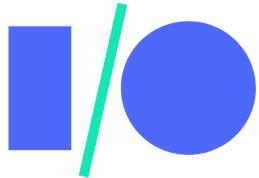


# Explore and have fun with TensorFlow



**Poo Kuan Hoong**

Google I/O Extended 2017 brings out  
the best Google technologies all the  
way from Mountain View to Kuala  
Lumpur.

22 July 2017

Google Malaysia, Kuala Lumpur



# About me



Poo Kuan Hoong, <http://www.linkedin.com/in/kuanhoong>



- Senior Data Scientist



- Senior Manager Data Science



- Senior Lecturer
- Chairperson Data Science Institute



- Founder R User Group & TensorFlow User Group
- Speaker/Trainer

# TensorFlow & Deep Learning Malaysia Group

The TensorFlow & Deep Learning Malaysia group's aims are:

- To enable people to create and deploy their own Deep Learning models built using primarily TensorFlow or other Deep Learning libraries.
- To build the key skill sets for this group from the combination of both beginner and intermediate models as well as advancing to the next level
- A knowledge sharing and presentations platform in relation to the cutting edge deep learning research papers and techniques.



# TensorFlow & Deep Learning Malaysia

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PINNED POST



Kuan Hoong created a poll.



Joined

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More



Write something...



Photo/Video



Feeling/Activity

...

ADD MEMBERS

+ Enter name or email address...



MEMBERS

256 members (77 new)



SUGGESTED MEMBERS



Kurt Orion G

Add Member

<https://www.facebook.com/groups/TensorFlowMY/>



# TensorFlow and Deep Learning Malaysia

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Kuala Lumpur,  
Malaysia

Founded Jul 4, 2017

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## Welcome!

[+ Schedule a new Meetup](#)

### Upcoming (1) [Calendar](#)

#### TensorFlow & Deep Learning Malaysia Inaugural Meetup

ASEAN Data Analytics Exchange (ADAX),  
Level 27, Tower B, The Vertical Business Suite,  
Avenue 3, Bangsar South, 59200, Kuala Lumpur ([map](#))



The TensorFlow and Deep Learning Malaysia welcomes you to the inaugural meet-up for the month of July 2017. The group's aim is to enable people to create and deploy...

[Learn more](#)

Thu Jul 6

7:00 PM

I'm going

2 going

0 comments

## What's new

NEW MEMBER

[Yap Wen Jiun](#)  
joined



Yesterday

NEW MEMBER

[Ng Chin Kit](#) joined



Yesterday

NEW MEMBER

[Vishnu Monn](#)  
joined



Yesterday

NEW RSVP

[John See](#) RSVPed  
Yes for [TensorFlow & Deep Learning Malaysia Inaugural Meetup](#)



Yesterday

<https://www.meetup.com/tensorflow-deep-learning-malaysia>



# Malaysia R User Group - (myRUG)

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Kuala Lumpur,  
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Founded Jun 5, 2016

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## Welcome to Malaysia R User Group (myRUG)

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Meetups

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You can schedule one!

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Oct 20, 2016 · 7:00 PM

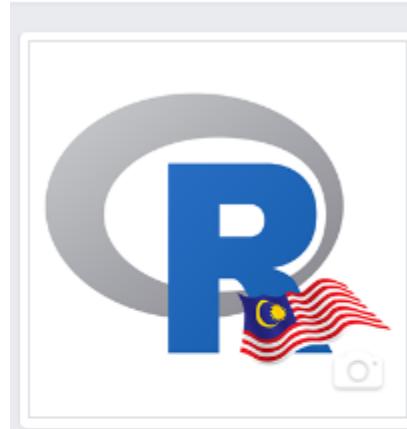
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## What's new



<https://www.meetup.com/MY-RUserGroup/>





## R User Group Malaysia

@rusergroupmalaysia

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224 likes

0 this week  
Andy Low and 18 other friends

226 follows

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309 post reach this week

The R User Group Malaysia is a diverse group that come together to discuss anything related to the R programming language.



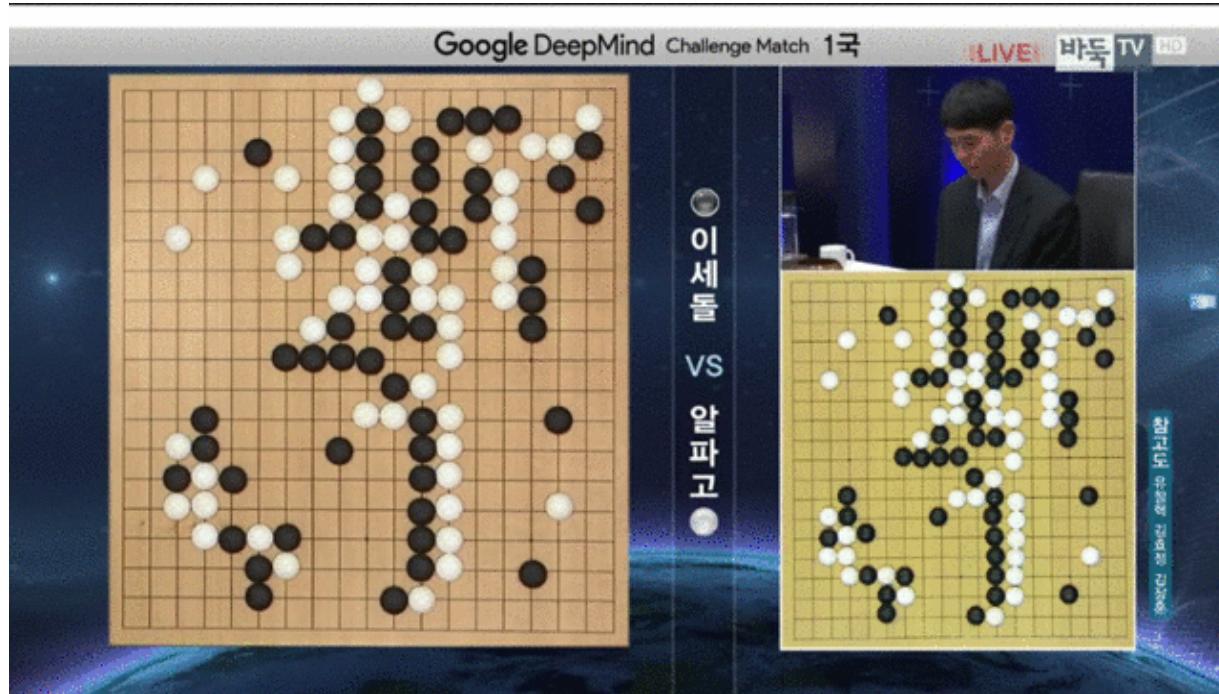
224 Likes

Andy Low and 18 other friends like this

<https://www.facebook.com/rusergroupmalaysia/>



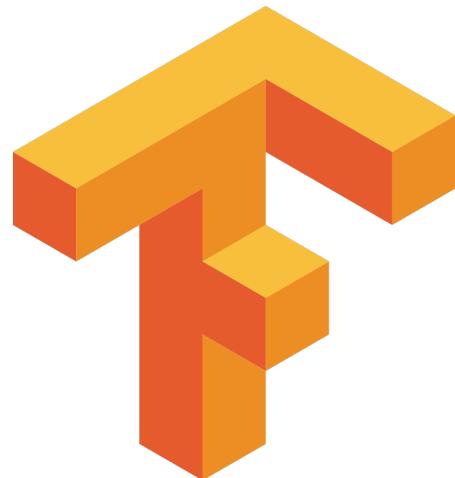
# Where we are now..



# Where we are now..



# Deep learning libraries



theano



Caffe

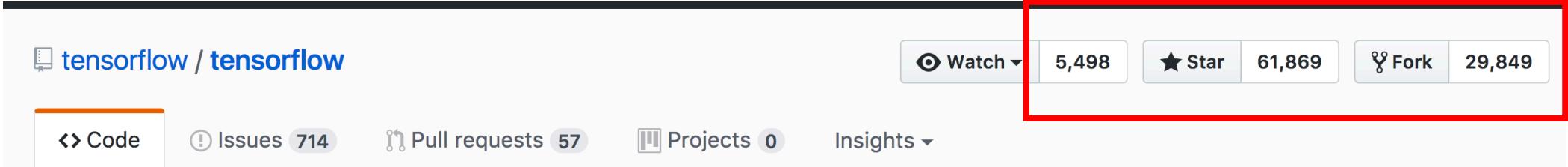


# What is TensorFlow?

- URL: <https://www.tensorflow.org/>
- Released under the open source license on November 9, 2015
- Current version 1.2
- Open source software library for numerical computation using data flow graphs
- Originally developed by Google Brain Team to conduct machine learning and deep neural networks research
- General enough to be applicable in a wide variety of other domains as well
- TensorFlow provides an extensive suite of functions and classes that allow users to build various models from scratch.



# Most popular on Github



tensorflow / tensorflow

Watch 5,498 Star 61,869 Fork 29,849

Code Issues 714 Pull requests 57 Projects 0 Insights

Computation using data flow graphs for scalable machine learning <http://tensorflow.org>

tensorflow machine-learning python deep-learning deep-neural-networks neural-network ml distributed

19,049 commits 16 branches 33 releases 917 contributors Apache-2.0

Branch: master New pull request Create new file Upload files Find file Clone or download

AnishShah committed with drpngx [issue #10835] Negative axis support for gradient of reduce\_prod (#11019) ... Latest commit ea79ba4 3 hours ago

tensorflow [issue #10835] Negative axis support for gradient of reduce\_prod (#11019) 3 hours ago

third\_party Add python import library on Windows (#10980) a day ago

tools Create tf\_env\_collect.sh 13 days ago

<https://github.com/tensorflow/tensorflow>



# TensorFlow architecture

- Core in C++
  - Low overhead
- Different front ends for specifying/driving the computation
  - Python, C++, R and many more



# TensorFlow Models

<https://github.com/tensorflow/models>

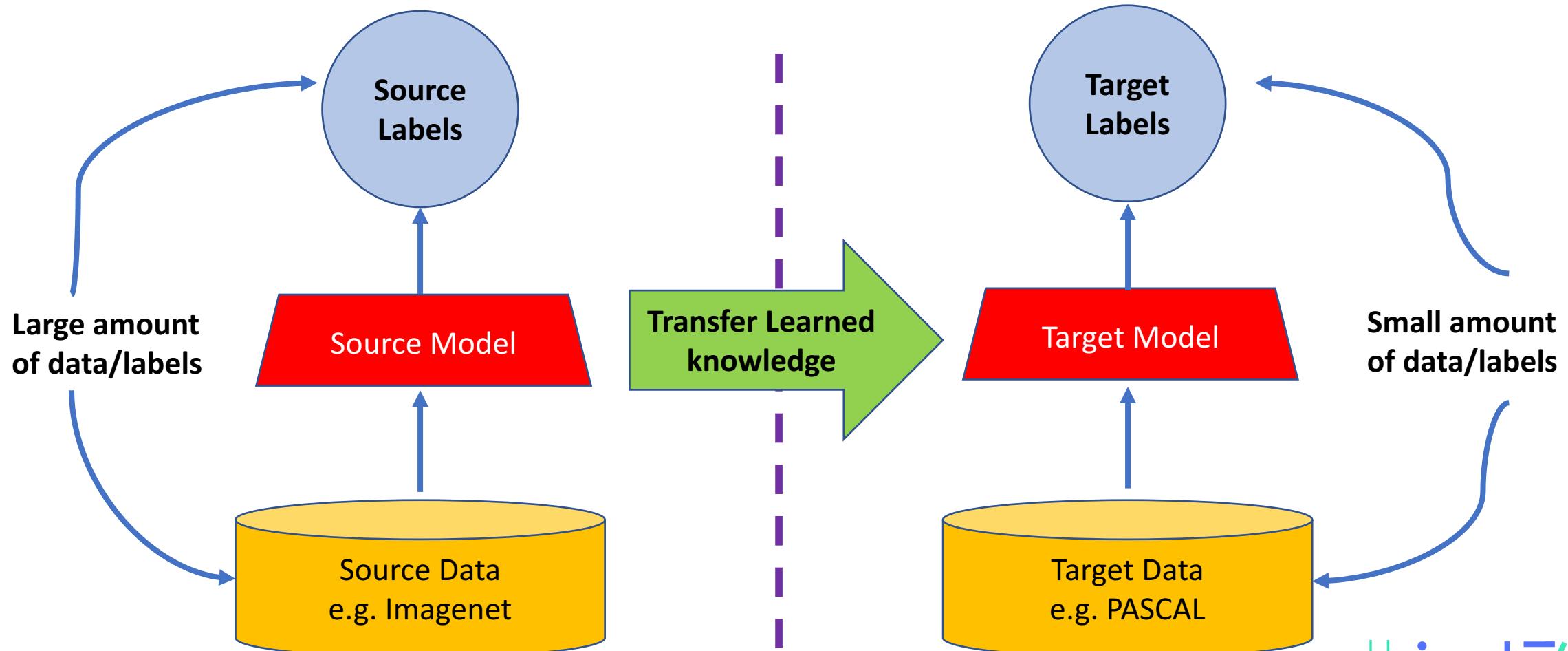
## Models

- [adversarial crypto](#): protecting communications with adversarial neural cryptography.
- [adversarial text](#): semi-supervised sequence learning with adversarial training.
- [attention ocr](#): a model for real-world image text extraction.
- [autoencoder](#): various autoencoders.
- [cognitive mapping and planning](#): implementation of a spatial memory based mapping and planning architecture for visual navigation.
- [compression](#): compressing and decompressing images using a pre-trained Residual GRU network.
- [differential privacy](#): privacy-preserving student models from multiple teachers.
- [domain adaptation](#): domain separation networks.
- [im2txt](#): image-to-text neural network for image captioning.
- [inception](#): deep convolutional networks for computer vision.

# Transfer Learning : Idea

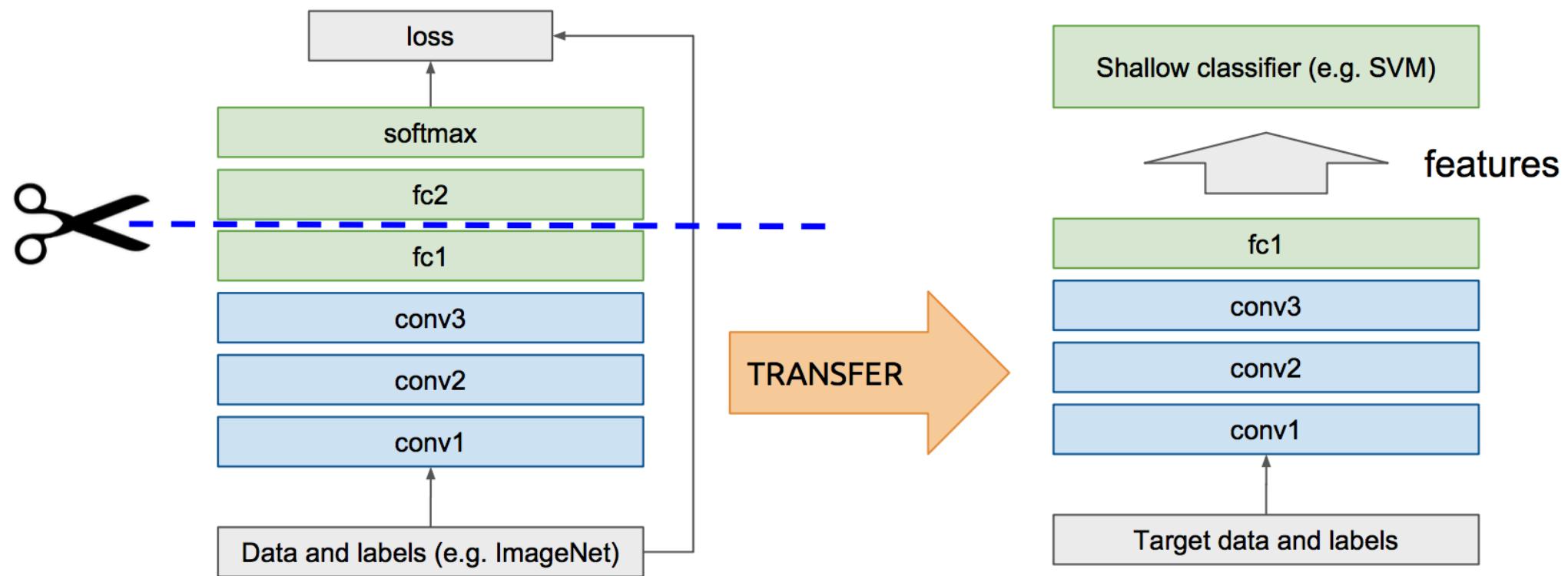
- Instead of training a deep network from scratch for your task:
  - Take a network trained on a different domain for a different **source task**
  - Adapt it for your domain and your **target task**

# Transfer Learning: Idea



# Off the Shelf

- Idea: use outputs of one or more layers of a network trained on a different task as generic feature detectors. Train a new shallow model on these features.

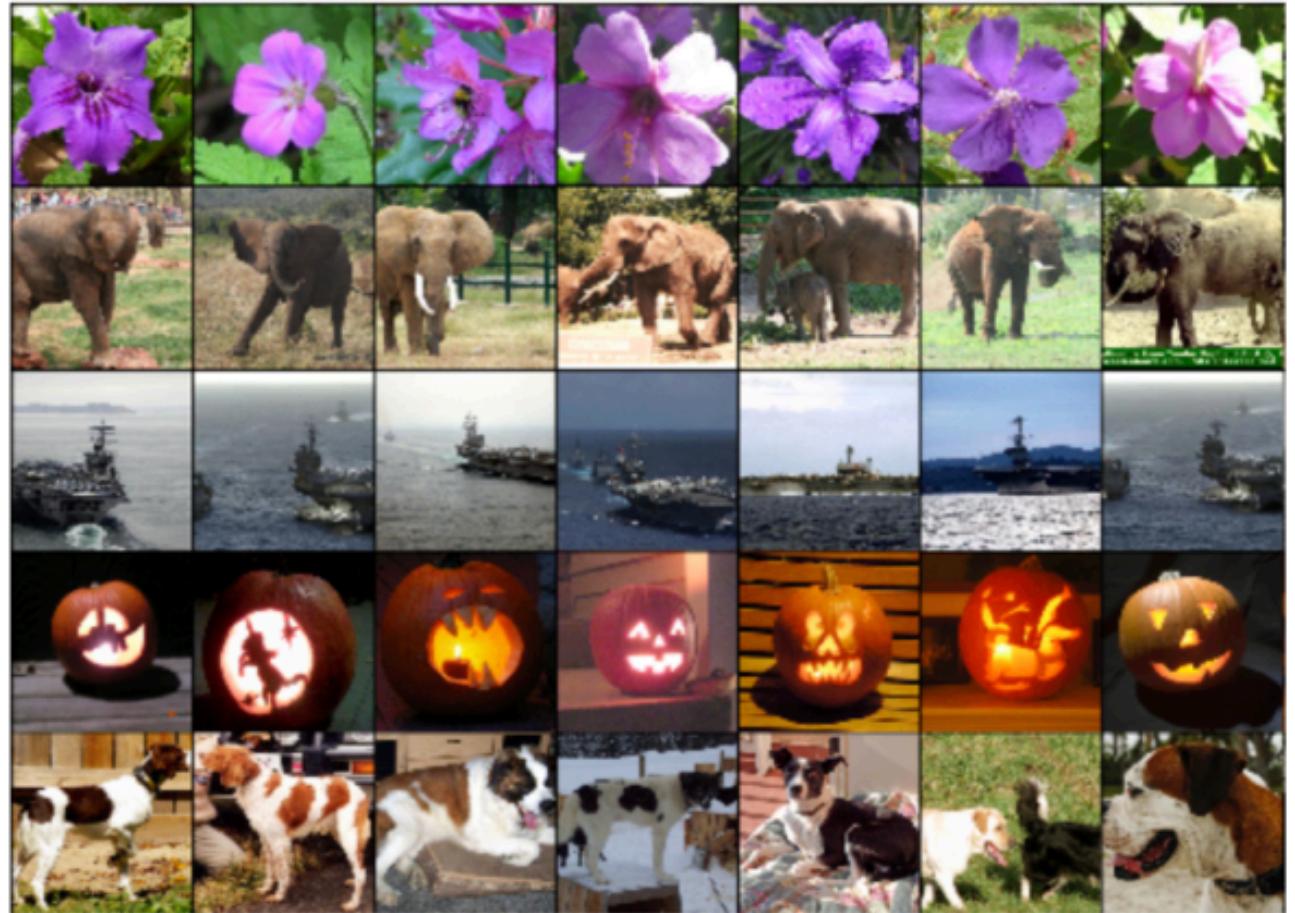


# Why use a pre-trained model?

- It is faster (it's pre-trained)
- It is cheaper (no need to have GPU farm)
- Achieve good accuracy

# ImageNet

- [ImageNet](#) is an image database organized according to the [WordNet](#) hierarchy (currently only the nouns), in which each node of the hierarchy is depicted by hundreds and thousands of images.
- Currently there are over five hundred images on average per node.

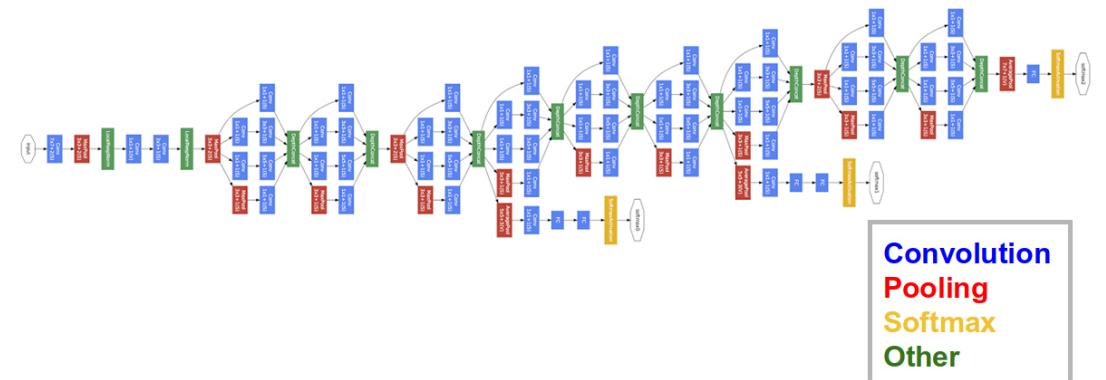


# Inception V3

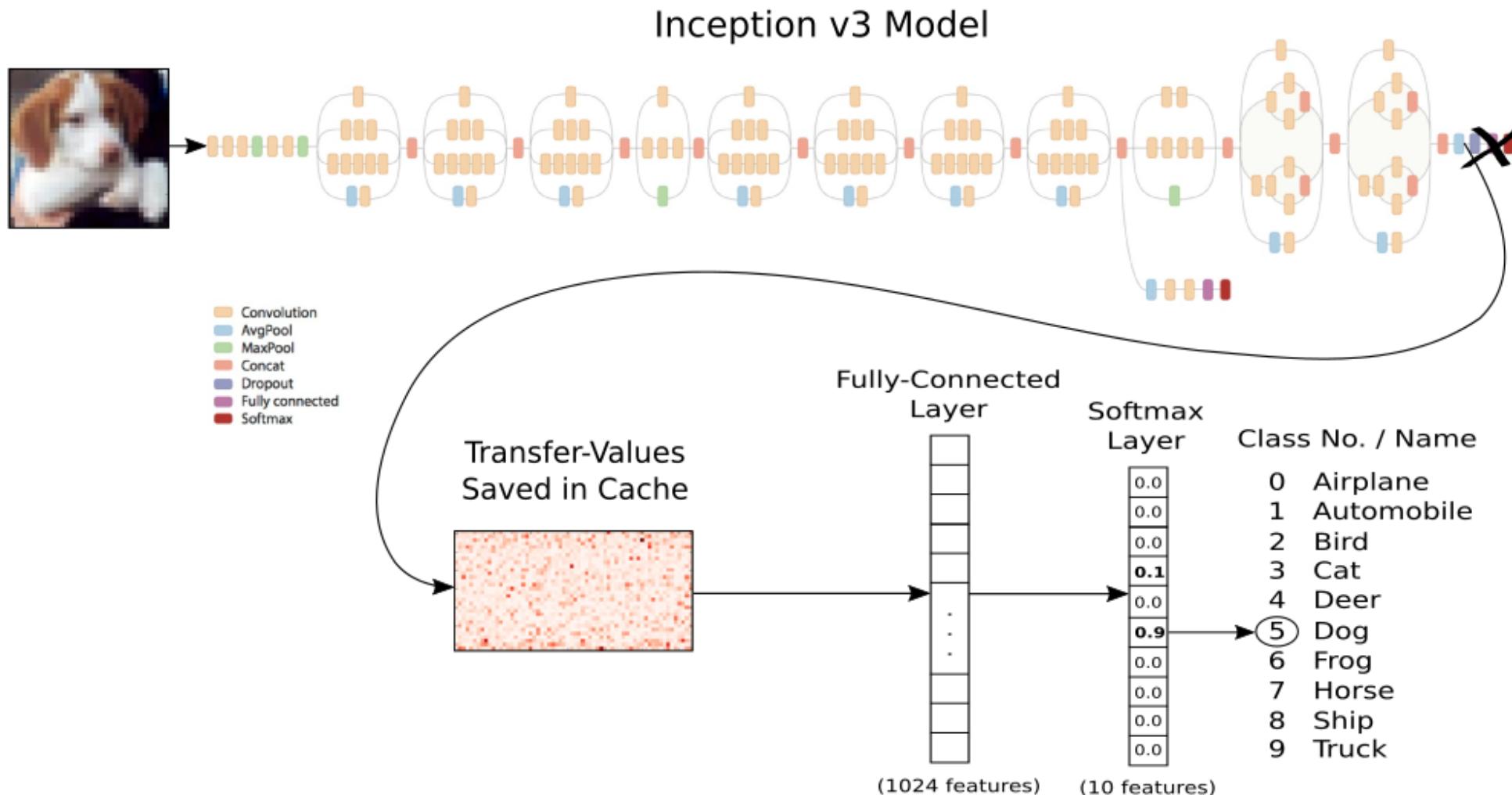
- [Inception-v3](#) is trained for the [ImageNet](#) Large Visual Recognition Challenge using the data from 2012.
- This is a standard task in computer vision, where models try to classify entire images into [1000 classes](#), like "Zebra", "Dalmatian", and "Dishwasher".



mite	container ship	motor scooter	leopard
mite	container ship	motor scooter	leopard
black widow	lifeboat	go-kart	jaguar
cockroach	amphibian	moped	cheetah
tick	fireboat	bumper car	snow leopard
starfish	drilling platform	golfcart	Egyptian cat



# Transfer Learning

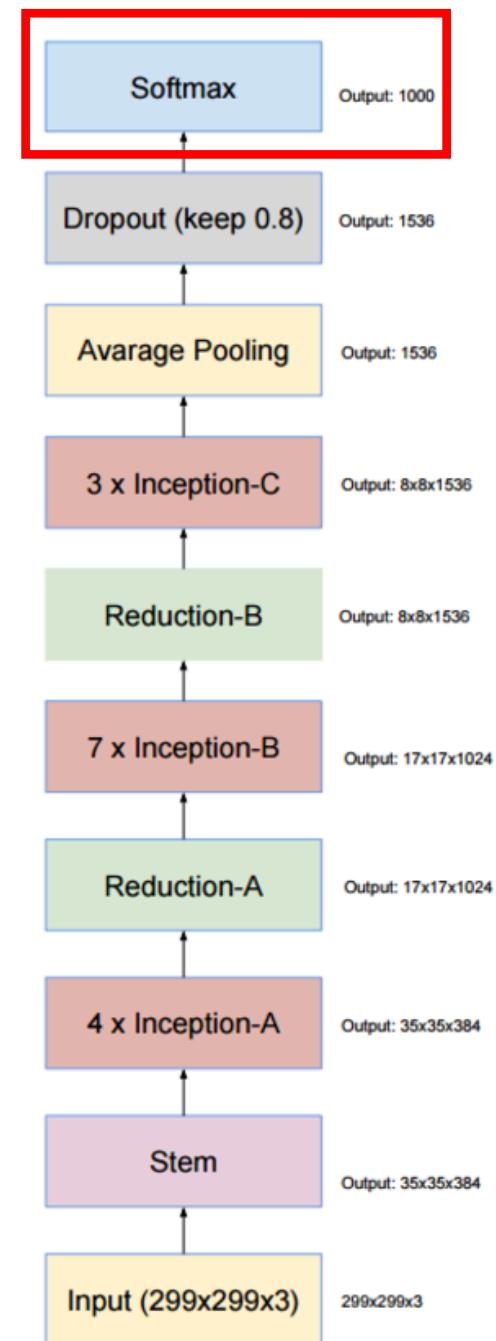


# Transfer Learning

- Pre-trained model has learned to pick out features from images that are useful in distinguishing one image (class) from another.
- Initial layer filters encode edges and color, while later layer filters encode texture and shape.
- Cheaper to “transfer” that learning to new classification scenario than retrain a classifier from scratch.

# Transfer Learning

- Remove the Fully Connected (Bottleneck layer) from pre-trained ImageNet Inception v3 model.
- Run images from Dataset through this truncated network to produce (semantic) image vectors.
- Use these vectors to train another classifier to predict the labels in training set.
- Prediction
  - Image needs to be preprocessed into image vector through truncated pre-trained ImageNet Inception v3 model.
  - Prediction made with second classifier against image vector



# Further Fine Tuning...

- Remove bottleneck (classifier) layer from pre-trained network.
- Freeze all weights except the last (few) convolutional layers.
- Attach your own classifier to the bottom.
- Train the resulting classifier with very low learning rate.
- Computationally more expensive than Transfer Learning but still cheaper than training network from scratch.
- More robust model.



# Transfer Learning with TensorFlow

- Transfer learning does not require GPUs to train
- Training across the training set (2,000 images) took less than a minute on my Macbook Pro without GPU support. This is not entirely surprising though, as the final model is just a [softmax regression](#).
- With TensorBoard, it is able to provide summaries that make it easier to understand, debug, and optimize the retraining.
- It is also able visualize the graph and statistics, such as how the weights or accuracy varied during training.
- [https://www.tensorflow.org/tutorials/image\\_retraining](https://www.tensorflow.org/tutorials/image_retraining)



# Demo

Slides & Codes available from Github:

<http://bit.ly/google-io-kl>

# Summary

- Possible to train very large models on small data by using transfer learning and domain adaptation
- Off the shelf features work very well in various domains and tasks
- Lower layers of network contain very generic features, higher layers more task specific features
- Supervised domain adaptation via fine tuning almost always improves performance



# Thanks!

## Questions?



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