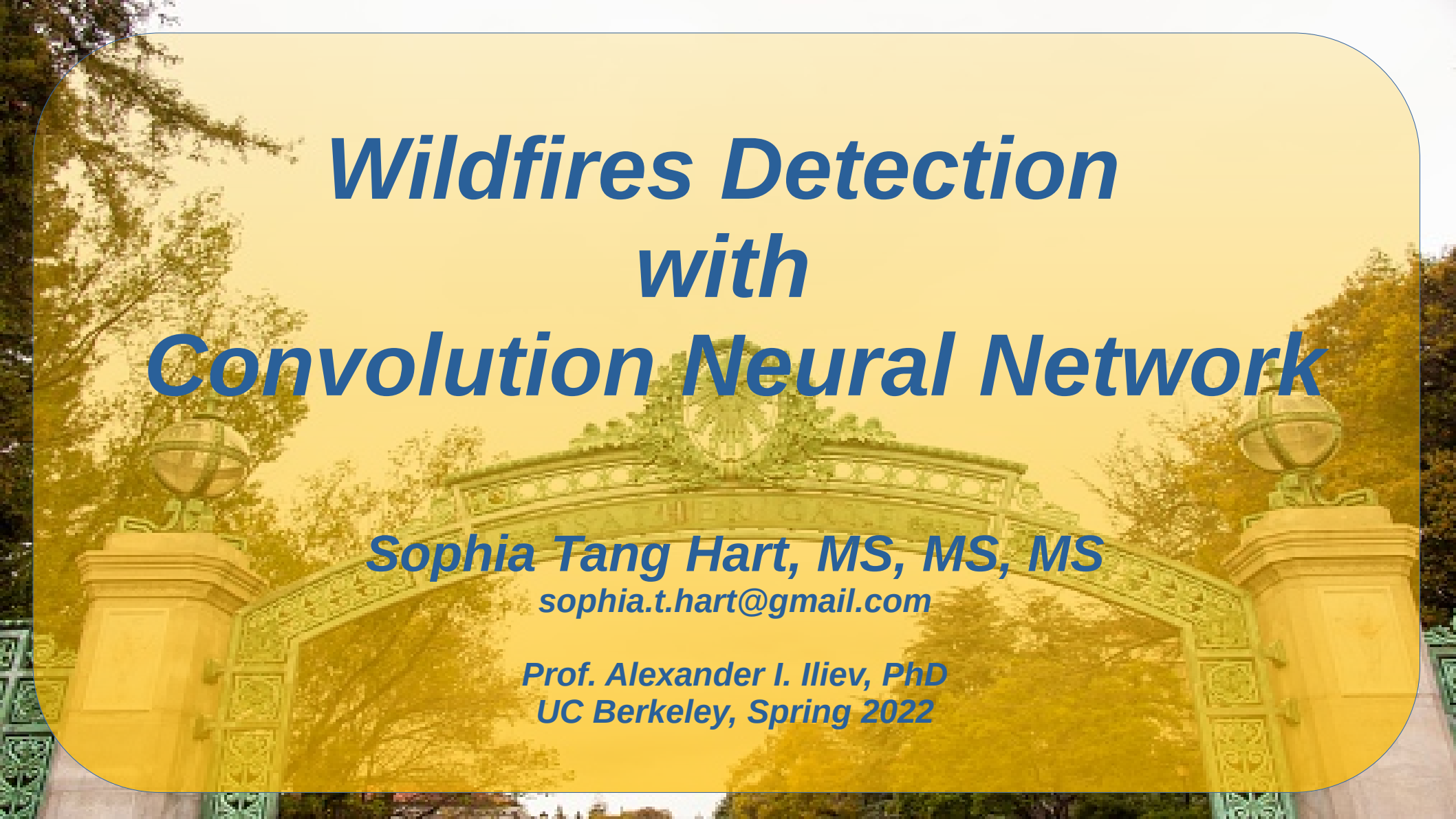

Wildfires Detection with Convolution Neural Network

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Motivation

Increase of CO_2 accumulation

→ Climate Change:

Temperature rise

Wildfires

Drought – agriculture

Less snow

Intense hurricanes

Arctic ice shrinkage

Sea level rise

Animals endangered

185 Wildfires in California, 2021

Month	Number of wildfires
January	10
February	0
March	3
April	10
May	24
June	51
July	36
August	27
September	14
October	9
November	1
December	0
Source	**Cal Fire incidents 2021**

Wildfires: Problem and Solution

Ways to Detect Wildfires

1. Infrared images from satellites (e.g. NOAA/NASA Suomi)
2. Images from camera towers (e.g. HPWREN)
3. People report

Problem: looking at images by human cause fatigue and error

Solution: Train models for computer vision (CNN)

Fire and nonfire images

Fire






Nonfire






Creating Dataset

Method 1: TFRecord

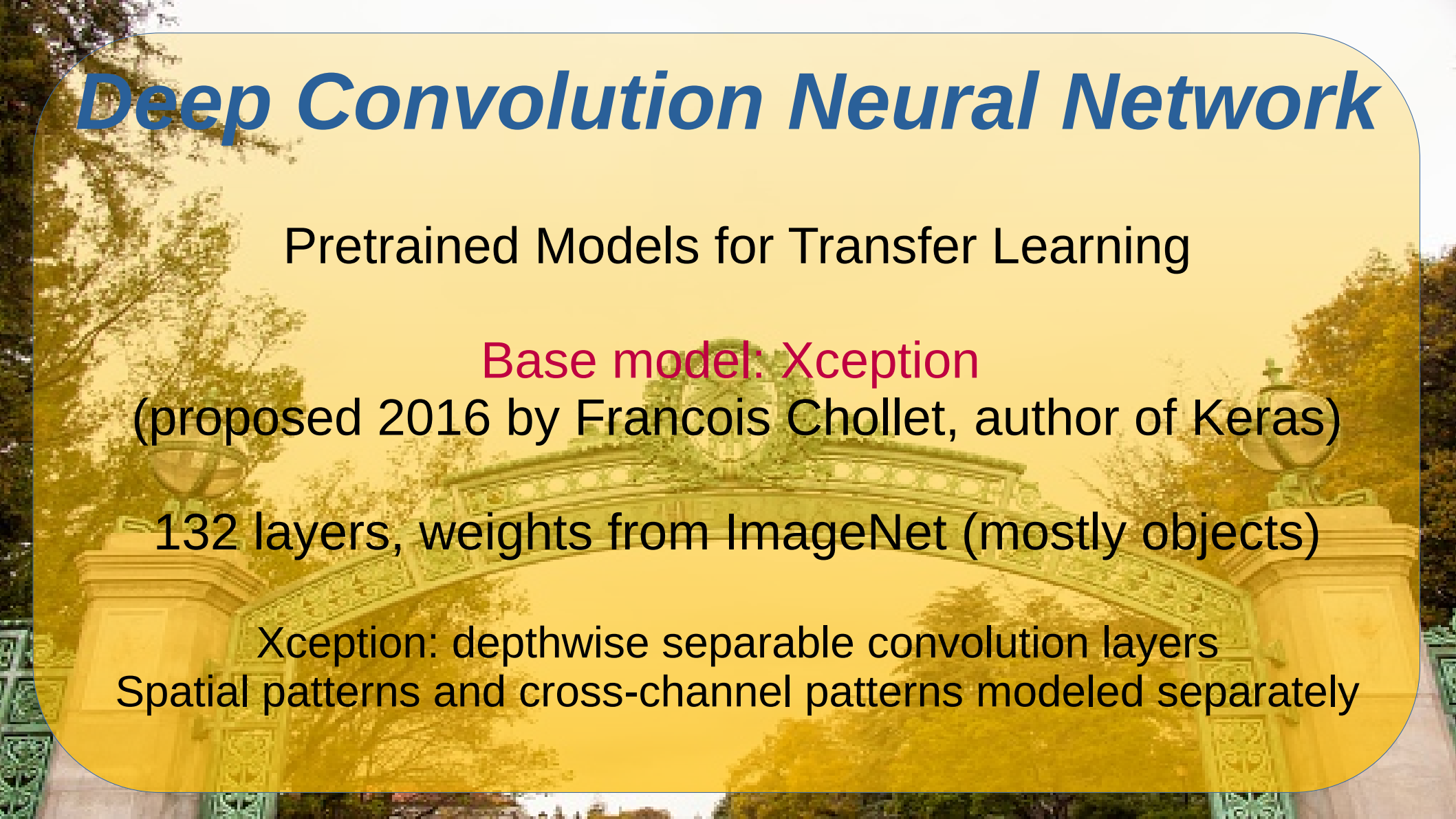
To create: decode_jpeg,
serialize_tensor,
write each example (image, label) to tfrecord
To extract tfrecord data: parse_single_example,
Then, iterator.get_next() for training model

→ Problem with dimensionality
Shape 30020 instead of 30000 (100x100x3)

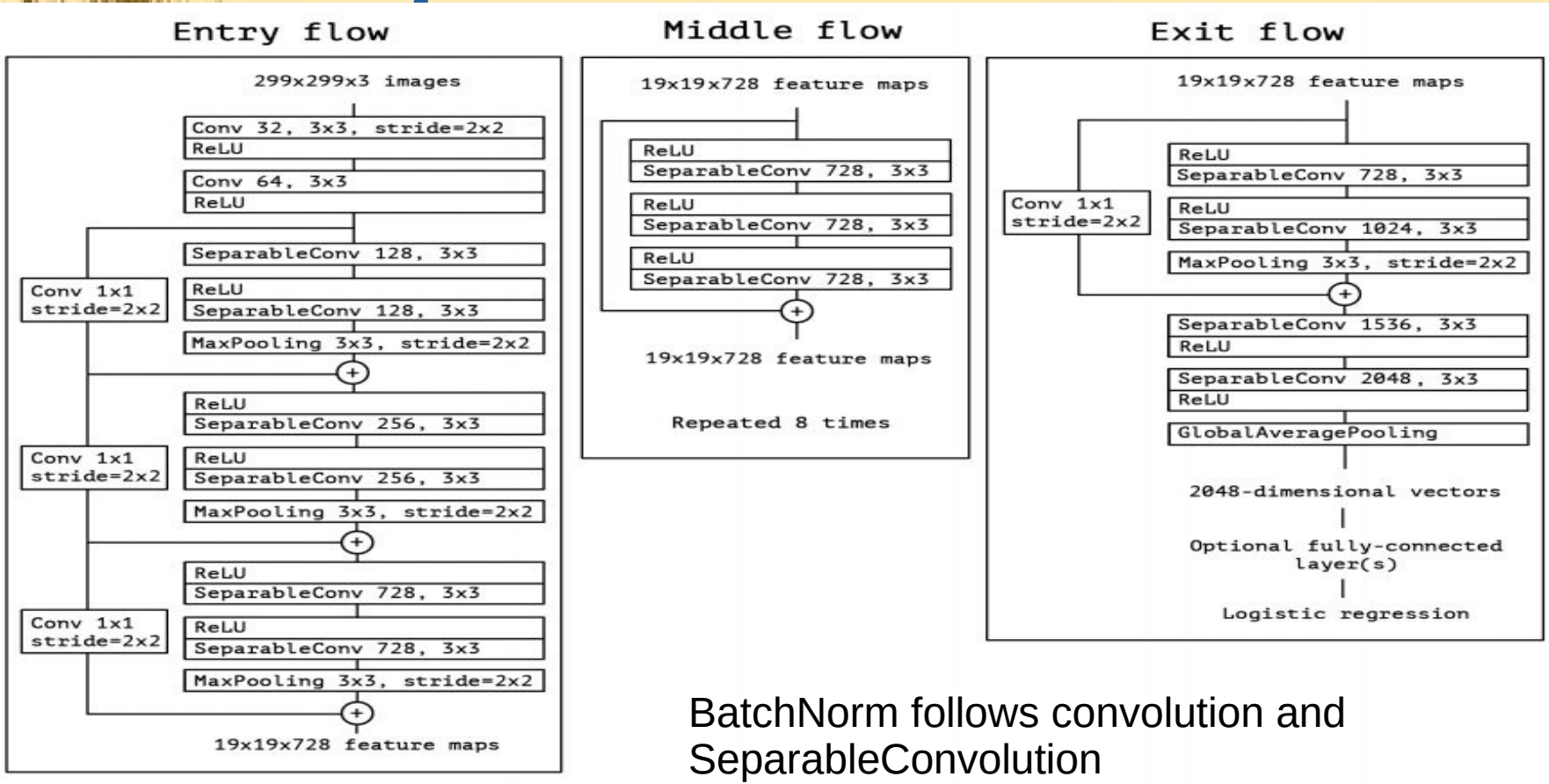
Creating Dataset

Alternative – Method 2: Write images and targets/labels to two separate files with same order

Fire 30 images
Nonfire 30 images
Data Augmentation (flips) becomes 240 images
Resize to 224 x 224
Keep 3 channels (color important feature of fires)


Deep Convolution Neural Network
Pretrained Models for Transfer Learning
Base model: Xception
(proposed 2016 by Francois Chollet, author of Keras)
132 layers, weights from ImageNet (mostly objects)
Xception: depthwise separable convolution layers
Spatial patterns and cross-channel patterns modeled separately

Xception Architecture

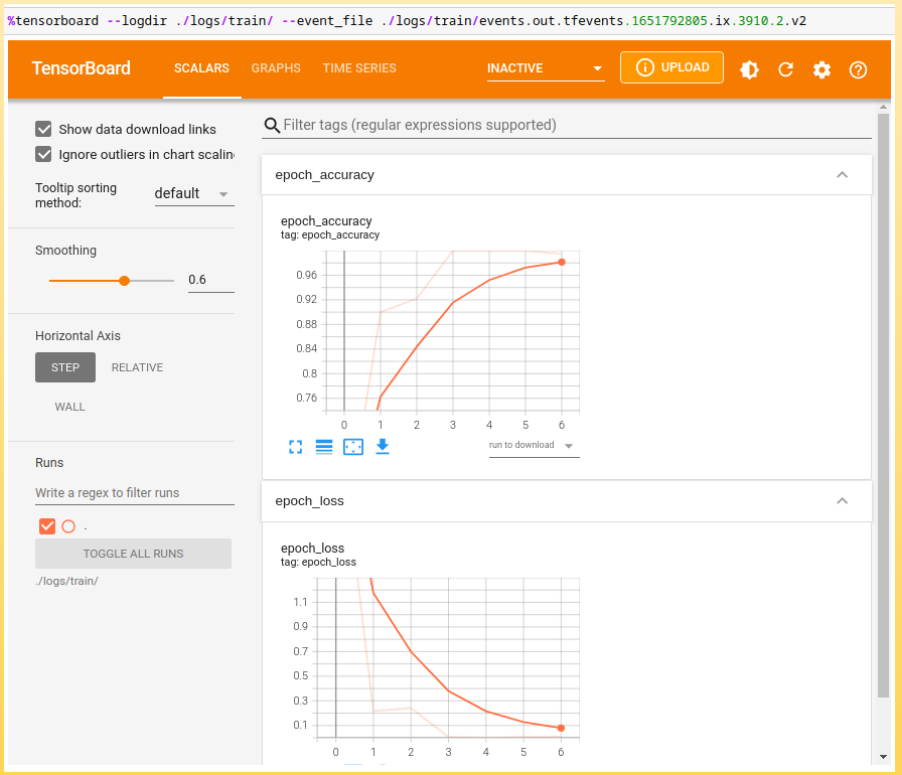


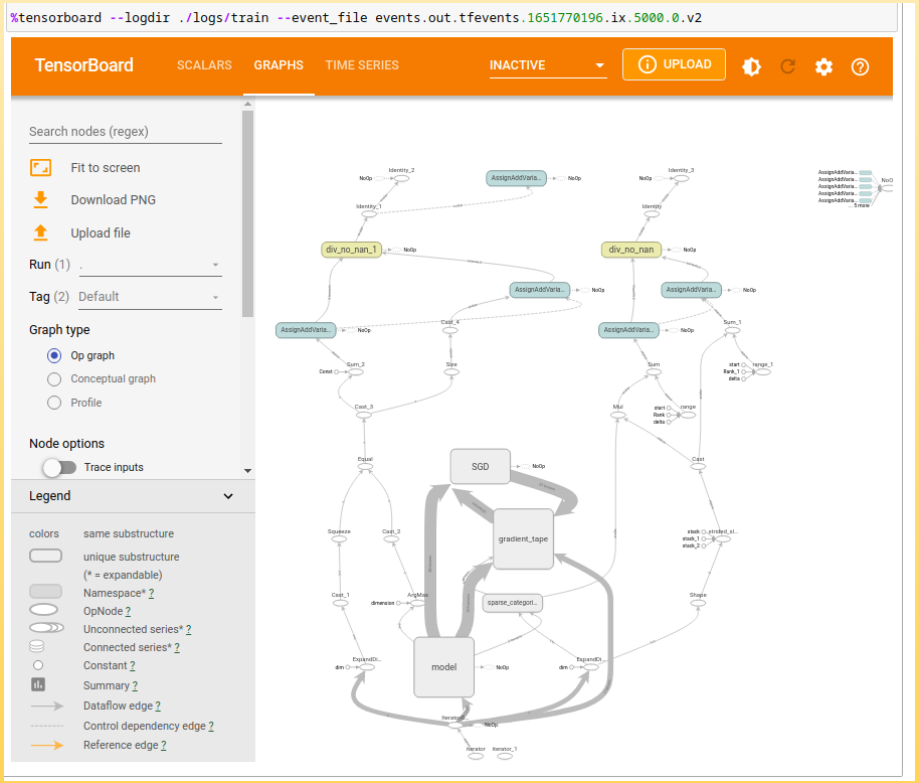
BatchNorm follows convolution and SeparableConvolution

Results

Review Jupyter Notebook

TensorBoard





Model Fine-tuning

1. Unfreeze top 22 layers, trainable weights

2. Add a dropout layer on the top layer

3. Change optimizer (SGD → Adam)

→ didn't improve accuracy,
but the last method gives no false negative.

Conclusion

CNN with Xception pretrained model achieves 95.7% accuracy on average across 10 runs of the program with different amount of data.

Computer vision with pretrained models is amazing in accuracy and simplicity.

Wildfire detection can be done with deep convolution neural network on images rather than human looking at them constantly.