Course

Stanford/Coursera

- Machine Learning
- Deep Learning Specialization

3Blue1Brown

- Neural networks

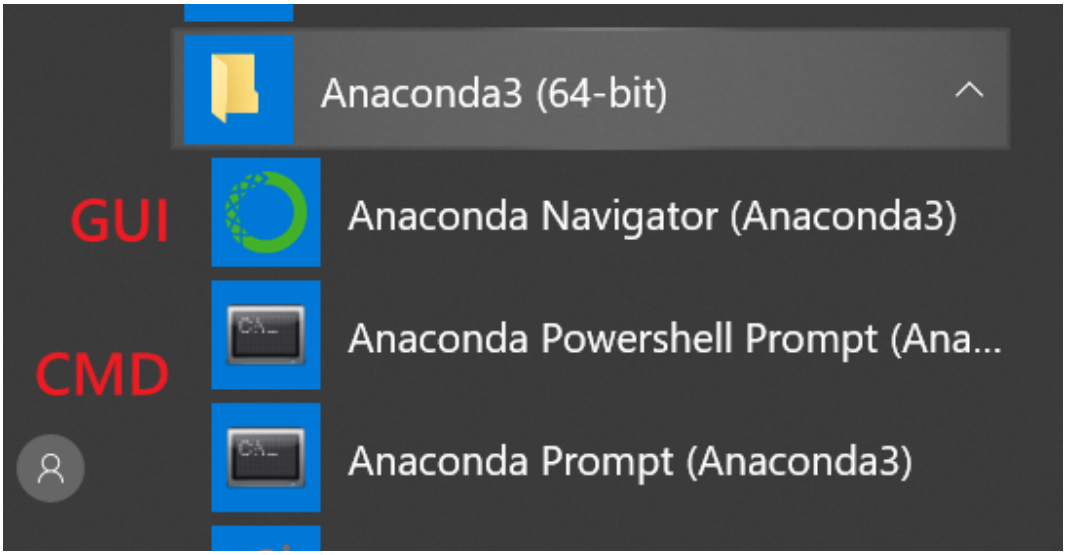
Deep Learning

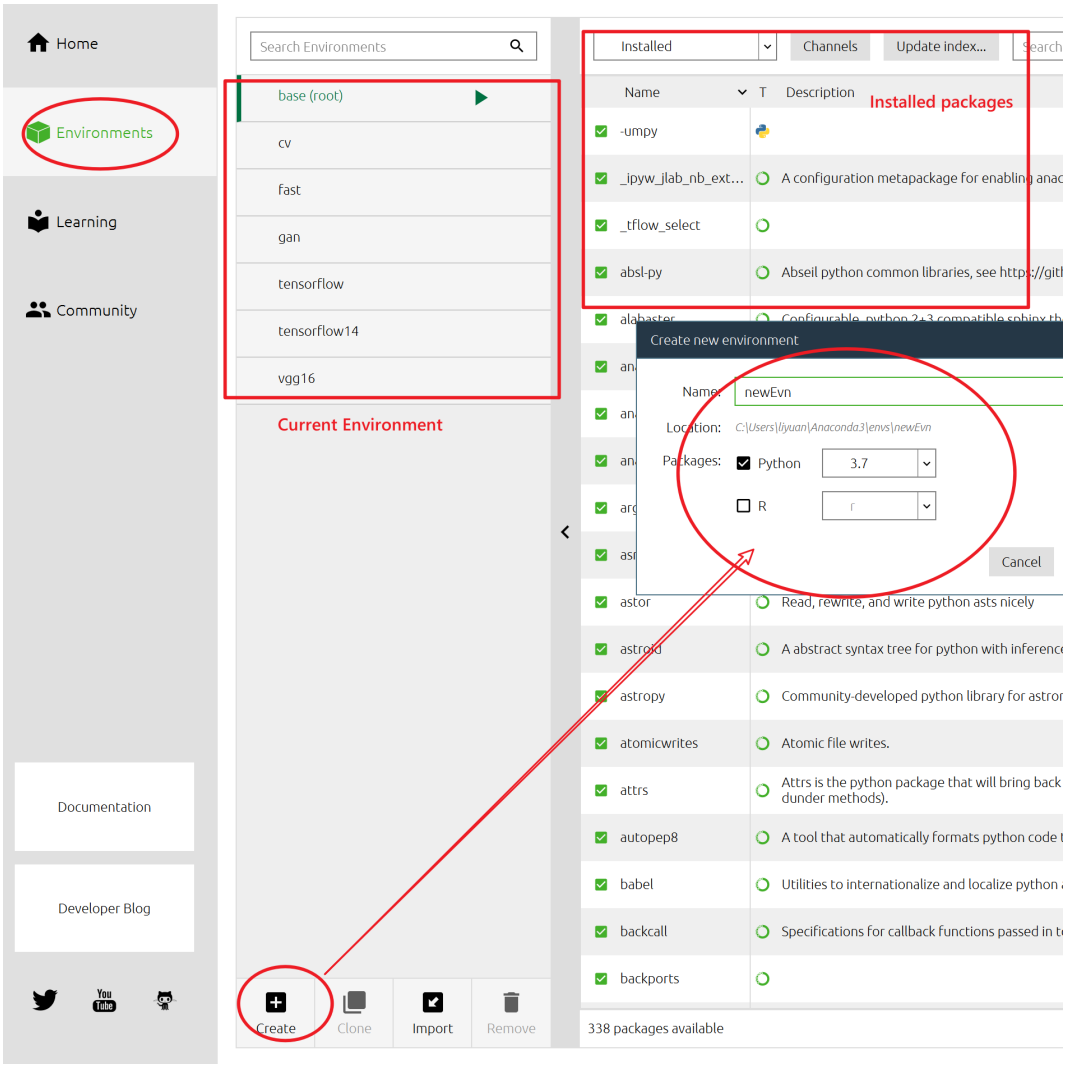
- Hung-yi Lee: Deep Learning

Development Environment/Tools

Anaconda

- Home Page
- General Package Management Environment. It is used to setup basic developement environment with Python/TensorFlow version specified.
- Install Steps
    1. Download and Install Anaconda: Home Page
    2. Open Anaconda Command Line/GUI





3. Create New Env

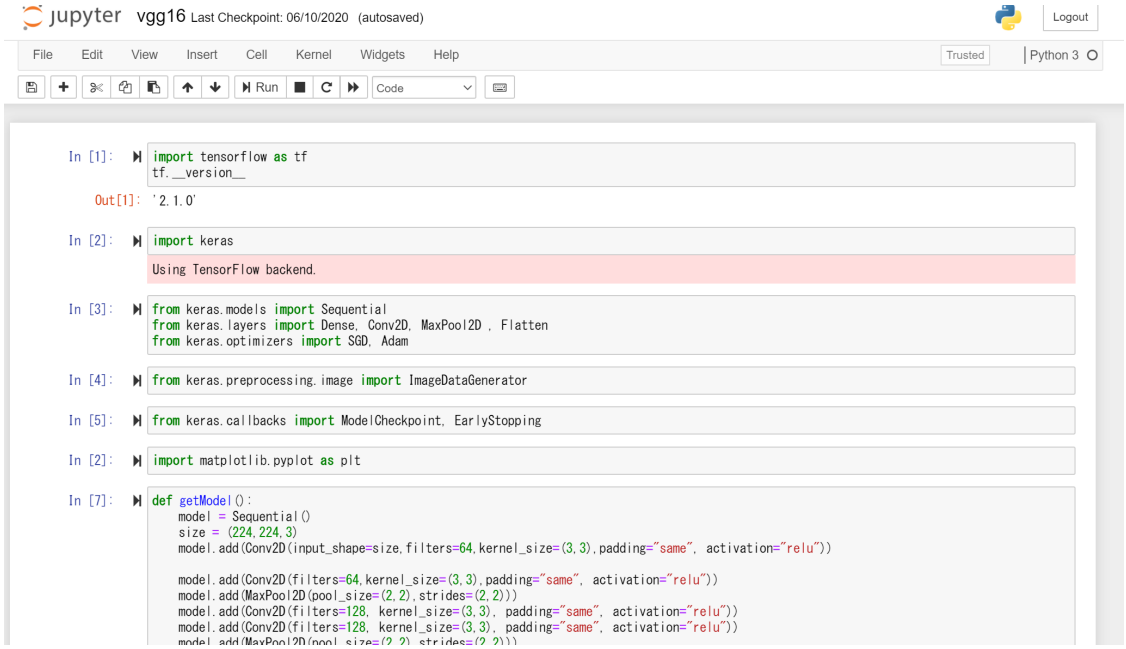
```
conda create -n MyTensorflow python=3.7
```

4. Activate/Enter Env

```
conda activate MyTensorflow

//Quit Env
conda deactivate
```

Jupyter

- Interactive Python/Tensorflow Development "IDE"
- Web-based



- Install

```
conda install jupyter
```

TensorFlow

Install Tensorflow

```
conda install tensorflow-gpu=2.1.0
```

- There are CPU(tensorflow) and GPU(tensorflow-gpu) verison of Tensorflow
- Tensorflow 1.x and 2.x are different
- Use `conda search tensorflow` or `conda search tensorflow-gpu` to list TF version

Keras

- Higher level API above Tensorflow
- Has more Deep Learning Model/Dataset prepared(i.e: VGG16)
- Tensorflow 2.x has interagted Keras, no need to install it seperately.
- Install(Optional)

```
conda install keras
```

Local vs Cloud

- Local: Anaconda + Jupyter + TensorFlow GPU/Keras
- Cloud: Google Colab

Tips

- Local GPU Memory is not enough

```
import os
os.environ["TF_FORCE_GPU_ALLOW_GROWTH"] = "true"
```

- Convert to TFLite Error

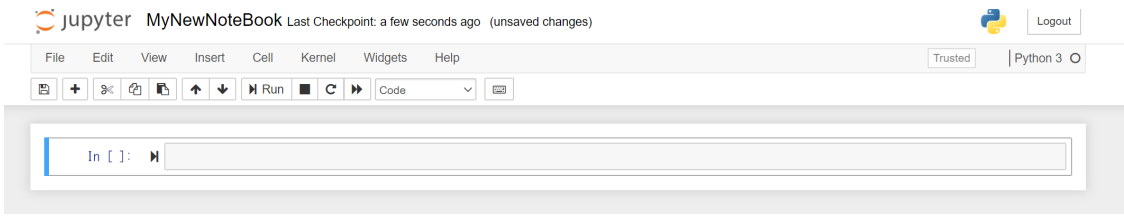
  Do not install keras, use ternsorflow's `tensorflow.keras`

Examples

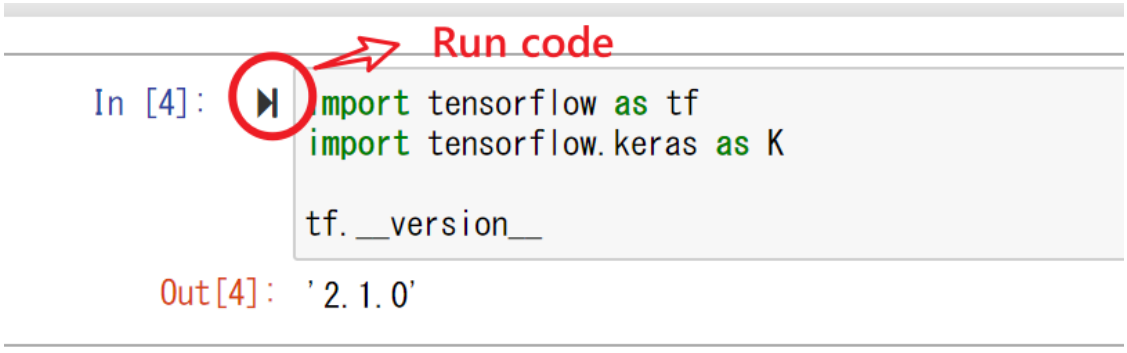
Keras Startup Example

1. Activate Env: `conda activate MyTensorflow`
2. Startup Jupyter: `jupyter notebook`
3. Create new notebook

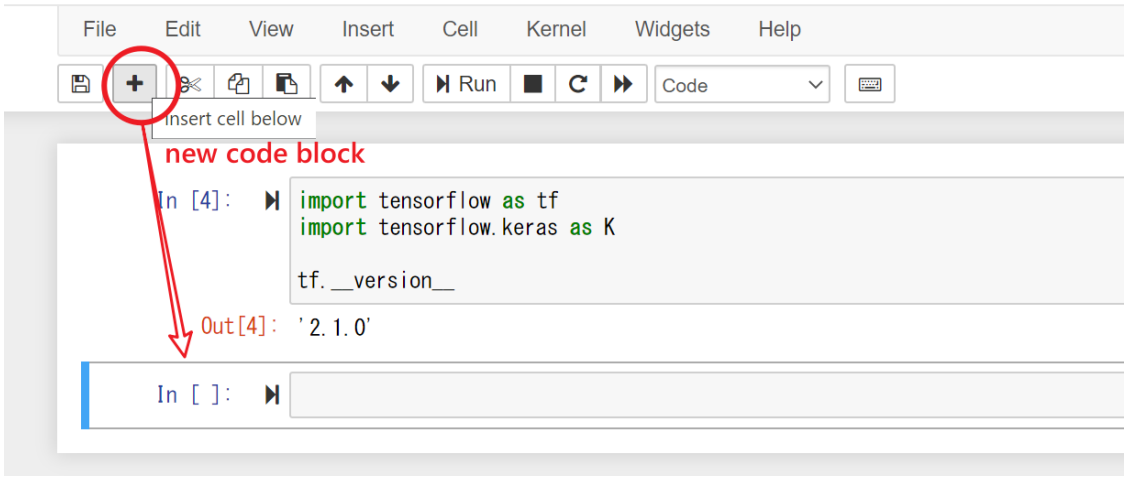
4. Coding



5. Import Tensorflow/Kares

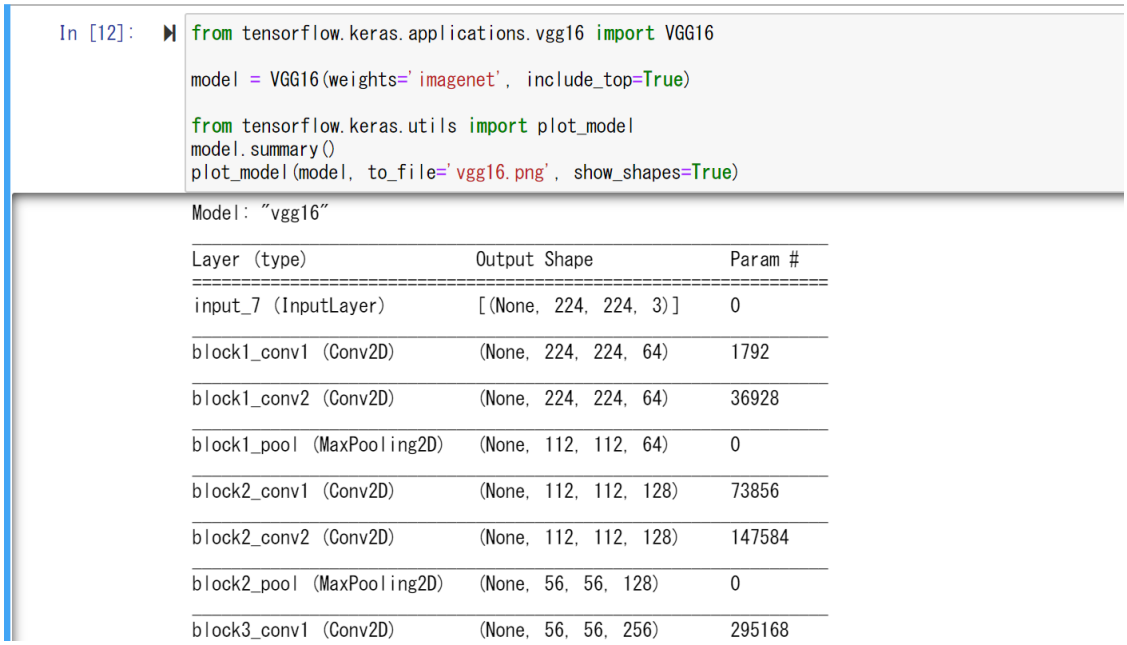


6. New Code Block



7. Model Print/Save

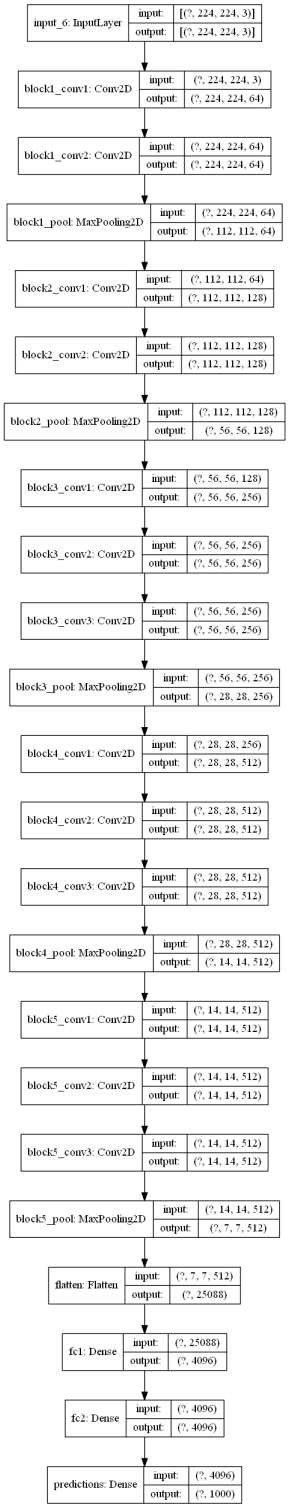
```
from tensorflow.keras.utils import plot_model
model.summary()
plot_model(model, to_file='vgg16.png', show_shapes=True)
```



```
In [12]:
from tensorflow.keras.applications.vgg16 import VGG16

model = VGG16(weights='imagenet', include_top=True)

from tensorflow.keras.utils import plot_model
model.summary()
plot_model(model, to_file='vgg16.png', show_shapes=True)
```

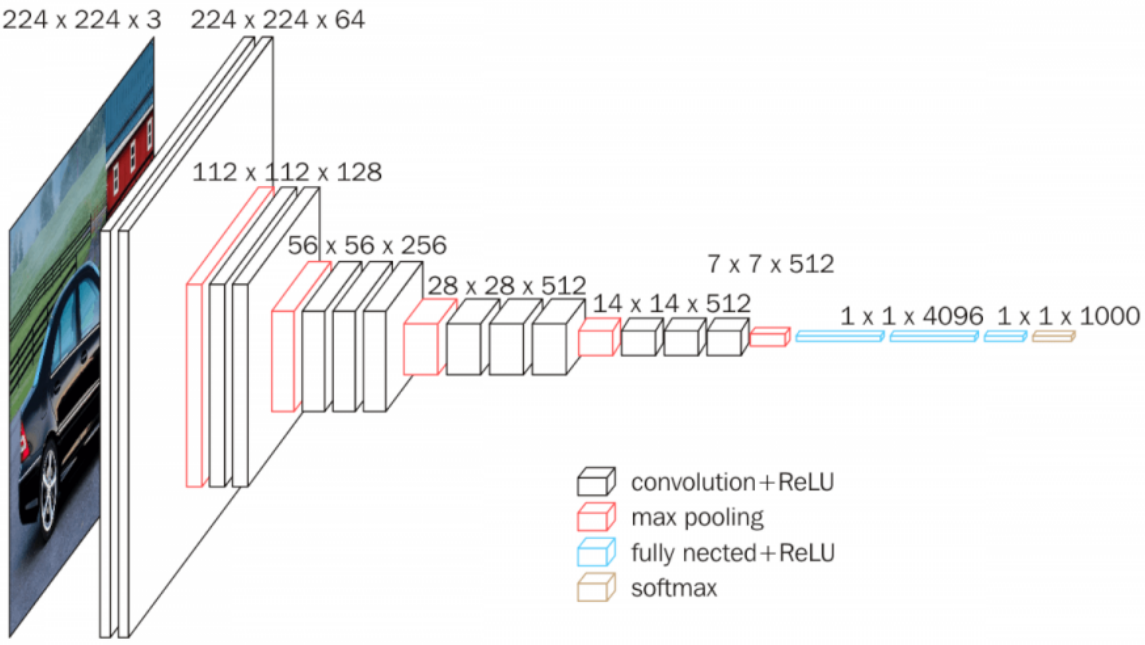
```
Model: "vgg16"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
input_7 (InputLayer)         [(None, 224, 224, 3)]     0
_________________________________________________________________
block1_conv1 (Conv2D)        (None, 224, 224, 64)      1792
_________________________________________________________________
block1_conv2 (Conv2D)        (None, 224, 224, 64)      36928
_________________________________________________________________
block1_pool (MaxPooling2D)   (None, 112, 112, 64)      0
_________________________________________________________________
block2_conv1 (Conv2D)        (None, 112, 112, 128)     73856
_________________________________________________________________
block2_conv2 (Conv2D)        (None, 112, 112, 128)     147584
_________________________________________________________________
block2_pool (MaxPooling2D)   (None, 56, 56, 128)       0
_________________________________________________________________
block3_conv1 (Conv2D)        (None, 56, 56, 256)       295168
```

VGG Model



- Build-in Loss: https://keras.io/api/losses/
- Build-in Optimizers: https://keras.io/api/optimizers/
- Build-in Model: https://keras.io/api/applications/
- Build-in Dataset: https://keras.io/api/datasets/

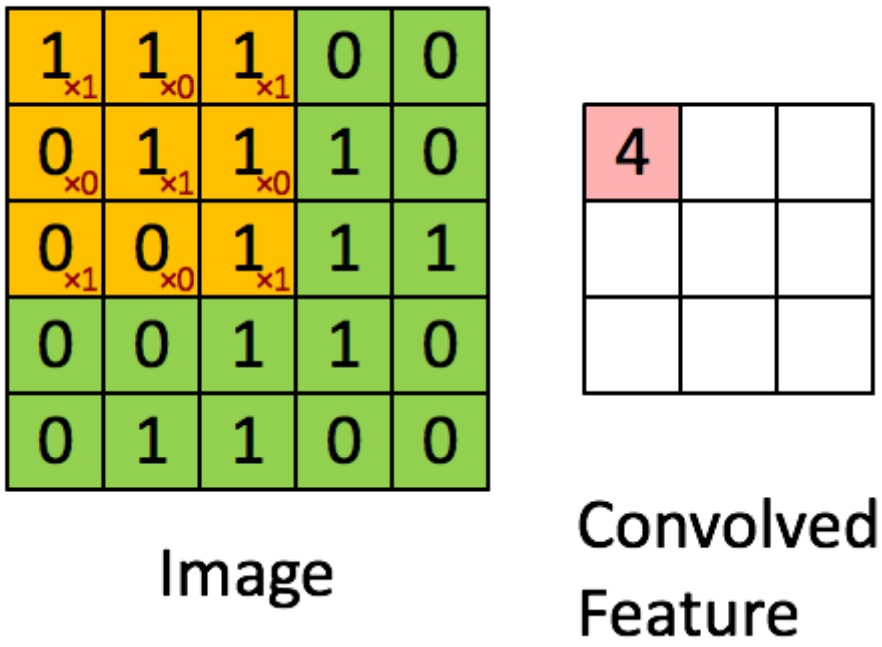
VGG16 Implementation



- Sequential Mode: Input->Network->Output
- 画像分類（Classification）問題：Input（224x224 RGB 画像）->Network->Output（種類：Cat・Dog・Brid...）
- Implementation Details 実装の詳細
  - Code: DeepLearning/code/vgg/vgg16.ipynb
  - Convolution

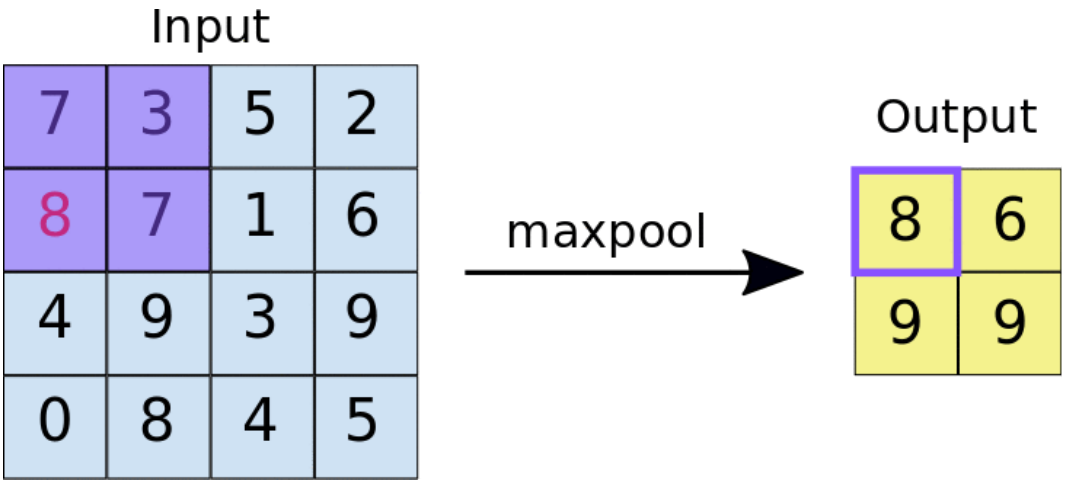
    Kernel Size: 3x3

    $$\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$$

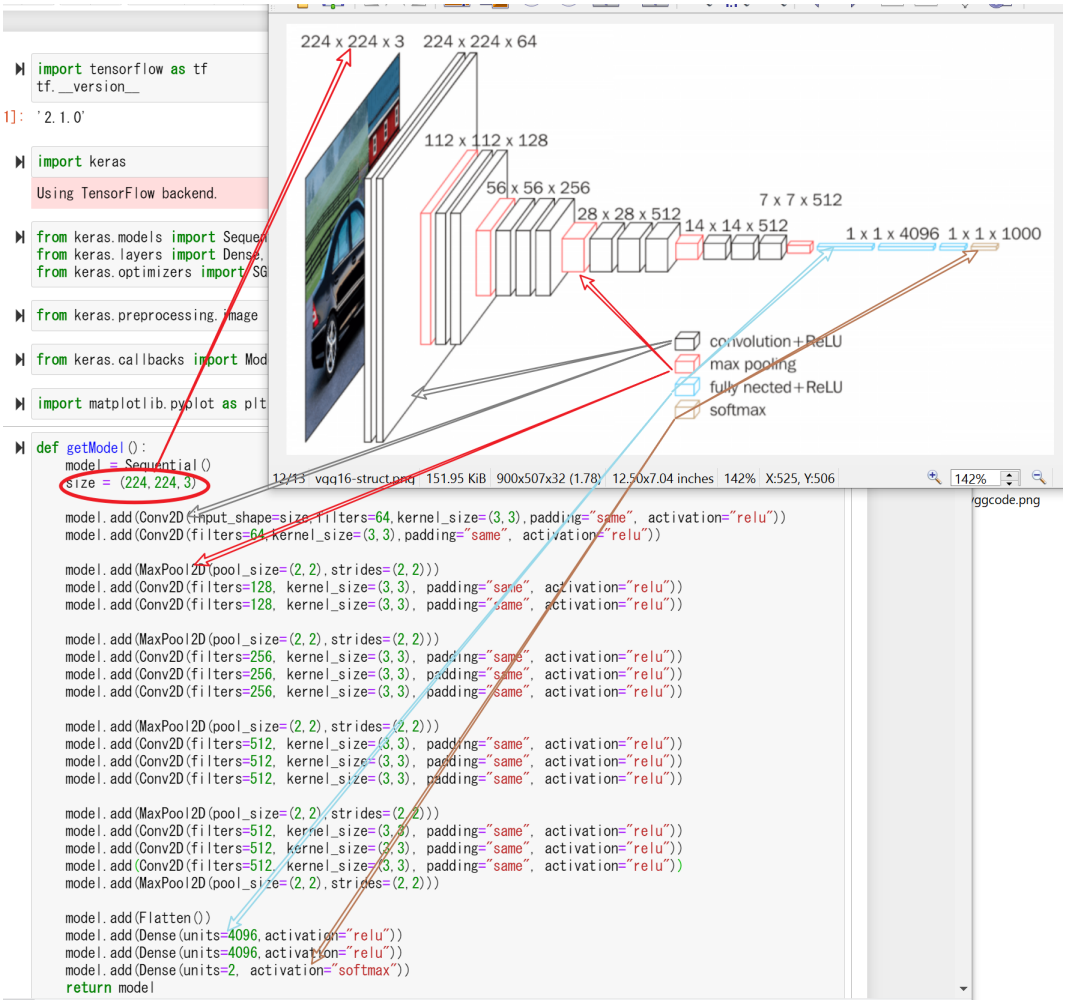


  - Max pooling

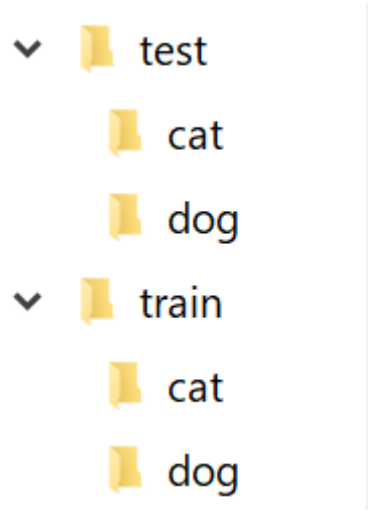
- filter 2x2
- stride 2x2
- **Max** value in filter



- Code<->Graph



- Training:
  - Keras has well-trained vgg mode
  - If custom training data prepared.自分のDatasetがある場合は
  - Dog/Cat Dataset as an example to explain training process
    - Download Dog/Cat Dataset: [Kaggle Cats and Dogs Dataset]
    - Pick some(most of) images as Training Data;
    - Pick rest of images as Testing Data;
    - Folder struct is as follow:



- Loading data

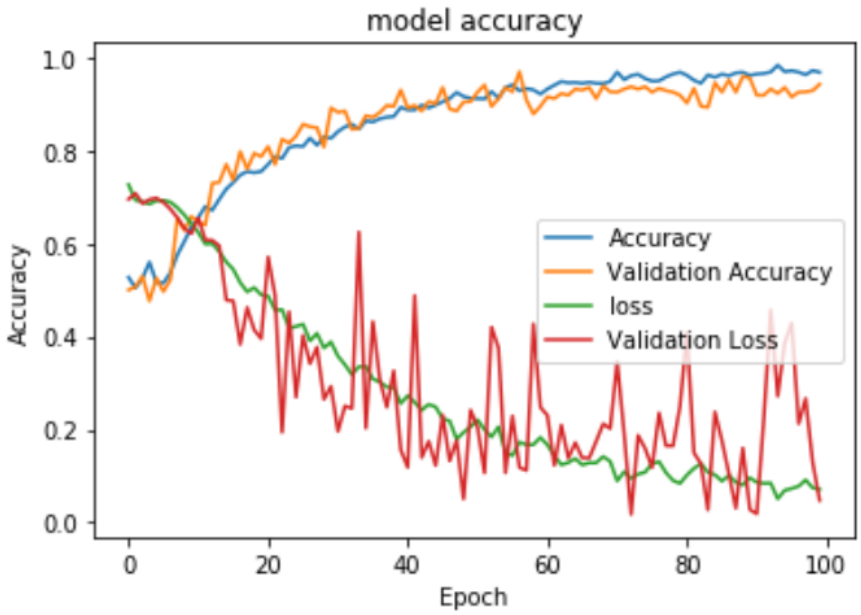
```
size = (224,224)
traind =
ImageDataGenerator().flow_from_directory(directory="train",
target_size=size)
testd =
ImageDataGenerator().flow_from_directory(directory="test",
target_size=size)
```

- Training

```
hist = model.fit_generator(
    steps_per_epoch=100,
    generator=traind,
    validation_data=testd,
    validation_steps=10,
    epochs=100)
```

- To display Training graph

```
plt.plot(hist.history["accuracy"])
plt.plot(hist.history['val_accuracy'])
plt.plot(hist.history['loss'])
plt.plot(hist.history['val_loss'])
plt.title("model accuracy")
plt.ylabel("Accuracy")
plt.xlabel("Epoch")
plt.legend(["Accuracy","Validation Accuracy","loss","Validation
Loss"])
plt.show()
```



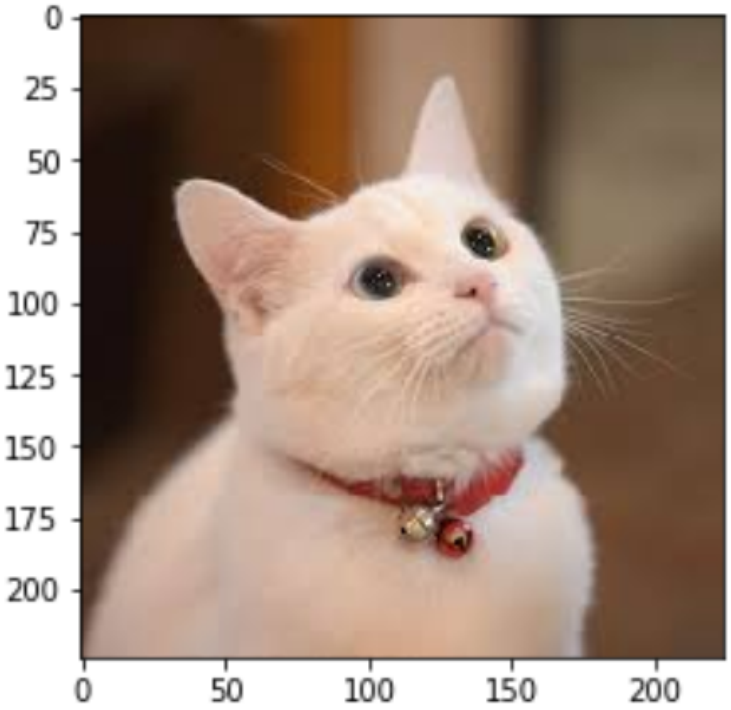
- Save/Load Model

```
model.save('vgg16_trained.h5')

from keras.models import load_model
saved_model = load_model("vgg16_trained.h5")
```

- Prediction

```
from keras.preprocessing import image
import numpy as np
img = image.load_img("test5.jpeg",target_size=(224,224))
img = np.asarray(img)
plt.imshow(img)
img = np.expand_dims(img, axis=0)
output = model.predict(img)
if output[0][0] > output[0][1]:
    print("cat")
else:
    print('dog')

print('{:.2}'.format(output[0][0]))
print('{:.2}'.format(output[0][1]))
```

```
cat
0. 78
0. 22
```



- Reference:
  - https://www.cc.gatech.edu/~san37/post/dlhc-cnn/
  - https://developers.google.com/machine-learning/practica/image-classification/convolutional-neural-networks?hl=id

GAN

Pix2Pix

TL/Keras Official Examples

Unity

- TLLite
- Unity Example