DL Training Example

With TF Keras API

https://medium.com/tensorflow/training-and-serving-ml-models-with-tf-keras-fd975cc0fa27

Keras introduced in 2017 is a API for neural networks that runs on multiple backends such as Tensorflow 1.9, as tf.keras. Although tf.keras and Keras have separate code bases, they are tightly coupled.

Prerequisite: (1) TensorFlow, 1.11.0; (2) Keras

To find TF version, $python -c 'import tensorflow as tf; print(tf.__version__)'

To find keras version, $python -c 'import keras; print(keras.__version__)'

```
 python -c 'import keras; print(keras.__version__)'
Using TensorFlow backend.
2.2.4
```

Coding to Architecture

```
image_input = tf.keras.Input(shape=(IM_SIZE, IM_SIZE, 3), name='input_layer')
```

```
conv_1 = tf.keras.layers.Conv2D(32,
                                kernel_size=(3, 3),
                                padding='same',
                                activation='relu')(image_input)
```

```
conv_1 = tf.keras.layers.MaxPooling2D(padding='same')(conv_1)
```

```
conv_flat = tf.keras.layers.Flatten()(conv_2)
```

```
fc_1 = tf.keras.layers.Dense(128,
                             activation='relu')(conv_flat)
```

```
fc_1 = tf.keras.layers.Dropout(0.2)(fc_1)
```

```
import tensorflow as tf
import ast
import numpy as np
import math
import os
import random
import pandas as pd
```

Coding to Architecture

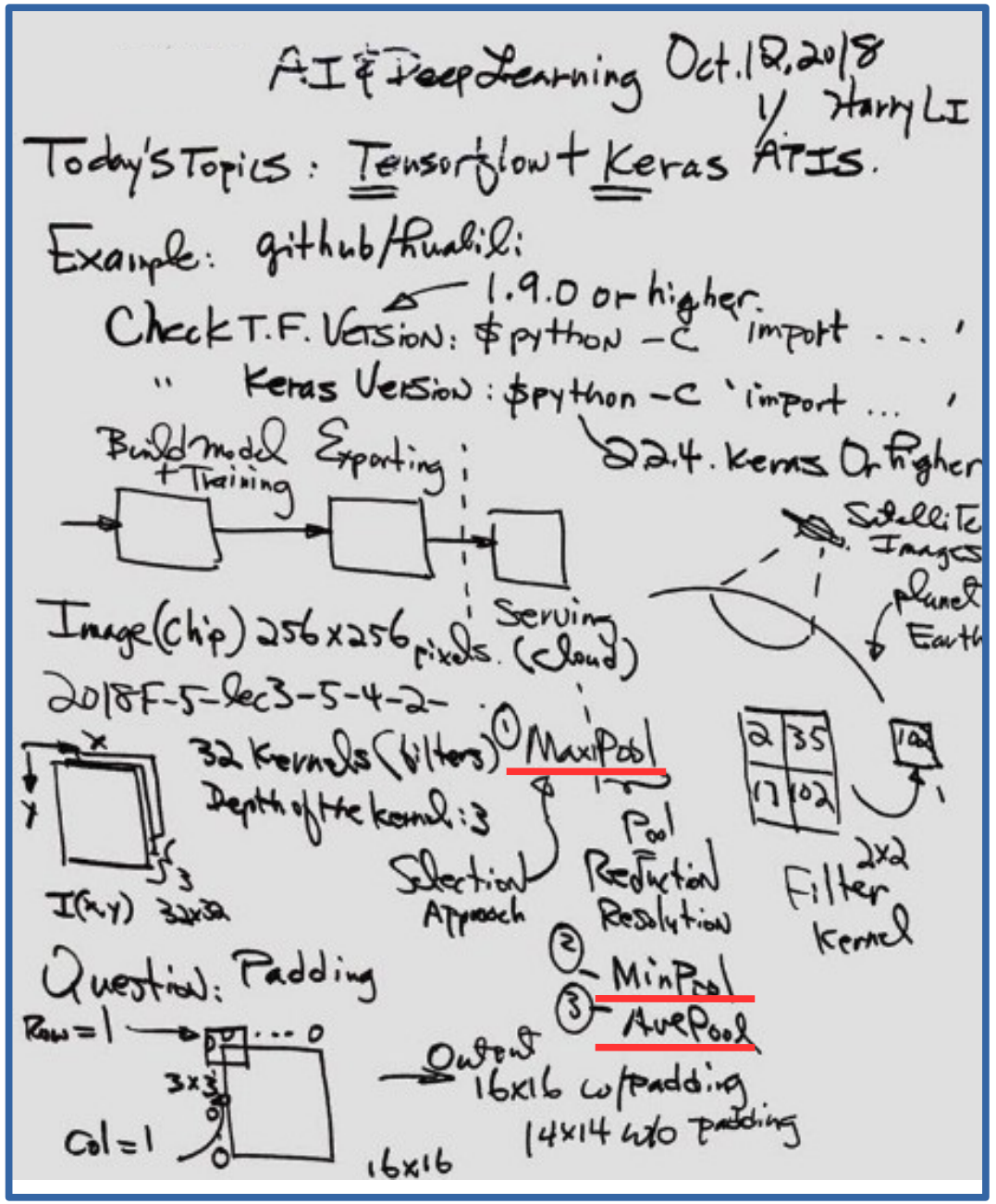
```
weather_output = tf.keras.layers.Dense(4,
                                       activation='softmax',
                                       name='weather')(fc_2)
```

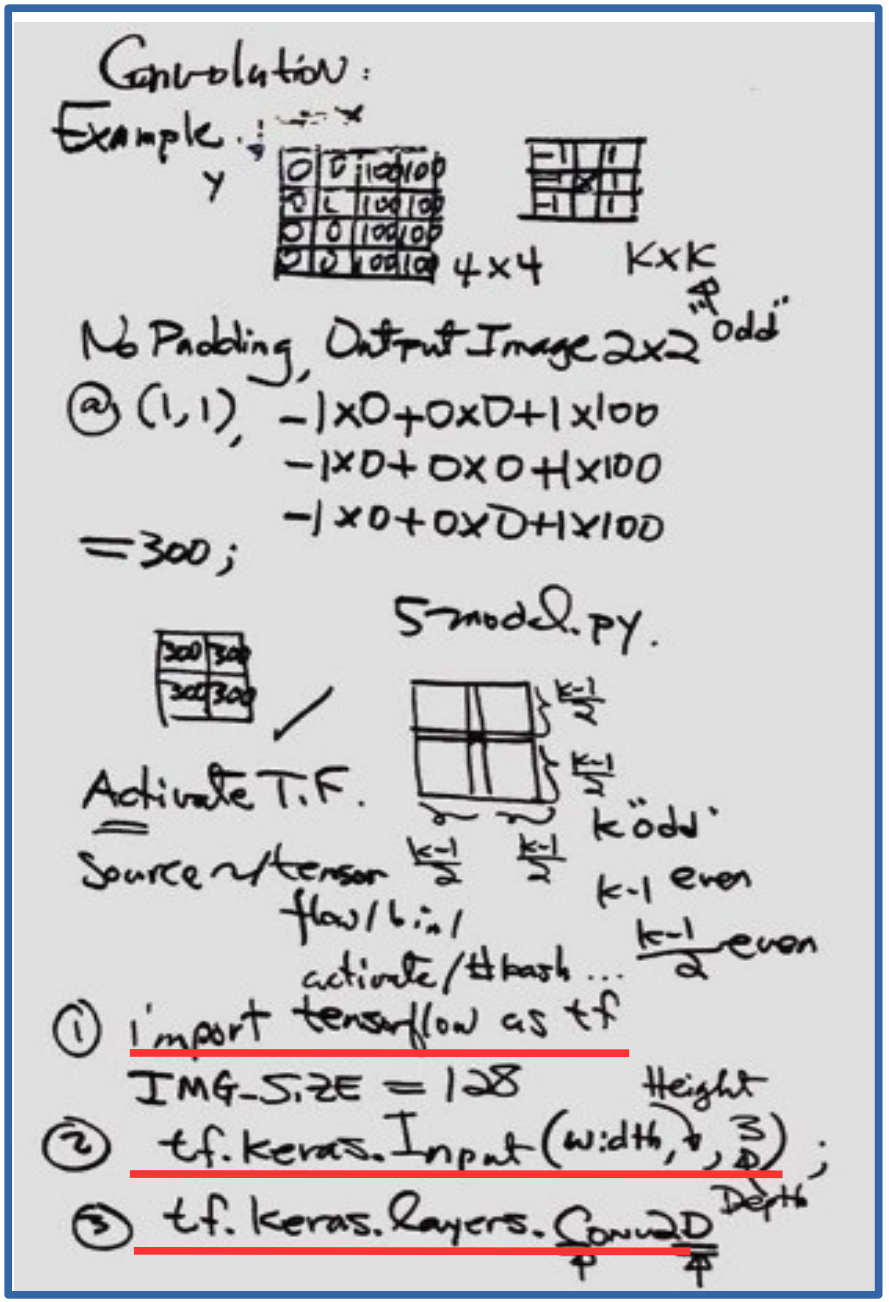
```
model = tf.keras.Model(inputs=image_input, outputs=[weather_output, ground_output])
```

```
model.compile(optimizer='adam',
              loss={'weather': 'categorical_crossentropy',
                    'ground': 'binary_crossentropy'})
```

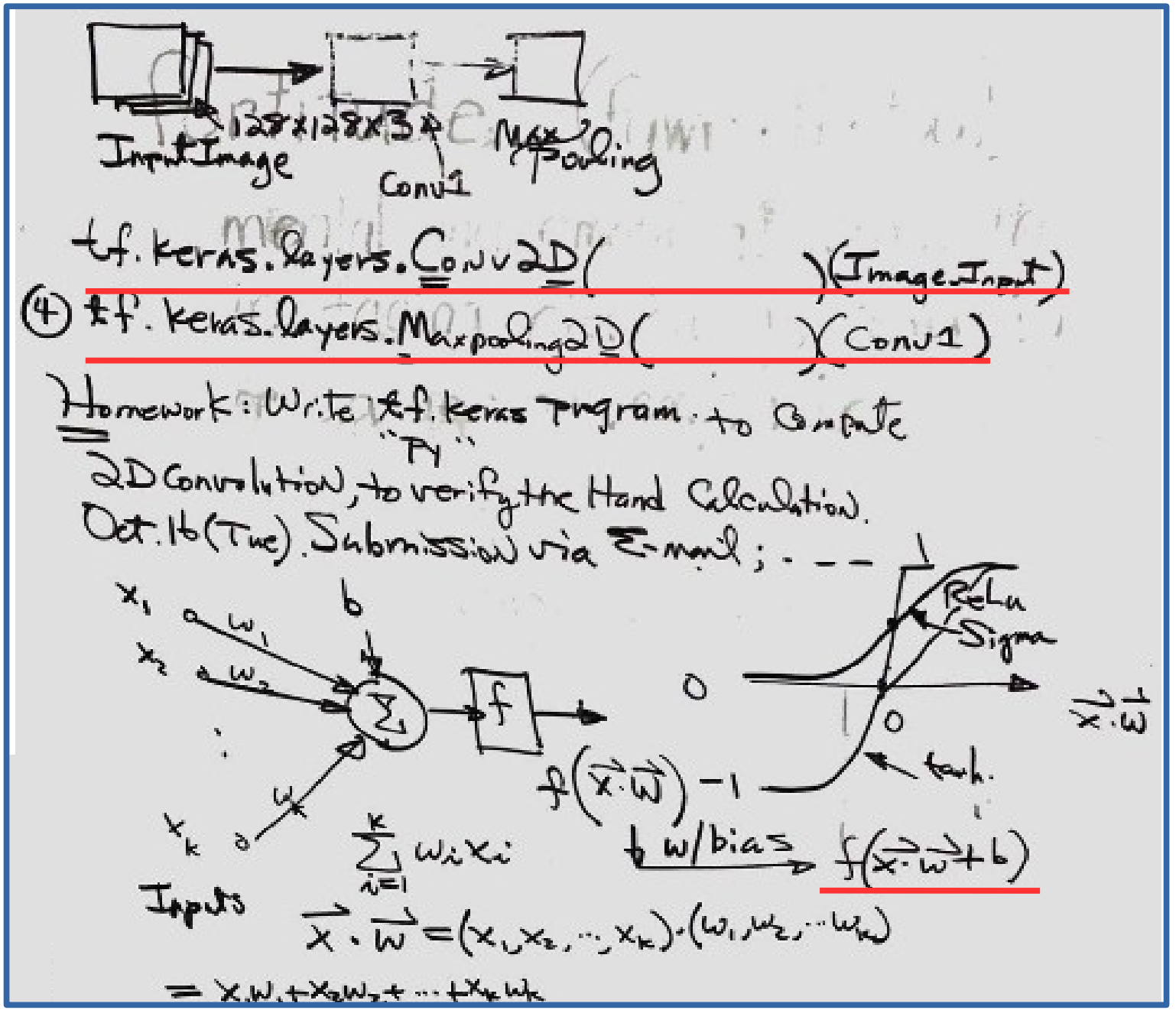
```
from tensorflow.keras.preprocessing.image import img_to_array as img_to_array
from tensorflow.keras.preprocessing.image import load_img as load_img
```

10-12-2018 AI Deep Learning with tf.keras Examples





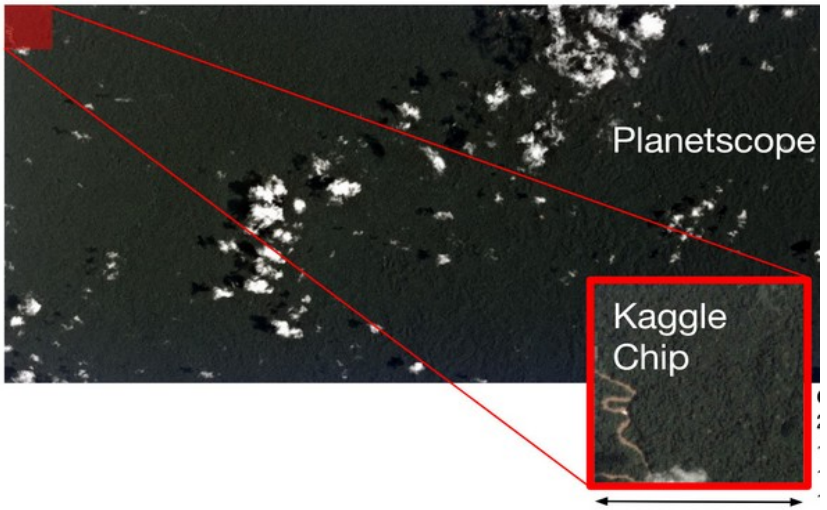
10-12-2018 First Neural Network Example with tf.keras



With Google Deep Learning Tool Tensorflow Keras

With Images From 4-band Planet Sensing Satellite

https://www.kaggle.com/c/planet-understanding-the-amazon-from-space/data



Chip (Image) Data Format: The chips were derived from Planet's full-frame analytic scene products using 4-band satellites in sun-synchronous orbit (SSO) and International Space Station (ISS) orbit. The set of chips use the GeoTiff format and each contain four bands of data: red, green, blue, and near infrared. The specific spectral response of the satellites can be found in the Planet documentation. Each channel is in 16-bit digital number format, and meets the specification of the Planet four band analytic ortho scene product.

Harry Li, Ph.D.

Image Labels Example

https://www.kaggle.com/c/planet-understanding-the-amazon-from-space/data

The image is available for download on Kaggle. The training data consists of approximately 40000 labeled images of the Amazon rain forest. Each image is associated with multiple labels:

Exactly one ‘weather’ label: clear, haze, cloudy or partly cloudy
One or more ‘ground’ labels: agriculture, bare ground, habitation, road, water…

A Pandas DataFrame For Image Labels

https://www.kaggle.com/c/planet-understanding-the-amazon-from-space/data

```
image_name,weather_labels,ground_labels
train_0,"[0, 0, 1, 0]","[0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0]"
train_1,"[1, 0, 0, 0]","[1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1]"
train_2,"[1, 0, 0, 0]","[0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0]"
train_3,"[1, 0, 0, 0]","[0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0]"
train_4,"[1, 0, 0, 0]","[1, 0, 0, 0, 0, 0, 0, 1, 1, 1, 0, 0, 0]"
train_5,"[0, 0, 1, 0]","[0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1]"
train_6,"[1, 0, 0, 0]","[1, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 1]"
```

pandas.DataFrame

```
In [1]: import pandas as pd

In [2]: import numpy as np

In [3]: import matplotlib.pyplot as plt
```

```
In [9]: df
Out[9]:
                   A         B         C         D
2013-01-01  0.469112 -0.282863 -1.509059 -1.135632
2013-01-02  1.212112 -0.173215  0.119209 -1.044236
2013-01-03 -0.861849 -2.104569 -0.494929  1.071804
2013-01-04  0.721555 -0.706771 -1.039575  0.271860
2013-01-05 -0.424972  0.567020  0.276232 -1.087401
2013-01-06 -0.673690  0.113648 -1.478427  0.524988
```

https://pandas.pydata.org/pandas-docs/stable/10min.html

Build DL Model

```
import tensorflow as tf
IM_SIZE = 128
image_input = tf.keras.Input(shape=(IM_SIZE, IM_SIZE, 3), name='input_layer')
# Some convolutional layers
conv_1 = tf.keras.layers.Conv2D(32,kernel_size=(3, 3),
                                padding='same',
                                activation='relu')(image_input)
conv_1 = tf.keras.layers.MaxPooling2D(padding='same')(conv_1)
conv_2 = tf.keras.layers.Conv2D(32,kernel_size=(3, 3),
                                padding='same',
                                activation='relu')(conv_1)
conv_2 = tf.keras.layers.MaxPooling2D(padding='same')(conv_2)
# Flatten the output of the convolutional layers
conv_flat = tf.keras.layers.Flatten()(conv_2)
# Some dense layers with two separate outputs
fc_1 = tf.keras.layers.Dense(128,activation='relu')(conv_flat)
fc_1 = tf.keras.layers.Dropout(0.2)(fc_1)
fc_2 = tf.keras.layers.Dense(128, activation='relu')(fc_1)
fc_2 = tf.keras.layers.Dropout(0.2)(fc_2)
# Output layers: separate outputs 4 weather & ground labels
weather_output = tf.keras.layers.Dense(4,
   activation='softmax',name='weather')(fc_2)
ground_output = tf.keras.layers.Dense(13,activation='sigmoid',
                                      name='ground')(fc_2)
# Wrap in a Model
model = tf.keras.Model(inputs=image_input, outputs=[weather_output, ground_output])
```

(1) 2 output layers, so they are passed as a list of outputs

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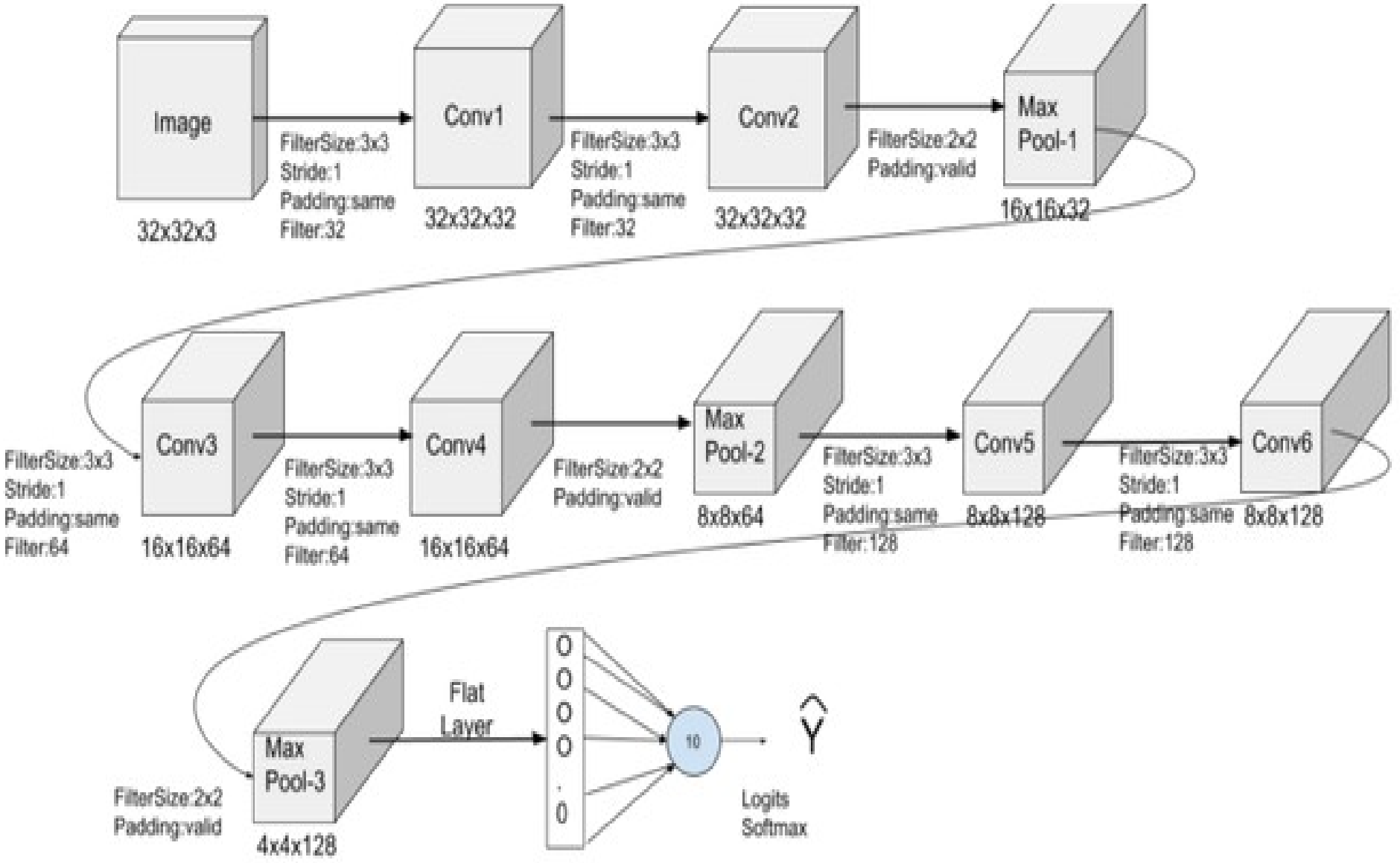
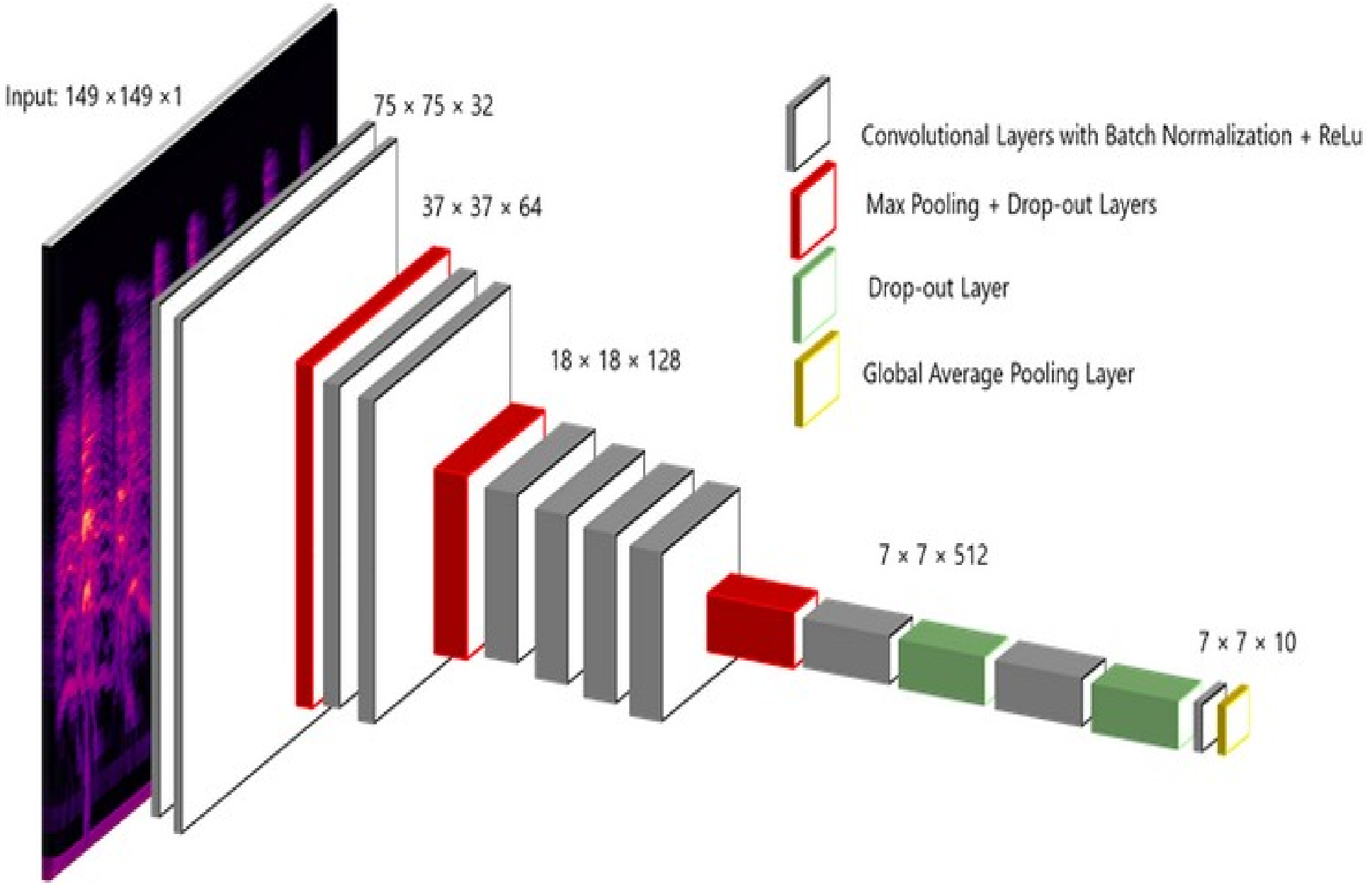
Convolutional Neural Network Architecture Example



http://androidkt.com/train-keras-model-with-tensorflow-estimators-and-datasets-api/

tf.keras Example of ANN Architecture

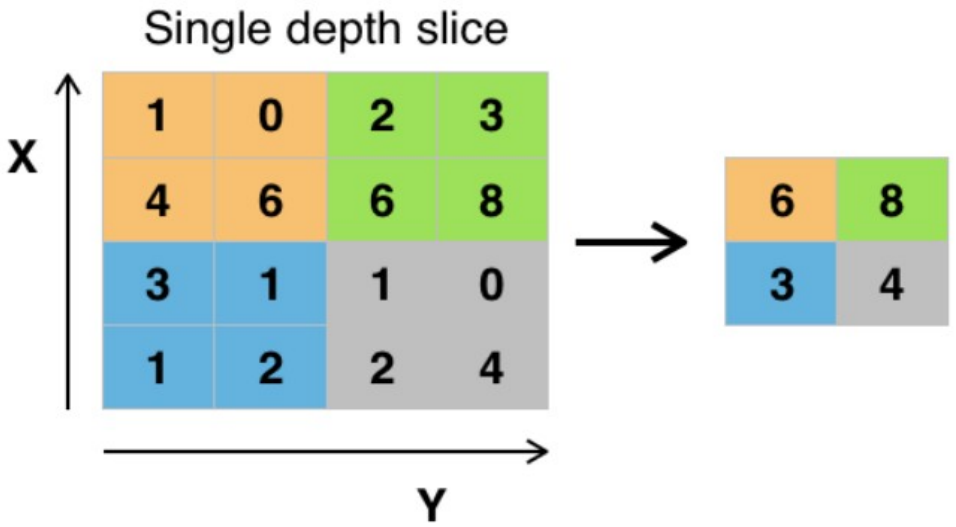


tf.keras.Model etc

```
import tensorflow as tf
tf.keras.Input( )

tf.keras.layers.Conv2D()
tf.keras.layers.MaxPooling2D()
tf.keras.layers.Flatten()(conv_2)
tf.keras.layers.Dense()(conv_flat)
tf.keras.layers.Dropout( )(fc_1)
tf.keras.Model()
```

https://www.tensorflow.org/api_docs/python/tf/keras/layers/MaxPool2D



`tf.keras.layers.MaxPooling2D()`

tf.keras.layers.Dense( ) Activation Functions