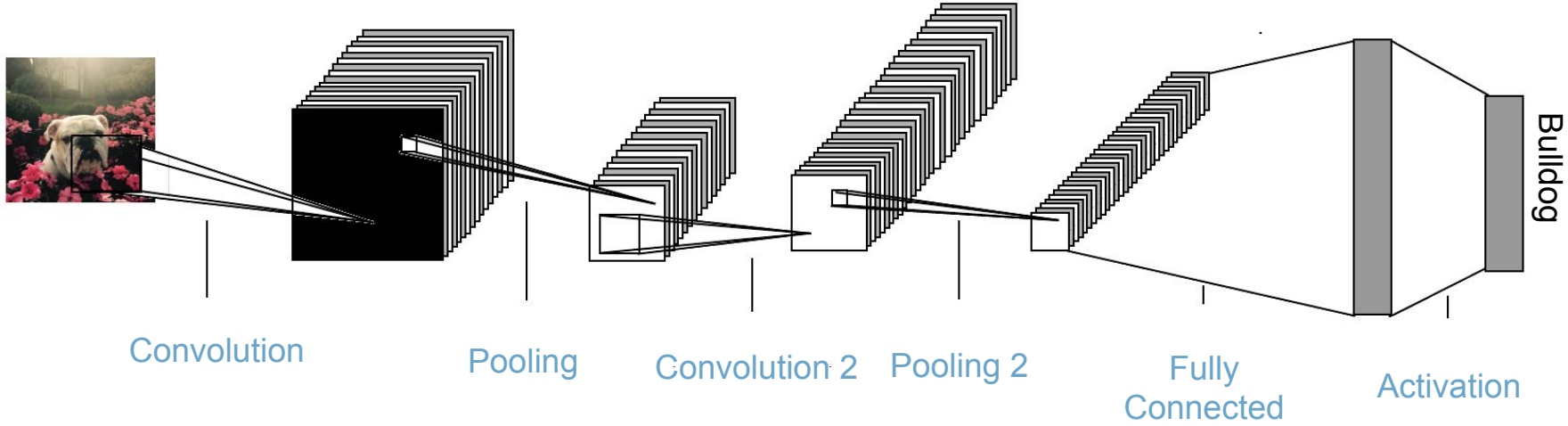
WeRateDogs™

Dataset generation

50,000 images

Of 188 breeds

Convolutional Neural Networks

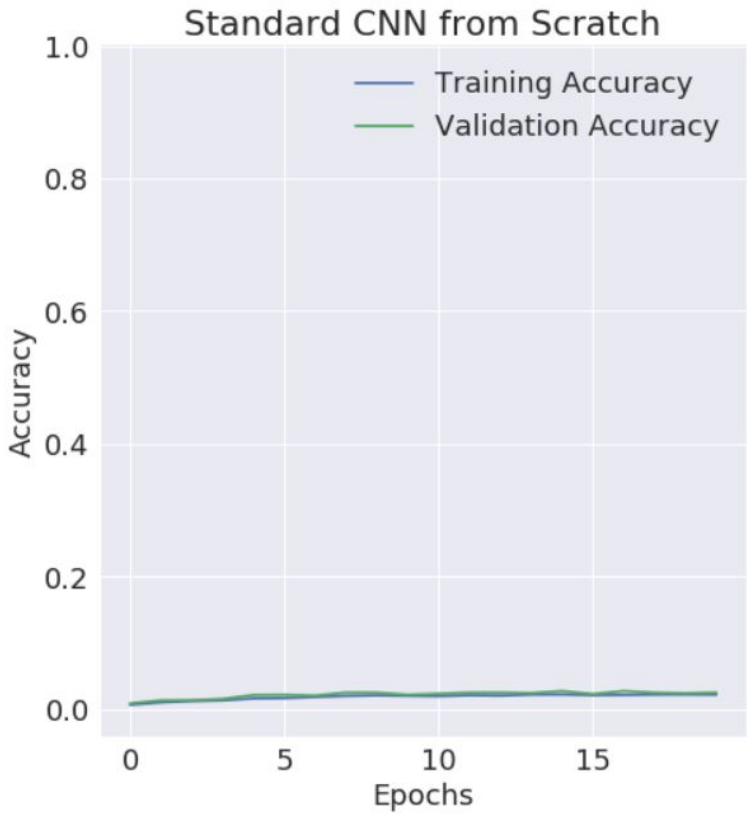


Convolutional neural networks (CNNs) draw inspiration from the human visual cortex to classify images

A simple CNN doesn't work very well...

Holdout Accuracy:

2.4%



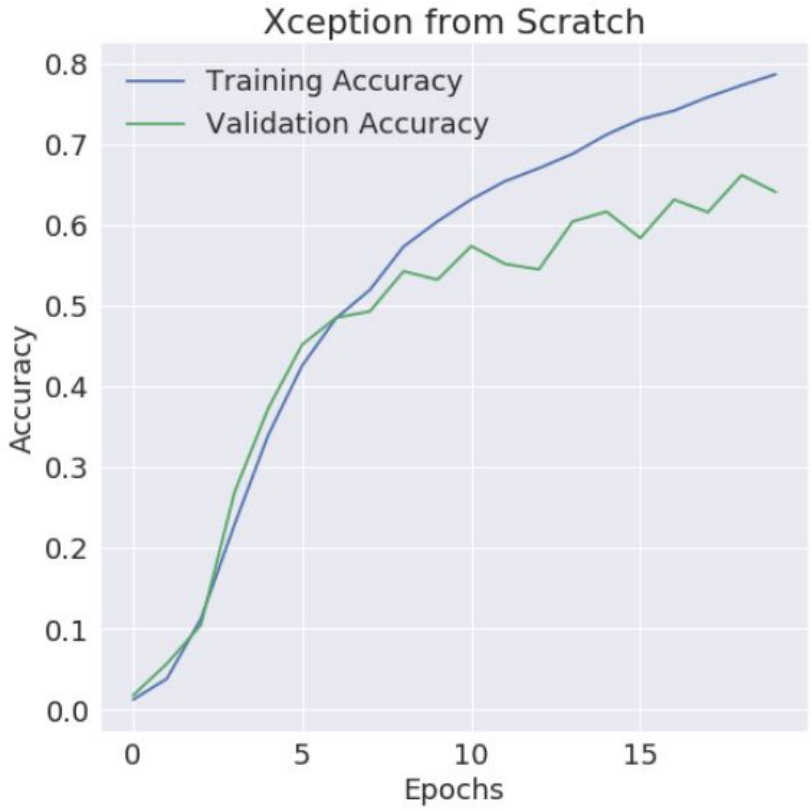
Let’s go deeper

- That model only had 12 layers with two convolutional (feature extraction) layers
- Let’s use an advanced model with 134 layers

Better!

Holdout Accuracy:

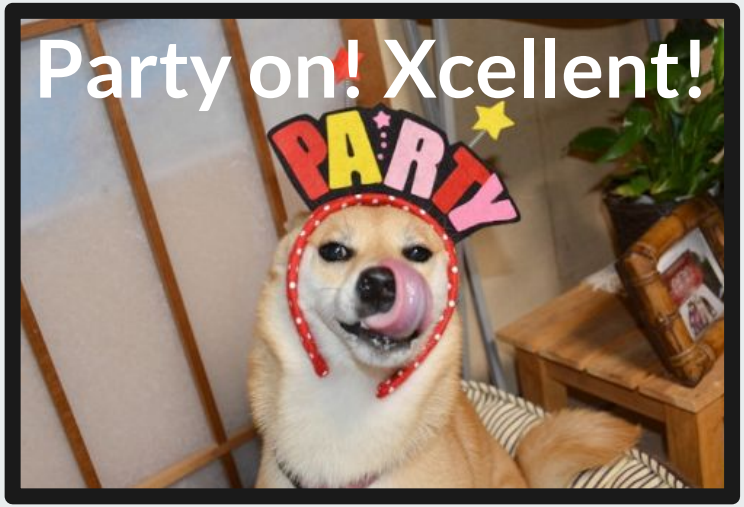
64.1%

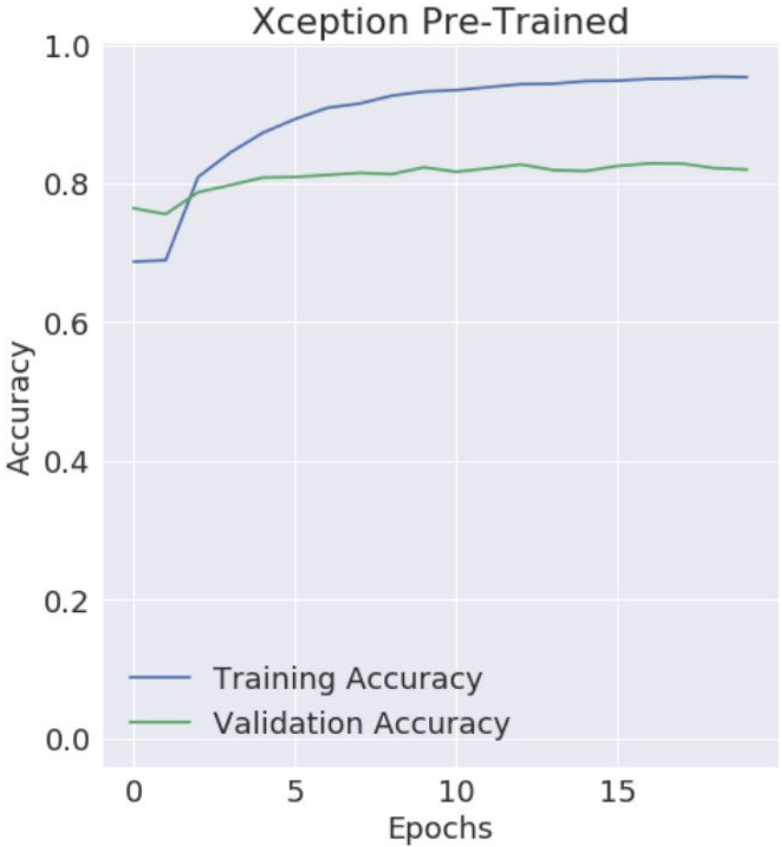


Transfer learning

- You wouldn’t expect a baby to tell the difference between a dachshund and a corgi…
  - Why should my network?
- Let’s try using a model called Xception that has been pre-trained on *millions* of images

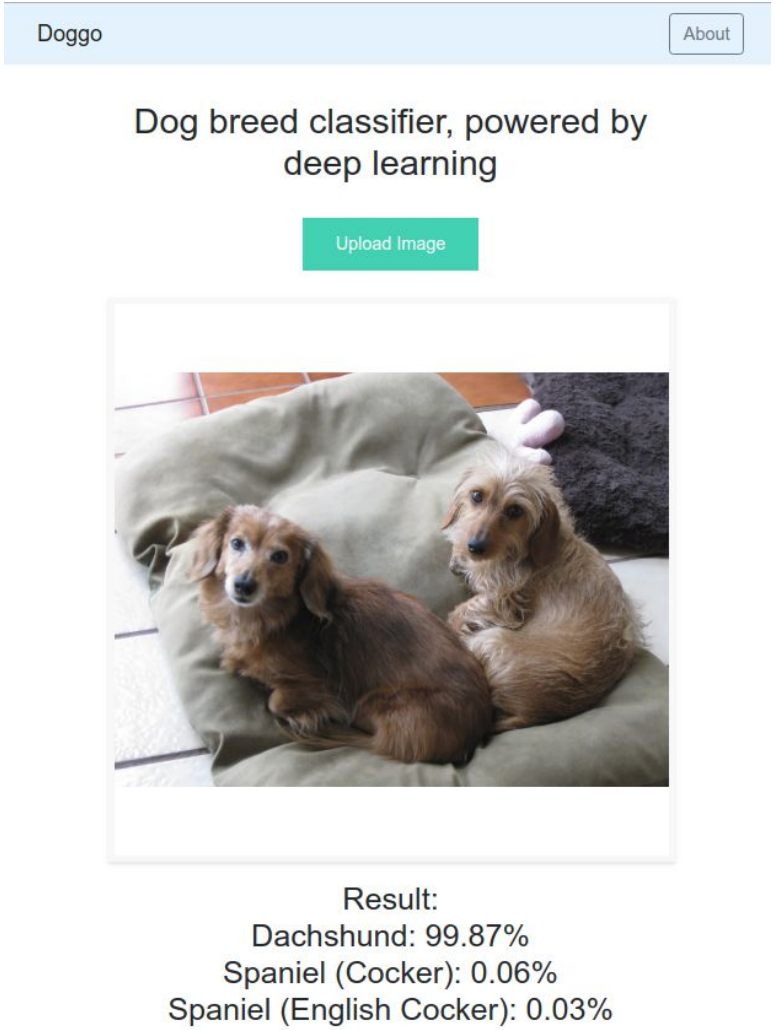
It's Xceptional!





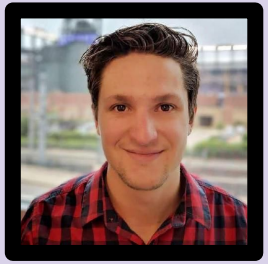
Doggo.name
(will be online in next week)

82% accuracy on the top result



Context & Future Work

- Outcomes:
  - High accuracy on many more breeds than similar apps
- Working on:
  - Better support for mixed breed dogs
  - 95% + Accuracy



Result:
Plott: 95.34%
Puli: 2.06%
Beauceron: 1.87%

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“What type of doggo is my pupper?”

Dog breed classification with deep learning

michaellouisdyer@gmail.com
github.com/michaellouisdyer
linkedin.com/in/michaellouisdyer

Stack

Keras

Pandas

amazon web services

Google Cloud Platform

NVIDIA

Flask

Appendix

References

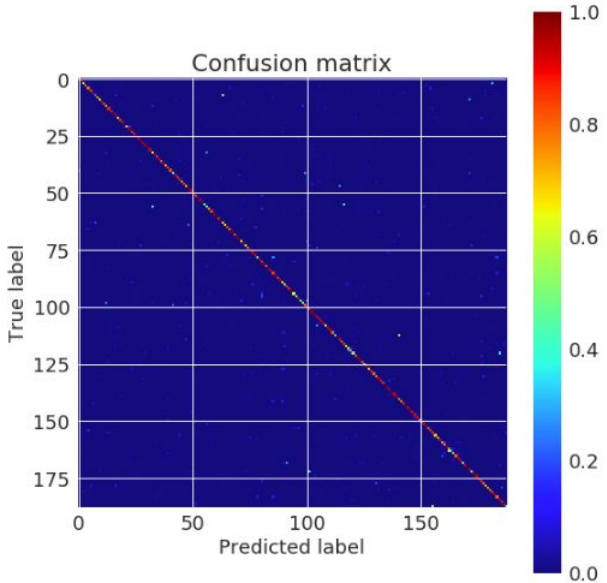
Fukushima, K. (1988). Neocognitron: A hierarchical neural network capable of visual pattern recognition. *Neural networks*, *1*(2), 119-130.

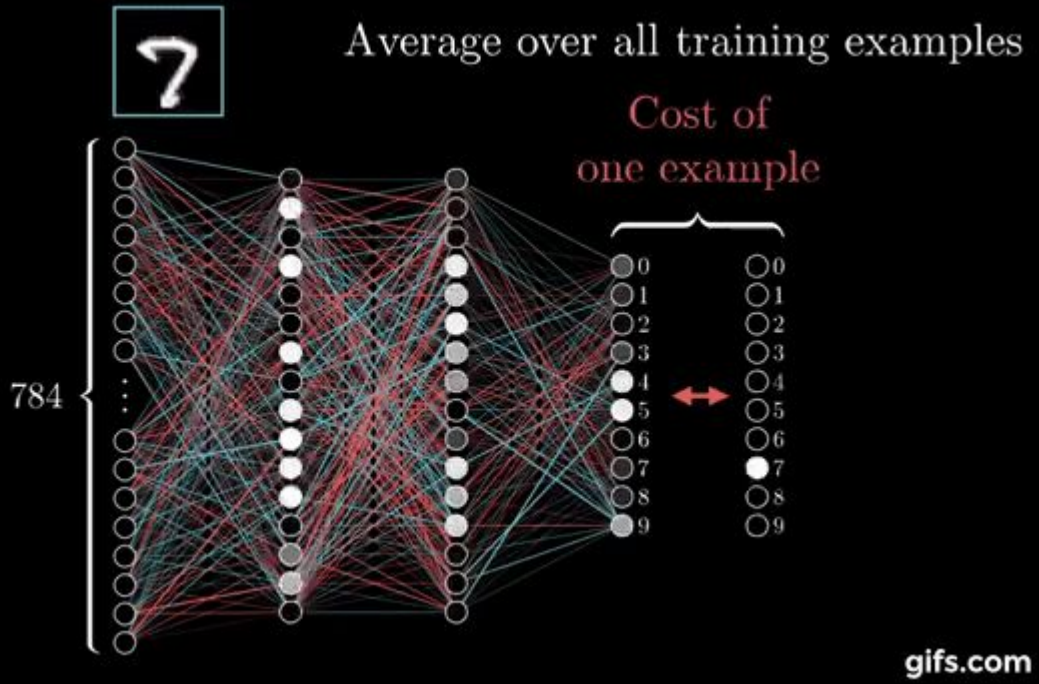
Chollet, F. (2017). Xception: Deep learning with depthwise separable convolutions. *arXiv preprint*, 1610-02357.

Gershgorn, D. (2017). The Data That Transformed AI Research—and Possibly the World. *Quartz, July, 26.*

Commonly confused dogs

Breed	Confused for	%
Spaniel (English Cocker)	Spaniel (Cocker)	64
Yorkshire Terrier	Silky Terrier	54
Standard Collie	Border Collie	39
Standard Schnauzer	Miniature Schnauzer	38
Norwich Terrier	Norfolk Terrier	29





Neural nets work by using the difference between the predicted and the actual outcome to update the strength of connections between nodes

Loss Function:

Categorical Cross Entropy

Binary

$$-(y\log(p)+(1-y)\log(1-p))$$

Multiclass

$$-\sum_{c=1}^{M} y_{o,c}\,\log(p_{o,c})$$

Training Machine

Google Cloud Deep Learning VM

16 vCPUs

4 NVIDIA Tesla P100 GPUs

104GB of RAM

40GB SSD

Image Classification

- It’s hard
- Modern technologies such as cloud computing and accessible neural network frameworks have make great improvements
- Image classification error in international contests decreased over 10x from 2010 to 2017[1]