```
from keras.preprocessing.image import img_to_array
from keras.models import load_model
import numpy as np
import pandas as pd
import argparse
import imutils
import pickle
import cv2
import os
from keras.applications.vgg19 import VGG19
from keras.models import Model
from keras.layers import Dense, GlobalAveragePooling2D, Dropout
from keras.optimizers import SGD
import matplotlib.pyplot as plt
import urllib.request
```

```
Using TensorFlow backend.
```

```
data_list = pd.read_excel('Internship_data.xlsx')
```

```
# Run this cell to mount your Google Drive.
from google.colab import drive
drive.mount('/content/drive')
```

```
!unzip drive/My\ Drive/final_data-fynd.zip
```

```
labels = ['backstrap_BV',
 'backstrap_NBV',
 'buckle_BV',
 'buckle_NBV',
 'hook&look_BV',
 'hook&look_NBV',
 'lace_up_BV',
 'lace_up_NBV',
 'slip_on_BV',
 'slip_on_NBV',
 'zipper_BV',
 'zipper_NBV']
```

```
vgg_model = VGG19(weights='imagenet', include_top=False)
```

```
WARNING: Logging before flag parsing goes to stderr.
W0630 10:36:18.381148 139780937172864 deprecation_wrapper.py:119] From /usr/l

W0630 10:36:18.402068 139780937172864 deprecation_wrapper.py:119] From /usr/l

W0630 10:36:18.405764 139780937172864 deprecation_wrapper.py:119] From /usr/l

W0630 10:36:18.436507 139780937172864 deprecation_wrapper.py:119] From /usr/l

W0630 10:36:18.984603 139780937172864 deprecation_wrapper.py:119] From /usr/l

W0630 10:36:18.986264 139780937172864 deprecation_wrapper.py:119] From /usr/l
```

```
x = vgg_model.output
x = GlobalAveragePooling2D()(x)

# add fully-connected layer
x = Dense(512, activation='relu')(x)
x = Dropout(0.3)(x)

# add output layer
predictions = Dense(12, activation='softmax')(x)

model = Model(inputs=vgg_model.input, outputs=predictions)
model.load_weights('drive/My Drive/fine_tune_shoes_multiclass.best.hdf5')
```

```
W0630 10:36:21.114876 139780937172864 deprecation.py:506] From /usr/local/lib
Instructions for updating:
Please use `rate` instead of `keep_prob`. Rate should be set to `rate = 1 - k
```

```
def identify_type_submission(images , labels):
    class_link = pd.DataFrame(columns = ['predicted_class', 'best_view_image'])
    for i in range(0,len(images['class'])):
      best_image_index = 0
      type_score = dict()
      image_list = []
      best_image_link = []
      j = 0
      for view in ['view_1','view_2','view_3','view_4','view_5']:
        try:
          url_response = urllib.request.urlopen(images[view][i])
          img_array = np.array(bytearray(url_response.read()), dtype=np.uint8)
          image = cv2.imdecode(img_array, -1)
          image_list.append(image)
          best_image_link.append(images[view][i])
          image = cv2.resize(image, (128,128))
          image = img_to_array(image)
          image = np.expand_dims(image, axis=0)
          proba = model.predict(image)[0]
          idxs = np.argsort(proba)[::-1][:1]
          type_score[j] = {proba[idxs[0]] : labels[idxs[0]]}
          j = j+1
        except:
          continue

      best_image = dict()
      count = 0
      for key,i in type_score.items() :
          type_image  = list(i.values())[0]
          score = list(i.keys())[0]
          if type_image.split('_')[1] == 'BV':
              best_image[count] = {score : type_image.split('_')[0]}
          count = count + 1

      type_of_footwear = ''
      if len(best_image) == 1:
        for key,value in best_image.items():
            type_of_footwear = list(value.values())[0]
        best_image_index = list(best_image.keys())[0]
        class_link = class_link.append(pd.Series([type_of_footwear, best_image_link[best

      if len(best_image) > 1 :
        max_score = 0
        best_image_index = 0
        for key,value in best_image.items():
          if list(value.keys())[0] > max_score:
            max_score = list(value.keys())[0]
            best_image_index = key
            type_of_footwear = list(value.values())[0]
        class_link = class_link.append(pd.Series([type_of_footwear, best_image_link[best

      if len(best_image) == 0:
        max_score = 0
        best_image_index = 0
        for key,value in type_score.items():
          if list(value.keys())[0] > max_score:
            max_score = list(value.keys())[0]
            best_image_index = key
            type_of_footwear = list(value.values())[0].split('_')[0]
        class_link = class_link.append(pd.Series([type_of_footwear, best_image_link[best
    return class_link
```

```
%%time
predicted_data_list = identify_type_submission(data_list, labels)
```

```
CPU times: user 1h 15min 16s, sys: 57.8 s, total: 1h 16min 14s
Wall time: 6h 53min 45s
```

```
predicted_data_list.loc[predicted_data_list['predicted_class'] == 'slip', 'predicted_cla
predicted_data_list.loc[predicted_data_list['predicted_class'] == 'lace', 'predicted_cla
```

```
new_data = pd.concat([data_list, predicted_data_list], axis=1)
new_data.to_excel('Internship_Data-Predicted(Final).xlsx', index=False)
```

```
!pip install pandas_ml
```

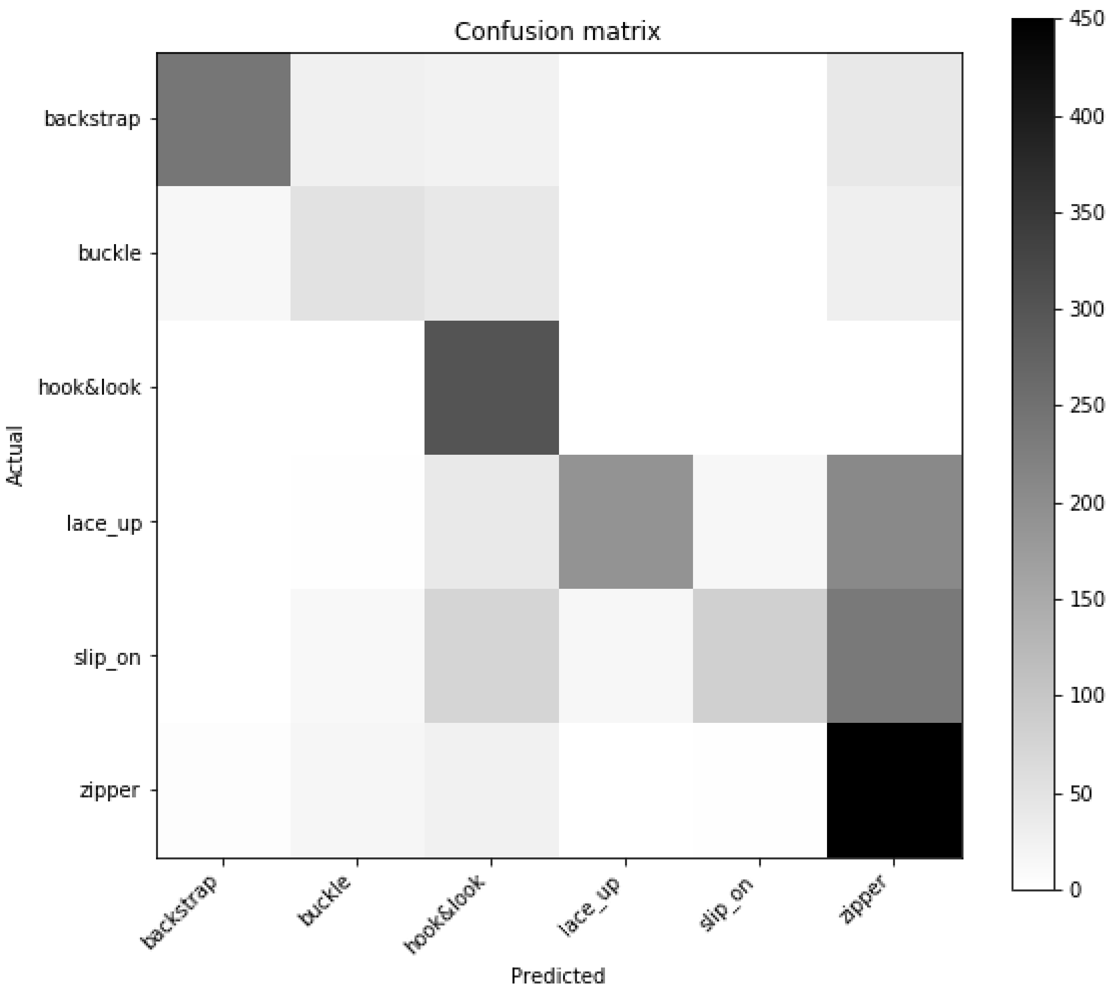
```
Collecting pandas_ml
  Downloading https://files.pythonhosted.org/packages/ae/72/6d90debfcb9ea74ec
    |████████████████████████████████| 102kB 2.7MB/s
Requirement already satisfied: enum34 in /usr/local/lib/python3.6/dist-packag
Requirement already satisfied: pandas>=0.19.0 in /usr/local/lib/python3.6/dis
Requirement already satisfied: pytz>=2011k in /usr/local/lib/python3.6/dist-p
Requirement already satisfied: python-dateutil>=2.5.0 in /usr/local/lib/pytho
Requirement already satisfied: numpy>=1.12.0 in /usr/local/lib/python3.6/dist
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.6/dist-pack
Installing collected packages: pandas-ml
Successfully installed pandas-ml-0.6.1
```

```
from sklearn.metrics import confusion_matrix, accuracy_score
from pandas_ml import ConfusionMatrix
import matplotlib.pyplot as plt
```

```
cm = ConfusionMatrix(new_data['class'], new_data['predicted_class'])
cm
```

```
Predicted  backstrap  buckle  hook&look  lace_up  slip_on  zipper  __all__
Actual
backstrap        241      27         24        0        1      42      335
buckle            15      52         41        1        1      29      139
hook&look          1       0        302        0        0       1      304
lace_up            0       2         39      189       15     208      453
slip_on            1      13         75       15       84     237      425
zipper             5      16         26        1        2     450      500
```

```
cm.plot()
plt.show()
```



```
accuracy_score(new_data['class'], new_data['predicted_class'])
```

```
0.6113172541743971
```