TF2.0 신경망 만들기 ¶

- CNN 신경망 이해
- 고양이와 개의 분류를 CNN을 이용하여 구현해 보기

In [1]:

```
!pip install -q tensorflow-gpu==2.0.0-rc1
```

```
|████████████████████████████████| 380.5MB 39kB/s
|████████████████████████████████| 4.3MB 42.6MB/s
|████████████████████████████████| 501kB 38.5MB/s
```

In [0]:

```
import tensorflow as tf
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Conv2D, Flatten, Dropout, MaxPooling2D
from tensorflow.keras.preprocessing.image import ImageDataGenerator

import os
import numpy as np
import matplotlib.pyplot as plt
```

In [11]:

```
print(tf.__version__)
```

```
2.0.0-rc1
```

데이터 불러오기

- Kaggle의 필터링 된 버전의 Dogs vs Cats 데이터 세트를 사용

In [0]:

```
_URL = 'https://storage.googleapis.com/mledu-datasets/cats_and_dogs_filtered.zip'

path_to_zip = tf.keras.utils.get_file('cats_and_dogs.zip', origin=_URL, extract=True)

PATH = os.path.join(os.path.dirname(path_to_zip), 'cats_and_dogs_filtered')
```

```
cats_and_dogs_filtered
|__ train
    |______ cats: [cat.0.jpg, cat.1.jpg, cat.2.jpg ....]
    |______ dogs: [dog.0.jpg, dog.1.jpg, dog.2.jpg ...]
|__ validation
    |______ cats: [cat.2000.jpg, cat.2001.jpg, cat.2002.jpg ....]
    |______ dogs: [dog.2000.jpg, dog.2001.jpg, dog.2002.jpg ...]
```

In [13]:

```
train_dir = os.path.join(PATH, 'train')
validation_dir = os.path.join(PATH, 'validation')
print(train_dir, validation_dir)
```

```
/root/.keras/datasets/cats_and_dogs_filtered/train /root/.keras/datasets/cats_and_do
gs_filtered/validation
```

In [0]:

```
train_cats_dir = os.path.join(train_dir, 'cats')  # directory with our training cat pictures
train_dogs_dir = os.path.join(train_dir, 'dogs')  # directory with our training dog pictures
validation_cats_dir = os.path.join(validation_dir, 'cats')  # directory with our validation cat
validation_dogs_dir = os.path.join(validation_dir, 'dogs')  # directory with our validation dog
```

데이터 탐색

In [0]:

```
num_cats_tr = len(os.listdir(train_cats_dir))
num_dogs_tr = len(os.listdir(train_dogs_dir))

num_cats_val = len(os.listdir(validation_cats_dir))
num_dogs_val = len(os.listdir(validation_dogs_dir))

total_train = num_cats_tr + num_dogs_tr
total_val = num_cats_val + num_dogs_val
```

In [16]:

```
print('total training cat images:', num_cats_tr)
print('total training dog images:', num_dogs_tr)

print('total validation cat images:', num_cats_val)
print('total validation dog images:', num_dogs_val)
print("--")
print("Total training images:", total_train)
print("Total validation images:", total_val)
```

```
total training cat images: 1000
total training dog images: 1000
total validation cat images: 500
total validation dog images: 500
--
Total training images: 2000
Total validation images: 1000
```

In [0]:

```
batch_size = 128
epochs = 15
IMG_HEIGHT = 150
IMG_WIDTH = 150
```

데이터 준비

- tf.keras에서 제공하는 ImageDataGenerator class
- 디스크에서 이미지를 읽고, 적절한 텐서로 사전 처리가 가능하다.

In [0]:

```
train_image_generator = ImageDataGenerator(rescale=1./255) # Generator for our training data
validation_image_generator = ImageDataGenerator(rescale=1./255) # Generator for our validation
```

- 이미지 생성기를 정의한 후, flow_from_directory 메서드를 이용
  - 이미지를 로드
  - 이미지의 크기 조정 적용

In [21]:

```
train_data_gen = train_image_generator.flow_from_directory(batch_size=batch_size,
                                                           directory=train_dir,
                                                           shuffle=True,
                                                           target_size=(IMG_HEIGHT, IMG_WIDTH),
                                                           class_mode='binary')
```

```
Found 2000 images belonging to 2 classes.
```

In [23]:

```
val_data_gen = validation_image_generator.flow_from_directory(batch_size=batch_size,
                                                              directory=validation_dir,
                                                              target_size=(IMG_HEIGHT, IMG_WIDTH),
                                                              class_mode='binary')
```

```
Found 1000 images belonging to 2 classes.
```

이미지 추출 후, 이에 대한 시각화

In [0]:

```
sample_training_images, _ = next(train_data_gen)
```

In [0]:

```
# This function will plot images in the form of a grid with 1 row and 5 columns where images ar
def plotImages(images_arr):
    fig, axes = plt.subplots(1, 5, figsize=(20,20))
    axes = axes.flatten()
    for img, ax in zip( images_arr, axes):
        ax.imshow(img)
        ax.axis('off')
    plt.tight_layout()
    plt.show()
```

In [26]:

```
plotImages(sample_training_images[:5])
```

In [27]:

```
sample_training_images, _ = next(train_data_gen)
plotImages(sample_training_images[:5])
```

모델 만들기(Create the model)

- 개 고양이 분류 : 마지막 뉴런 1개(sigmoid)
- MNIST 분류 : 뉴런 10개(softmax)

In [0]:

```
model = Sequential([
    Conv2D(16, 3, padding='same', activation='relu', input_shape=(IMG_HEIGHT, IMG_WIDTH ,3)),
    MaxPooling2D(),
    Conv2D(32, 3, padding='same', activation='relu'),
    MaxPooling2D(),
    Conv2D(64, 3, padding='same', activation='relu'),
    MaxPooling2D(),
    Flatten(),
    Dense(512, activation='relu'),
    Dense(1, activation='sigmoid')
])
```

모델 컴파일(Compile the model)

- binary_crossentropy : label이 두개
- categorical_crossentropy : label이 여러개

In [0]:

```
model.compile(optimizer='adam',
              loss='binary_crossentropy',
              metrics=['accuracy'])
```

In [31]:

```
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #   
=================================================================
conv2d (Conv2D)              (None, 150, 150, 16)      448       
_________________________________________________________________
max_pooling2d (MaxPooling2D) (None, 75, 75, 16)        0         
_________________________________________________________________
conv2d_1 (Conv2D)            (None, 75, 75, 32)        4640      
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 37, 37, 32)        0         
_________________________________________________________________
conv2d_2 (Conv2D)            (None, 37, 37, 64)        18496     
_________________________________________________________________
max_pooling2d_2 (MaxPooling2 (None, 18, 18, 64)        0         
_________________________________________________________________
flatten (Flatten)            (None, 20736)             0         
_________________________________________________________________
dense (Dense)                (None, 512)               10617344  
_________________________________________________________________
dense_1 (Dense)              (None, 1)                 513       
=================================================================
Total params: 10,641,441
Trainable params: 10,641,441
Non-trainable params: 0
_________________________________________________________________
```

모델 훈련시키기

- ImageDataGenerator의 fit_generator를 사용한다.

In [32]:

```
%%time

history = model.fit_generator(
    train_data_gen,
    steps_per_epoch=total_train // batch_size,
    epochs=epochs,
    validation_data=val_data_gen,
    validation_steps=total_val // batch_size
)
```

```
Epoch 1/15
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/tensorflow_core/pyt
hon/ops/math_grad.py:1394: where (from tensorflow.python.ops.array_ops) is depreca
ted and will be removed in a future version.
Instructions for updating:
Use tf.where in 2.0, which has the same broadcast rule as np.where
15/15 [==============================] - 70s 5s/step - loss: 0.7860 - accuracy: 0.
5037 - val_loss: 0.6802 - val_accuracy: 0.5123
Epoch 2/15
15/15 [==============================] - 68s 5s/step - loss: 0.6568 - accuracy: 0.
5887 - val_loss: 0.6540 - val_accuracy: 0.6071
Epoch 3/15
15/15 [==============================] - 68s 5s/step - loss: 0.6182 - accuracy: 0.
6474 - val_loss: 0.6076 - val_accuracy: 0.6562
Epoch 4/15
15/15 [==============================] - 68s 5s/step - loss: 0.5625 - accuracy: 0.
7009 - val_loss: 0.6079 - val_accuracy: 0.6775
Epoch 5/15
15/15 [==============================] - 68s 5s/step - loss: 0.5354 - accuracy: 0.
7244 - val_loss: 0.5564 - val_accuracy: 0.7176
Epoch 6/15
15/15 [==============================] - 68s 5s/step - loss: 0.4961 - accuracy: 0.
7537 - val_loss: 0.5662 - val_accuracy: 0.7054
Epoch 7/15
15/15 [==============================] - 69s 5s/step - loss: 0.4397 - accuracy: 0.
7933 - val_loss: 0.5958 - val_accuracy: 0.7020
Epoch 8/15
15/15 [==============================] - 70s 5s/step - loss: 0.4467 - accuracy: 0.
7854 - val_loss: 0.5968 - val_accuracy: 0.7109
Epoch 9/15
15/15 [==============================] - 67s 4s/step - loss: 0.3899 - accuracy: 0.
8202 - val_loss: 0.5964 - val_accuracy: 0.7076
Epoch 10/15
15/15 [==============================] - 68s 5s/step - loss: 0.3468 - accuracy: 0.
8488 - val_loss: 0.6184 - val_accuracy: 0.7098
Epoch 11/15
15/15 [==============================] - 70s 5s/step - loss: 0.3014 - accuracy: 0.
8870 - val_loss: 0.6024 - val_accuracy: 0.7098
Epoch 12/15
15/15 [==============================] - 68s 5s/step - loss: 0.2693 - accuracy: 0.
9006 - val_loss: 0.6435 - val_accuracy: 0.7266
Epoch 13/15
15/15 [==============================] - 68s 5s/step - loss: 0.2546 - accuracy: 0.
8990 - val_loss: 0.6528 - val_accuracy: 0.7009
Epoch 14/15
15/15 [==============================] - 67s 4s/step - loss: 0.2151 - accuracy: 0.
9150 - val_loss: 0.7066 - val_accuracy: 0.7132
Epoch 15/15
```

```
15/15 [==============================] - 69s 5s/step - loss: 0.1776 - accuracy: 0.
9339 - val_loss: 0.6925 - val_accuracy: 0.7232
```

학습 모델 결과 시각화

In [33]:

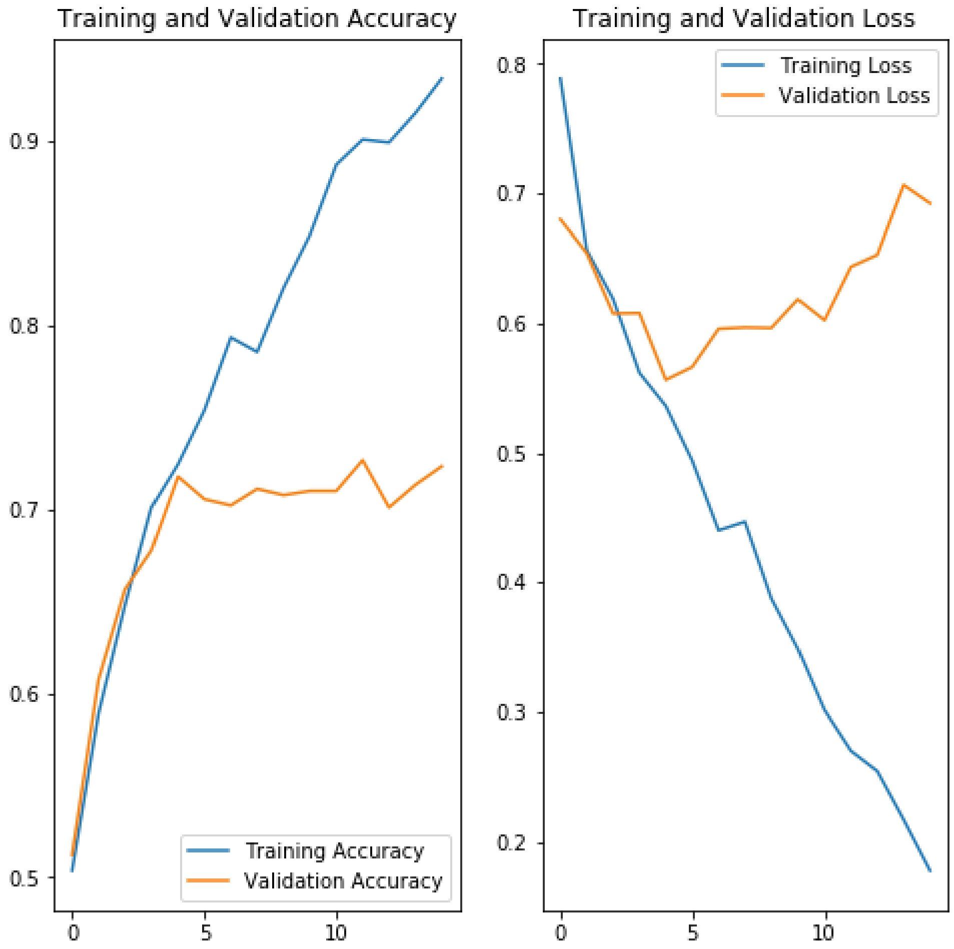
```
acc = history.history['accuracy']
val_acc = history.history['val_accuracy']

loss = history.history['loss']
val_loss = history.history['val_loss']

epochs_range = range(epochs)

plt.figure(figsize=(8, 8))
plt.subplot(1, 2, 1)
plt.plot(epochs_range, acc, label='Training Accuracy')
plt.plot(epochs_range, val_acc, label='Validation Accuracy')
plt.legend(loc='lower right')
plt.title('Training and Validation Accuracy')

plt.subplot(1, 2, 2)
plt.plot(epochs_range, loss, label='Training Loss')
plt.plot(epochs_range, val_loss, label='Validation Loss')
plt.legend(loc='upper right')
plt.title('Training and Validation Loss')
plt.show()
```



REF

- 이미지 분류 : https://www.tensorflow.org/tutorials/images/classification (https://www.tensorflow.org/tutorials/images/classification)

In [0]: