

计算机视觉第一次作业

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一、实验主题

基于Google Teachable Machine 实现简单的电子设备识别

二、实验目的

通过学习一定的相关知识，学习如何搭建计算机视觉需要用到的软件环境，以及使用Google Teachable Machine实现一些简单的物体识别，并将模型导出，在本地使用。

三、实验内容

1、配置环境

要实现本次实验以及后续可能需要完成的其他实验，配置好相应的软件环境至关重要。

根据Google Teachable Machine上提供的示例代码的注释了解到，要在本地运行已训练的模型，需要TensorFlow库的支持。

TensorFlow是一个强大的机器学习框架，可以支持深度学习的各种算法，是目前最受欢迎的机器学习开源方案，很多大型电商使用的客服系统就是基于TensorFlow开发。

1)建立虚拟环境

为了防止和其他python版本和对应的库混用，用Anaconda建立一个新的虚拟python环境，如图：

Anaconda Prompt (conda)

```
(base) C:\Users\72331>conda create --name tensorflow python=3.9
```

```
(base) C:\Users\72331>conda env list
# conda environments:
#
cs188                C:\Users\72331\.conda\envs\cs188
py36                  C:\Users\72331\.conda\envs\py36
tensorflow             C:\Users\72331\.conda\envs\tensorflow
base                  * D:\conda
```

再激活该环境：

```
(base) C:\Users\72331>conda activate tensorflow
(tensorflow) C:\Users\72331>
```

2)安装TensorFlow

在此处的python环境我们使用了python3.9，需要搭配TensorFlow2.5以正常使用。
使用pip指令安装，如图：

```
(tensorflow) C:\Users\72331>pip install tensorflow==2.5_
```

3)安装OpenCV

因为之后的测试样例常常用到OpenCV，一并将其配置到虚拟环境中，如图：

```
(tensorflow) C:\Users\72331>pip install opencv-python_
```

4)测试安装完毕

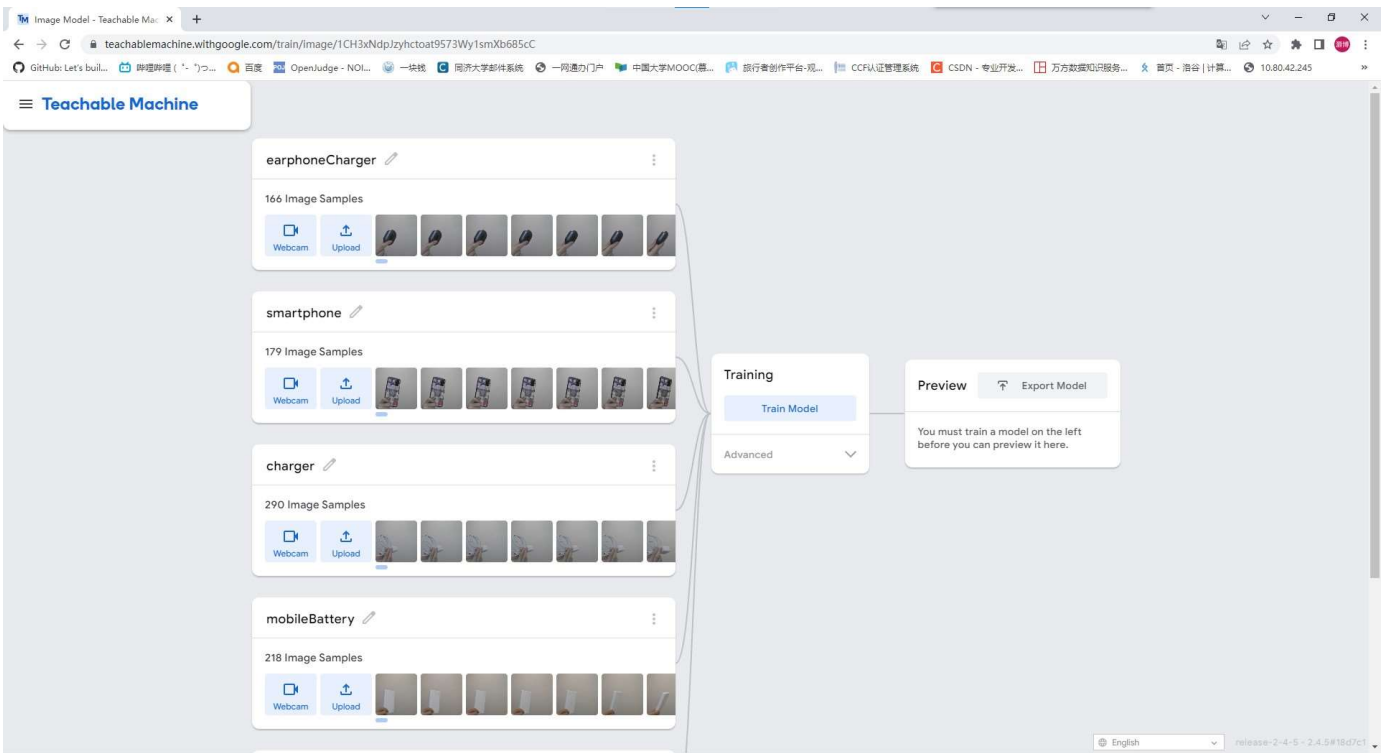
使用VSCode运行一段测试代码(代码如下)来测试是否已经安装完成TensorFlow和OpenCV：

```
import tensorflow as tf
import cv2
print(tf)
print(cv2)
```

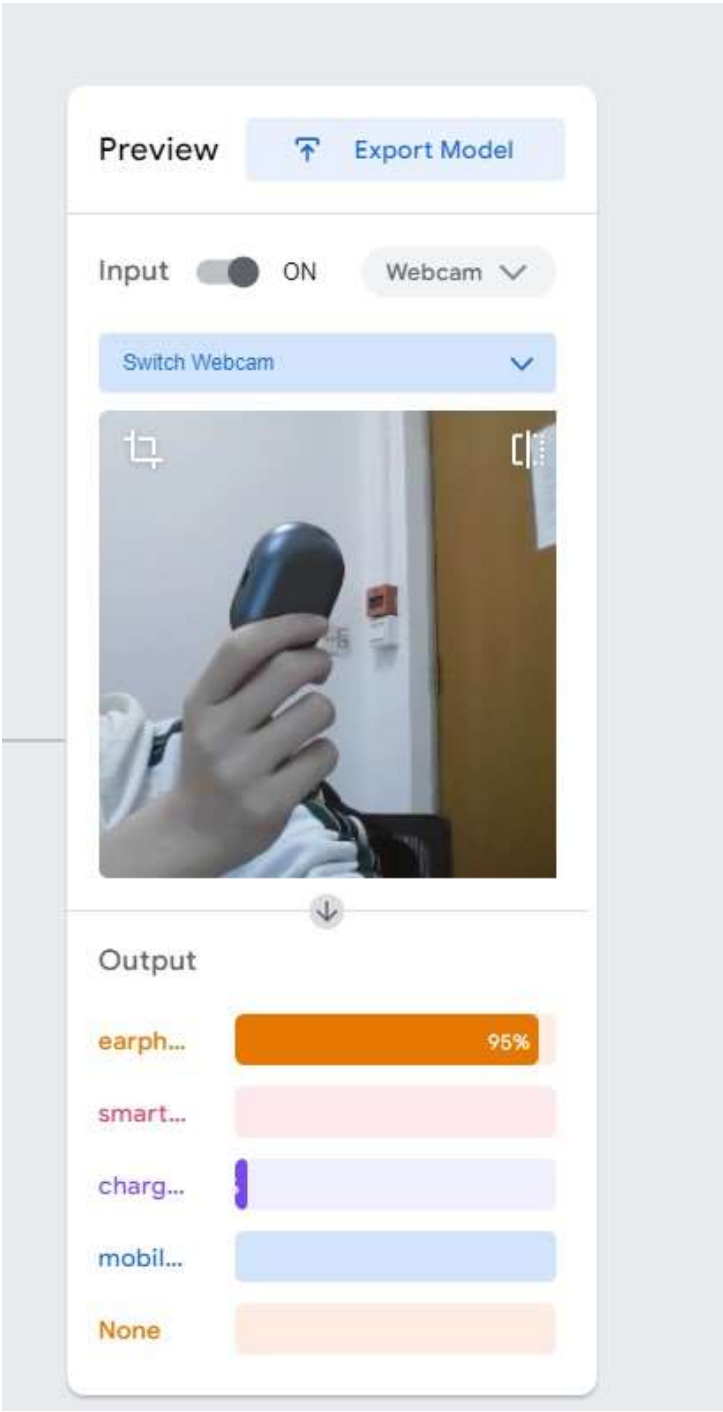
```
PS D:\Grade II\Computer Vision\作业_源代码> & 'C:\Users\72331\.conda\envs\tensorflow\python.exe' 'c:\Users\72331\.vscode\extensions\ms-python.python-2023.4.1\pythonFiles\lib\python\debugpy\adapter\..\debugpy\launcher' '51998' '--' 'D:\Grade II\Computer Vision\作业_源代码\test.py'
2023-03-22 18:28:07.990736: W tensorflow/stream_executor/platform/default/dso_loader.cc:64] Could not load dynamic library 'cudart64_110.dll'; dlderror:
cudart64_110.dll not found
2023-03-22 18:28:08.001909: I tensorflow/stream_executor/cuda/cudart_stub.cc:29] Ignore above cudart dlerror if you do not have a GPU set up on your mac
hine.
<module 'tensorflow' from 'C:\Users\72331\.conda\envs\tensorflow\lib\site-packages\tensorflow\__init__.py'>
<module 'cv2' from 'C:\Users\72331\.conda\envs\tensorflow\lib\site-packages\cv2\__init__.py'>
PS D:\Grade II\Computer Vision\作业_源代码>
```

2、开始初步训练

进入Teachable Machine后，点击开始使用，训练图片项目。
进入项目后，将分类分别命名成对应电子设备的名字，然后将webcam打开，分别采集每一种物品的样本图片，
如图所示：



分类建立完成，并添加好样本后，开始训练模型。等待一段时间后，可以在网页上即时预览到自己的模型准确程度，如图所示：



3、导出模型到本地

选择Export Model，选中TensorFlow，Download my model，将模型下载到本地。

Export your model to use it in projects. ✕

Tensorflow.js ⓘ

Tensorflow ⓘ

Tensorflow Lite ⓘ

Model conversion type:

☒ Keras

☐ Savedmodel

[Download my model](#)

Converts your model to a keras .h5 model. Note the conversion happens in the cloud, but your training data is not being uploaded, only your trained model.

Code snippets to use your model:

Keras

OpenCV Keras

[Contribute on Github](#)

```
from keras.models import load_model # TensorFlow is required for Keras to work
from PIL import Image, ImageOps # Install pillow instead of PIL
import numpy as np

# Disable scientific notation for clarity
np.set_printoptions(suppress=True)

# Load the model
model = load_model("keras_Model.h5", compile=False)

# Load the labels
class_names = open("labels.txt", "r").readlines()

# Create the array of the right shape to feed into the keras model
# The 'length' or number of images you can put into the array is
# determined by the first position in the shape tuple, in this case 1
data = np.zeros(shape=(1, 224, 224, 3), dtype=np.float32)
```

Copy

然后把下面的代码复制到一个python源文件里，将这个源文件和刚才下载模型放在同一目录下运行，即可对某张本地的图片进行识别，如图所示：

问题 输出 调试控制台 终端

+ FullyQualifiedErrorId : CommandNotFoundException

PS D:\Grade II\Computer Vision\作业_源代码> & 'C:\Users\72331\conda\envs\tensorflow\python.exe' 'c:\Users\72331\.vscode\extensions\ms-python.python-2023.4.1\pythonFiles\lib\python\debugpy\adapter\..\..\debugpy\launcher' '52580' '-.' 'D:\Grade II\Computer Vision\作业_源代码\电子设备识别.py'

2023-03-22 18:53:16.779994: W tensorflow/stream_executor/platform/default/dso_loader.cc:64] Could not load dynamic library 'cudart64_110.dll'; dlderror: cudart64_110.dll not found

2023-03-22 18:53:16.788353: I tensorflow/stream_executor/cuda/cudart_stub.cc:29] Ignore above cudart dlerror if you do not have a GPU set up on your machine.

2023-03-22 18:53:28.154734: W tensorflow/stream_executor/platform/default/dso_loader.cc:64] Could not load dynamic library 'nvcuda.dll'; dlderror: nvcuda.dll not found

2023-03-22 18:53:28.165710: W tensorflow/stream_executor/cuda/cuda_driver.cc:326] failed call to cuInit: UNKNOWN ERROR (303)

2023-03-22 18:53:28.179179: I tensorflow/stream_executor/cuda/cuda_diagnostics.cc:169] retrieving CUDA diagnostic information for host: LAPTOP-QCM9QP03

2023-03-22 18:53:28.193223: I tensorflow/stream_executor/cuda/cuda_diagnostics.cc:176] hostname: LAPTOP-QCM9QP03

2023-03-22 18:53:28.212387: I tensorflow/core/platform/cpu_feature_guard.cc:142] This TensorFlow binary is optimized with oneAPI Deep Neural Network Library (oneDNN) to use the following CPU instructions in performance-critical operations: AVX AVX2

To enable them in other operations, rebuild TensorFlow with the appropriate compiler flags.

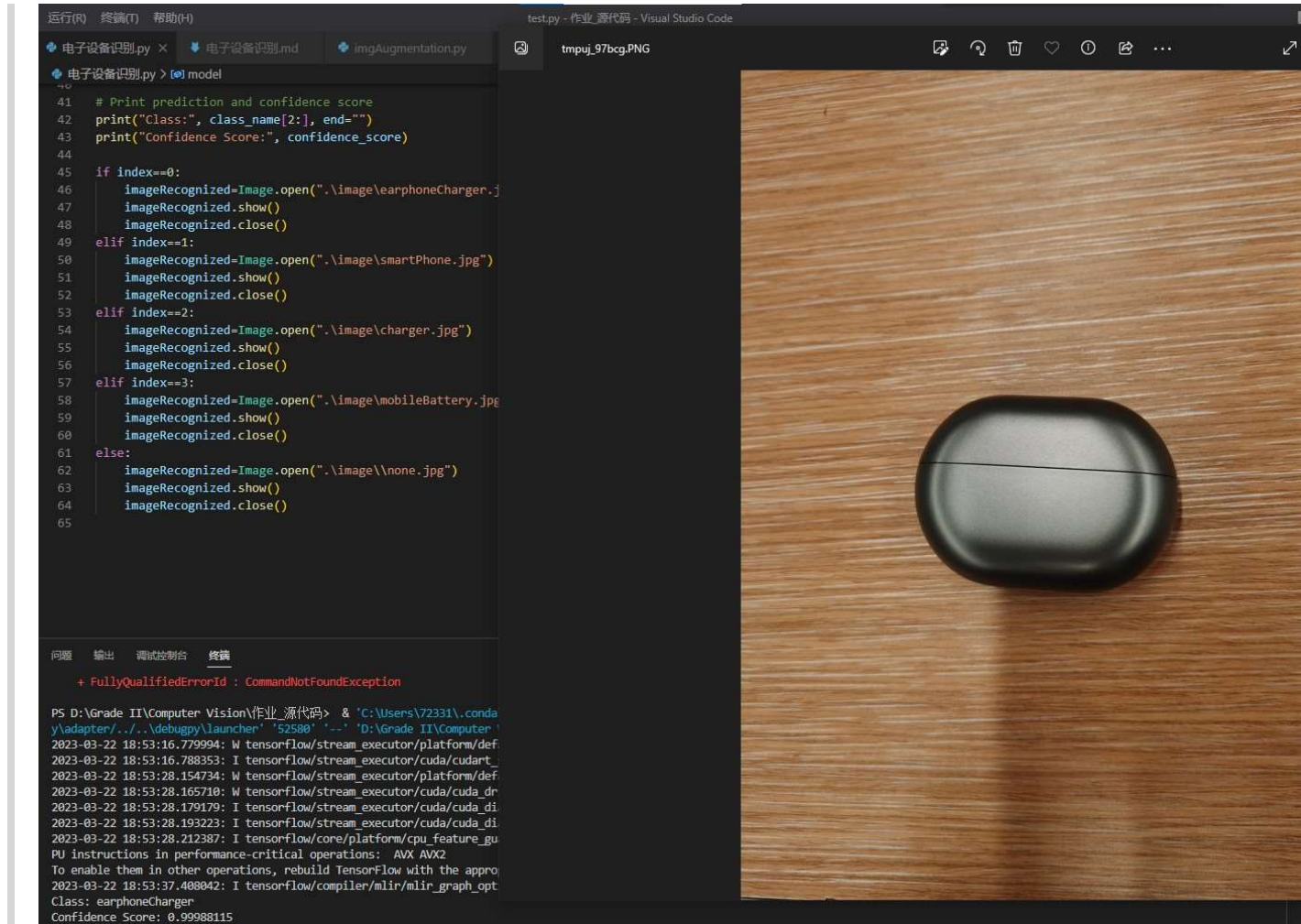
2023-03-22 18:53:37.488042: I tensorflow/compiler/mlir/mlir_graph_optimization_pass.cc:176] None of the MLIR Optimization Passes are enabled (registered 2)

Class: earphoneCharger

Confidence Score: 0.99988115

PS D:\Grade II\Computer Vision\作业_源代码> █

也就是说，我们已经成功将识别结果导出来了，现在我们就已经可以对它进行一些其他操作，比如，根据识别结果展示对应的图片，如图所示：

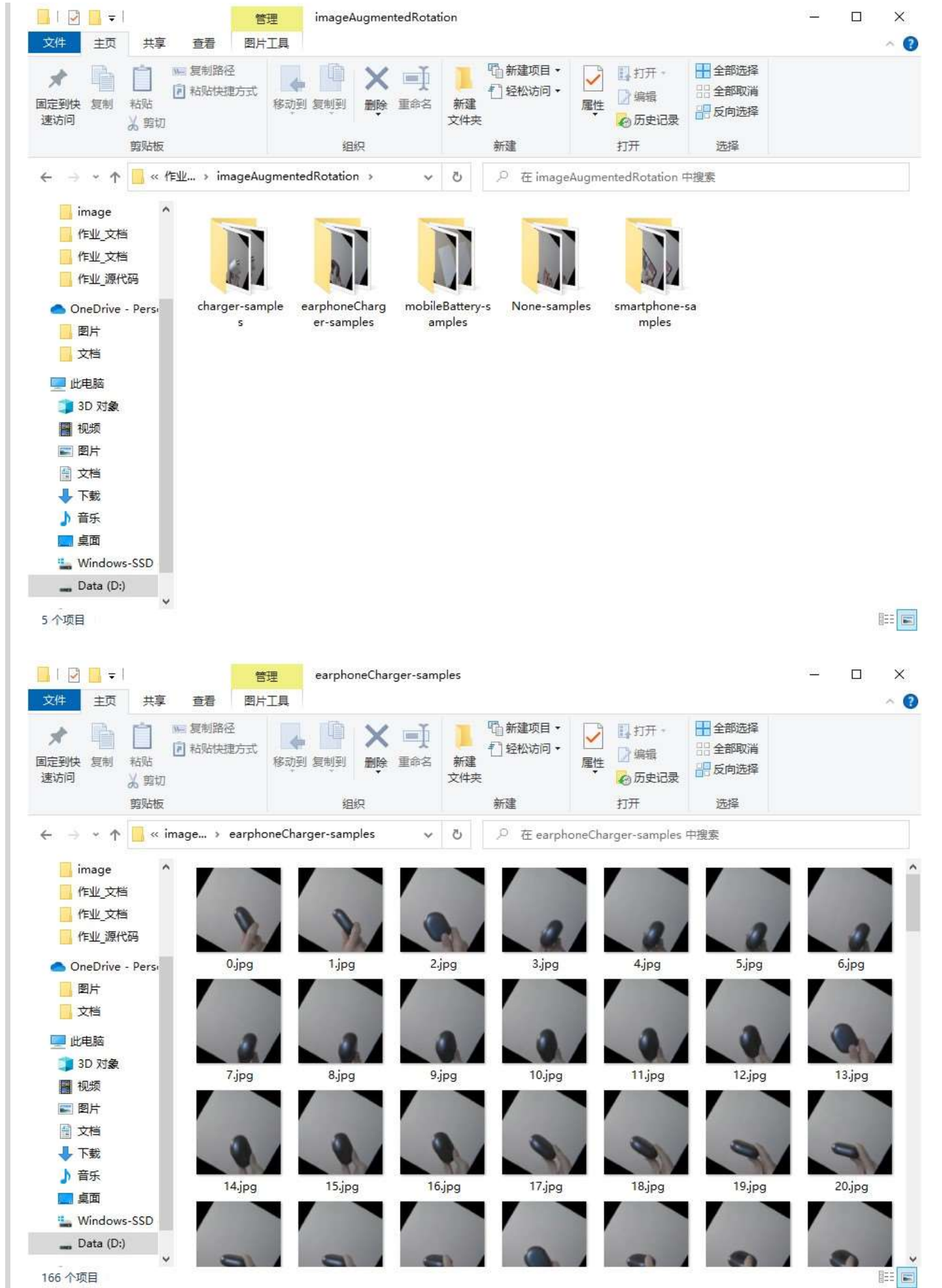


4、尝试数据增强

通过实验，发现有时候会识别错误或者识别不到，考虑通过数据增强的方式，预处理原始数据，然后重新导入样本到训练模型。

预处理采用了PIL库中的各项函数来对某张图片进行修改(翻转、旋转等)，然后批量处理输出到新文件夹中，最后将样本重新导入到网站中重新训练。(代码附在报告结尾)

以下是经过数据增强后的样本文件夹(以左右翻转、耳机充电仓为例)：



重新训练模型后重复之前的实验，发现识别的精度有所提高。

```
# 图像识别
from keras.models import load_model # TensorFlow is required for Keras to work
from PIL import Image, ImageOps # Install pillow instead of PIL
import numpy as np

# Disable scientific notation for clarity
np.set_printoptions(suppress=True)

# Load the model
model = load_model("keras_Model.h5", compile=False)

# Load the labels
class_names = open("labels.txt", "r").readlines()

# Create the array of the right shape to feed into the keras model
# The 'length' or number of images you can put into the array is
# determined by the first position in the shape tuple, in this case 1
data = np.ndarray(shape=(1, 224, 224, 3), dtype=np.float32)

# Replace this with the path to your image
image = Image.open(".\image\IMG_20230321_160416.jpg").convert("RGB")

# resizing the image to be at least 224x224 and then cropping from the center
size = (224, 224)
image = ImageOps.fit(image, size, Image.Resampling.LANCZOS)

# turn the image into a numpy array
image_array = np.asarray(image)

# Normalize the image
normalized_image_array = (image_array.astype(np.float32) / 127.5) - 1

# Load the image into the array
data[0] = normalized_image_array

# Predicts the model
prediction = model.predict(data)
index = np.argmax(prediction)
class_name = class_names[index]
confidence_score = prediction[0][index]

# Print prediction and confidence score
print("Class:", class_name[2:], end="")
print("Confidence Score:", confidence_score)

if index==0:
    imageRecognized=Image.open(".\image\earphoneCharger.jpg")
    imageRecognized.show()
    imageRecognized.close()
elif index==1:
    imageRecognized=Image.open(".\image\smartPhone.jpg")
    imageRecognized.show()
    imageRecognized.close()
elif index==2:
    imageRecognized=Image.open(".\image\charger.jpg")
    imageRecognized.show()
    imageRecognized.close()
elif index==3:
    imageRecognized=Image.open(".\image\mobileBattery.jpg")
    imageRecognized.show()
    imageRecognized.close()
```

```

else:
    imageRecognized=Image.open(".\image\\none.jpg")
    imageRecognized.show()
    imageRecognized.close()

# 数据批量预处理
from PIL import Image
import os
import imageAugFunctions as iaf
if __name__ == '__main__':
    deviceClasses=['charger-samples','earphoneCharger-samples',
                  'mobileBattery-samples','None-samples','smartphone-samples']
    for deviceClass in deviceClasses:
        path='D:\Grade II\Computer Vision\作业_源代码\imageSamples\\'+deviceClass
        filelist=os.listdir(path)

        path_all=[]
        for f in filelist:
            if f.endswith('.jpg'):
                path_all.append(os.path.join(path,f))

        pil_ims=[]
        for p in path_all:
            pil_ims.append(Image.open(p))
        print(len(pil_ims))
        counting=0
        savingPathRotation='.\imageAugmentedRotation\\'+deviceClass+'\\'
        savingPathGray='.\imageAugmentedGray\\'+deviceClass+'\\'
        savingPathFlipLR='.\imageAugmentedFlipLR\\'+deviceClass+'\\'
        savingPathFlipTB='.\imageAugmentedFlipTB\\'+deviceClass+'\\'

        for pilCurrent in pil_ims:
            iaf.Rotation(pilCurrent,counting,savingPathRotation,60)
            iaf.grayScaleConversion(pilCurrent,counting,savingPathGray)
            iaf.FlipLeftRight(pilCurrent,counting,savingPathFlipLR)
            iaf.FlipTopBottom(pilCurrent,counting,savingPathFlipTB)
            counting=counting+1

# 数据批量预处理所用函数
from PIL import Image
import os
def Rotation(pilCurrent,index,path,angel):
    savingPath=path+(str)(index)+'.jpg'
    pilRotate=pilCurrent.rotate(angel)
    pilRotate.save(savingPath)
def grayScaleConversion(pilCurrent,index,path):
    savingPath=path+(str)(index)+'.jpg'
    pilRotate=pilCurrent.convert('L')
    pilRotate.save(savingPath)
def FlipLeftRight(pilCurrent,index,path):
    savingPath=path+(str)(index)+'.jpg'
    pilRotate=pilCurrent.transpose(Image.FLIP_LEFT_RIGHT)
    pilRotate.save(savingPath)
def FlipTopBottom(pilCurrent,index,path):
    savingPath=path+(str)(index)+'.jpg'
    pilRotate=pilCurrent.transpose(Image.FLIP_TOP_BOTTOM)
    pilRotate.save(savingPath)

```