six_classify

September 3, 2020

[1]:
```
# Load the TensorBoard notebook extension
%load_ext tensorboard
```

[2]:
```
import tensorflow as tf
from keras import layers
from keras.preprocessing import image
from keras.preprocessing.image import ImageDataGenerator
import keras.backend as K
K.set_image_data_format('channels_last')

import numpy as np
import matplotlib.pyplot as plt
from matplotlib.pyplot import imshow
import datetime
from alexnet import AlexNet
```

[3]:
```
# Set the GPU growth in order to avoid the sudden stop of the runtime.
gpus = tf.config.experimental.list_physical_devices('GPU')
for gpu in gpus:
    tf.config.experimental.set_memory_growth(gpu, True)
```

[4]:
```
# Give the global constants.Please notify BATCH_SIZE for model.fit() and␣
 ↪Batch_Size for
# model.evaluate() and model.predict()
EPOCHS = 6
BATCH_SIZE = 32
Batch_Size = 1
image_width = 227
image_height = 227
channels = 3
num_classes = 6
```

[5]:
```
# Call the alexnet model in alexnet.py
model = AlexNet((image_width,image_height,channels), num_classes)
```

[6]:
```
# Compile the model
model.compile(optimizer=tf.keras.optimizers.Adam(0.001),
```

```
              loss='categorical_crossentropy',
              metrics=['accuracy'])
```

[7]:
```
# It will output the AlexNet model after executing the command
model.summary()
```

```
Model: "alex_net"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d (Conv2D)              (None, 55, 55, 96)        34944
_________________________________________________________________
max_pooling2d (MaxPooling2D) (None, 27, 27, 96)        0
_________________________________________________________________
conv2d_1 (Conv2D)            (None, 27, 27, 256)       614656
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 13, 13, 256)       0
_________________________________________________________________
conv2d_2 (Conv2D)            (None, 13, 13, 384)       885120
_________________________________________________________________
conv2d_3 (Conv2D)            (None, 13, 13, 384)       1327488
_________________________________________________________________
conv2d_4 (Conv2D)            (None, 13, 13, 256)       884992
_________________________________________________________________
max_pooling2d_2 (MaxPooling2 (None, 6, 6, 256)         0
_________________________________________________________________
flatten (Flatten)            (None, 9216)              0
_________________________________________________________________
dense (Dense)                (None, 4096)              37752832
_________________________________________________________________
dropout (Dropout)            (None, 4096)              0
_________________________________________________________________
dense_1 (Dense)              (None, 4096)              16781312
_________________________________________________________________
dropout_1 (Dropout)          (None, 4096)              0
_________________________________________________________________
dense_2 (Dense)              (None, 1000)              4097000
_________________________________________________________________
dense_3 (Dense)              (None, 6)                 6006
=================================================================
Total params: 62,384,350
Trainable params: 62,384,350
Non-trainable params: 0
_________________________________________________________________
```

[8]:
```
train_dir = '/home/mike/Documents/Six_Classify_AlexNet/seg_train/seg_train'
test_dir = '/home/mike/Documents/Six_Classify_AlexNet/seg_test/seg_test'
```

```
predict_dir = '/home/mike/Documents/Six_Classify_AlexNet/seg_pred/'
```

[9]:
```
# keras.preprocessing.image.ImageDataGenerator
train_datagen = ImageDataGenerator(rescale=1.0/255)

# keras.preprocessing.image.DirectoryIterator
train_generator = train_datagen.flow_from_directory(train_dir,
                                                    ␣
 ↪target_size=(image_width,image_height),
                                                     class_mode='categorical')

train_num = train_generator.samples
```

```
Found 14034 images belonging to 6 classes.
```

[10]:
```
# Start Tensorboard --logdir logs/fit
log_dir="logs/fit/" + datetime.datetime.now().strftime("%Y%m%d-%H%M%S")
tensorboard_callback = tf.keras.callbacks.TensorBoard(log_dir=log_dir)
callback_list = [tensorboard_callback]
```

[11]:
```
# Set verbose=1 (or verbose=0) for visibale (or invisible) training procedure.
model.fit(train_generator,
          epochs=EPOCHS,
          steps_per_epoch=train_num//BATCH_SIZE,
          callbacks=callback_list,
          verbose=1)
```

```
Epoch 1/6
438/438 [==============================] - 21s 47ms/step - loss: 1.7742 -
accuracy: 0.4466
Epoch 2/6
438/438 [==============================] - 16s 36ms/step - loss: 0.9922 -
accuracy: 0.6154
Epoch 3/6
438/438 [==============================] - 16s 36ms/step - loss: 0.8873 -
accuracy: 0.6619
Epoch 4/6
438/438 [==============================] - 16s 36ms/step - loss: 0.8150 -
accuracy: 0.7030
Epoch 5/6
438/438 [==============================] - 16s 37ms/step - loss: 0.7367 -
accuracy: 0.7302
Epoch 6/6
438/438 [==============================] - 16s 37ms/step - loss: 0.6516 -
accuracy: 0.7675
```

[11]:
```
<tensorflow.python.keras.callbacks.History at 0x7fcd8025ccd0>
```

[12]:
```
%tensorboard --logdir logs/fit
```

```
<IPython.core.display.HTML object>
```

[13]:
```
# It is the test generator as similar as the above.
test_datagen = ImageDataGenerator(rescale=1.0/255)

test_generator = test_datagen.flow_from_directory(test_dir,
                                                  ␣
 ↪target_size=(image_width,image_height),
                                                   class_mode='categorical')

test_num = test_generator.samples
```

```
Found 3000 images belonging to 6 classes.
```

[14]:
```
# Evalute the trained model and return both the loss and the test accuracy.
test_num = test_generator.samples
preds = model.evaluate(test_generator,
                       verbose=1,
                       batch_size=Batch_Size,
                       steps=test_num//Batch_Size)

print("Loss = " + str(preds[0]))
print("Test Accuracy = " + str(preds[1]))
```

```
3000/3000 [==============================] - 84s 28ms/step - loss: 0.6953 -
accuracy: 0.7533
Loss = 0.6952937245368958
Test Accuracy = 0.7533106207847595
```

[15]:
```
# Give the implicit steps=7301 for selecting the specific image number.
predict_datagen = ImageDataGenerator(rescale=1.0/255)

predict_generator = predict_datagen.flow_from_directory(predict_dir,
                                                        ␣
 ↪target_size=(image_width,image_height),
                                                         batch_size=Batch_Size,
                                                        ␣
 ↪class_mode='categorical')

predict_num = predict_generator.samples
```

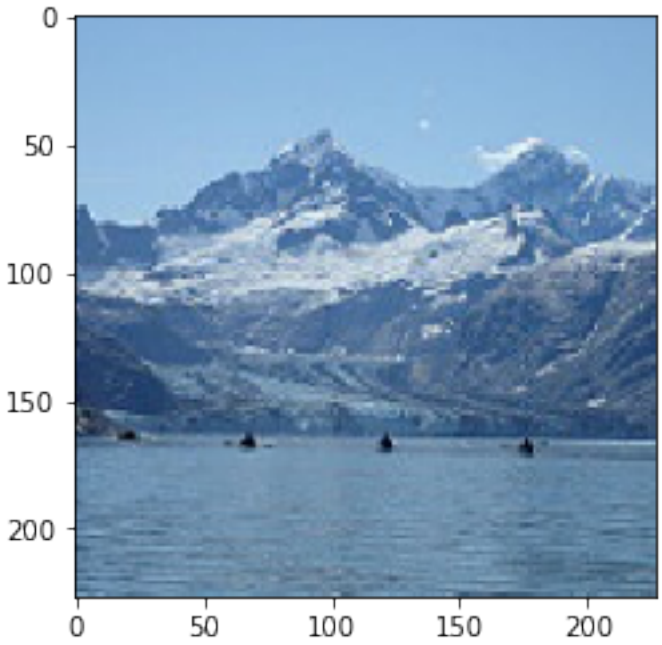
```
Found 7301 images belonging to 1 classes.
```

[16]:
```
# Make the prediction for any one of the predicted images
predictions = model.predict(predict_generator,
```

```
                                verbose=1,
                                batch_size=Batch_Size,
                                steps=predict_num//Batch_Size)
```

```
7301/7301 [==============================] - 18s 3ms/step
```

[17]:
```
# Plot the discriptive diagram
imshow(predict_generator[5800][0][0])
plt.imsave("predicted1.png",predict_generator[5800][0][0])
```



[18]:
```
predictions[5800]
```

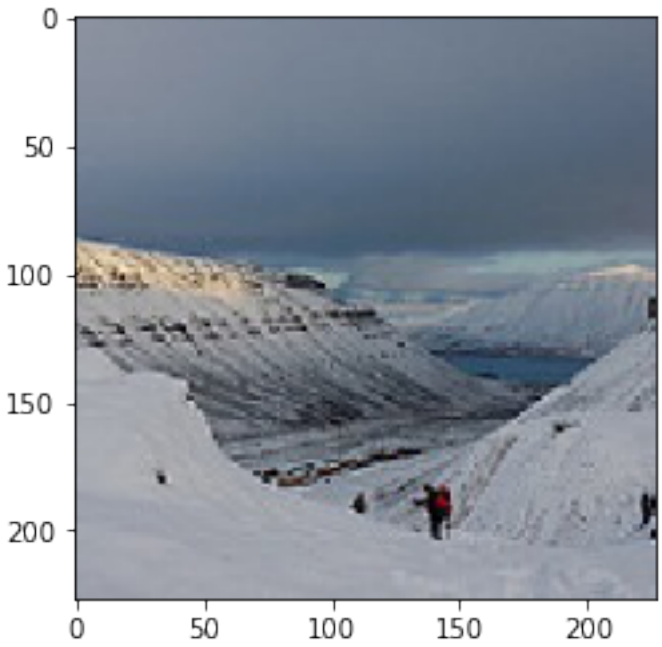
[18]:
```
array([8.7253749e-03, 4.4545028e-04, 2.4701746e-01, 1.2168474e-01,
       6.1795282e-01, 4.1741696e-03], dtype=float32)
```

[19]:
```
print(predictions[5800])
```

```
[8.7253749e-03 4.4545028e-04 2.4701746e-01 1.2168474e-01 6.1795282e-01
 4.1741696e-03]
```

[20]:
```
imshow(predict_generator[4800][0][0])
```

[20]:
```
<matplotlib.image.AxesImage at 0x7fce43302290>
```



[21]:
```
predictions[4800]
```

[21]:
```
array([3.4825638e-01, 1.6321901e-02, 5.2240654e-03, 1.5145056e-04,
       5.9335679e-04, 6.2945282e-01], dtype=float32)
```

[22]:
```
import os

def get_category(predicted_output):
    return os.listdir(train_dir)[np.argmax(predicted_output)]
```

[23]:
```
print(get_category(predictions[512]))
```

```
forest
```

[24]:
```
fig, axs = plt.subplots(2, 3, figsize=(10,10))

axs[0][0].imshow(predict_generator[1002][0][0])
axs[0][0].set_title(get_category(predictions[1002]))

axs[0][1].imshow(predict_generator[22][0][0])
axs[0][1].set_title(get_category(predictions[22]))

axs[0][2].imshow(predict_generator[1300][0][0])
axs[0][2].set_title(get_category(predictions[1300]))
```

```
axs[1][0].imshow(predict_generator[3300][0][0])
axs[1][0].set_title(get_category(predictions[3300]))

axs[1][1].imshow(predict_generator[7002][0][0])
axs[1][1].set_title(get_category(predictions[7002]))

axs[1][2].imshow(predict_generator[512][0][0])
axs[1][2].set_title(get_category(predictions[512]))
```

[24]: Text(0.5, 1.0, 'forest')