

Assignment 1C - Question 2

Semantic Person Search

In [1]:

```

from keras.models import Sequential
from keras_preprocessing.image import ImageDataGenerator
from keras.layers import Dense, Activation, Flatten, Dropout, BatchNormalization
from keras.layers import Conv2D, MaxPooling2D
from keras import regularizers, optimizers
import pandas as pd
import numpy as np
import glob
import cv2
import matplotlib.pyplot as plt
import keras
from keras import layers
from PIL import Image

import os
import datetime
import numpy

import tensorflow as tf

from tensorflow import keras
from tensorflow.keras import layers
from tensorboard import notebook
from tensorflow.keras.preprocessing.image import Iterator

from sklearn.metrics import confusion_matrix, ConfusionMatrixDisplay
import matplotlib.pyplot as plt

import pydot
import IPython
from IPython.display import SVG
from tensorflow.keras.utils import model_to_dot, plot_model
import imageio
import cv2

```

In [2]:

```

train = pd.read_csv('CAB420_Assessment_1C_Data/Data/Q2/Q2/Train_Data/Train.csv')
test = pd.read_csv('CAB420_Assessment_1C_Data/Data/Q2/Q2/Test_Data/Test.csv')

```

In [3]:

```

train_img = []
gnd = []
files = glob.glob('CAB420_Assessment_1C_Data/Data/Q2/Q2/Train_Data/Originals/*.png')
for myfile in files:
    im = keras.preprocessing.image.load_img(myfile, target_size=(268, 160))
    image = keras.preprocessing.image.img_to_array(im)
    gnd.append(myfile[58:])
    train_img.append(image)

train_img = np.array(train_img)
train_img = train_img.astype('float32') / 255.

```

In [4]:

```
print(train_img[0])

[[[0.27450982 0.2784314 0.24705882]
 [0.27450982 0.2784314 0.24705882]
 [0.27450982 0.2784314 0.24705882]
 ...
 [0.3372549 0.3372549 0.2901961 ]
 [0.34509805 0.34509805 0.29803923]
 [0.34117648 0.34117648 0.29411766]]

[[0.2784314 0.28235295 0.2509804 ]
 [0.2784314 0.28235295 0.2509804 ]
 [0.2784314 0.28235295 0.2509804 ]
 ...
 [0.3372549 0.3372549 0.2901961 ]
 [0.34901962 0.34901962 0.3019608 ]
 [0.34509805 0.34509805 0.29803923]]

[[0.2784314 0.28235295 0.2509804 ]
 [0.2784314 0.28235295 0.2509804 ]
 [0.2784314 0.28235295 0.2509804 ]
 ...
 [0.34117648 0.34117648 0.29411766]
 [0.3529412 0.3529412 0.30588236]
 [0.34901962 0.34901962 0.3019608 ]]

...
[[0.30980393 0.30980393 0.2627451 ]
 [0.30588236 0.30588236 0.25882354]
 [0.29803923 0.29803923 0.2509804 ]
 ...
 [0.4509804 0.44313726 0.39215687]
 [0.45490196 0.44705883 0.39607844]
 [0.45490196 0.44705883 0.39607844]]

[[0.30980393 0.30980393 0.2627451 ]
 [0.30588236 0.30588236 0.25882354]
 [0.29803923 0.29803923 0.2509804 ]
 ...
 [0.4392157 0.44313726 0.3882353 ]
 [0.44705883 0.4509804 0.39607844]
 [0.44705883 0.4509804 0.39607844]]

[[0.30980393 0.30980393 0.2627451 ]
 [0.30588236 0.30588236 0.25882354]
 [0.29803923 0.29803923 0.2509804 ]
 ...
 [0.44313726 0.44705883 0.39215687]
 [0.45490196 0.45882353 0.40392157]
 [0.4509804 0.45490196 0.4 ]]]
```

```
In [5]: test_img = []
test_gnd = []
files = glob.glob('CAB420_Assessment_1C_Data/Data/Q2/Q2/Test_Data/Originals/*.png')
for myfile in files:
    im = keras.preprocessing.image.load_img(myfile,target_size=(268,160))
    image = keras.preprocessing.image.img_to_array(im)
    test_gnd.append(myfile[58:])
    test_img.append(image)

test_img = np.array(test_img)
test_img = test_img.astype('float32') / 255.
```

```
In [6]: train = train.drop(columns=['torcol2','torcol3','tortex','torcol3','legcol2','legcol1'])
```

```

train_gender = train.iloc[:,1]
train_gender = np.asarray(train_gender)
train_tortyp = train.iloc[:,2]
train_tortyp = np.asarray(train_tortyp)
train_torcol = train.iloc[:,3]
train_torcol = np.asarray(train_torcol)
train_legtyp = train.iloc[:,4]
train_legtyp = np.asarray(train_legtyp)
train_legcol = train.iloc[:,5]
train_legcol = np.asarray(train_legcol)
train_luggage = train.iloc[:,6]
train_luggage = np.asarray(train_luggage)

```

In [7]:

```

test = test.drop(columns=['torcol2','torcol3','tortex','torcol3','legcol2','legcol3'])

test_gender = test.iloc[:,1]
test_gender = np.asarray(test_gender)
test_tortyp = test.iloc[:,2]
test_tortyp = np.asarray(test_tortyp)
test_torcol = test.iloc[:,3]
test_torcol = np.asarray(test_torcol)
test_legtyp = test.iloc[:,4]
test_legtyp = np.asarray(test_legtyp)
test_legcol = test.iloc[:,5]
test_legcol = np.asarray(test_legcol)
test_luggage = test.iloc[:,6]
test_luggage = np.asarray(test_luggage)

```

In [8]:

```

#fig = plt.figure(figsize=[20, 20])
#for i in range(100):
#    ax = fig.add_subplot(10, 10, i + 1)
#    ax.imshow(train_img[i])

```

In [9]:

```

#, tortyp, torcol, Legtyp, Legcol, Luggage]
#, train_tortyp, train_torcol, train_Legtyp, train_Legcol, train_Luggage]
#, test_tortyp, test_torcol, test_Legtyp, test_Legcol, test_Luggage]

```

In [10]:

```

inputs = keras.Input(shape=(268, 160, 3, ), name='img')

x = layers.Conv2D(filters=8, kernel_size=(3,3), padding='same', activation='swish')(x)
x = layers.Conv2D(filters=8, kernel_size=(3,3), padding='same', activation='swish')(x)
x = layers.BatchNormalization()(x)
x = layers.SpatialDropout2D(0.2)(x)
x = layers.MaxPool2D(pool_size=(2, 2))(x)
x = layers.Conv2D(filters=16, kernel_size=(3,3), padding='same', activation='swish')(x)
x = layers.Conv2D(filters=16, kernel_size=(3,3), padding='same', activation='swish')(x)
x = layers.BatchNormalization()(x)
x = layers.SpatialDropout2D(0.2)(x)
x = layers.MaxPool2D(pool_size=(2, 2))(x)
x = layers.Conv2D(filters=32, kernel_size=(3,3), padding='same', activation='swish')(x)
x = layers.Conv2D(filters=32, kernel_size=(3,3), padding='same', activation='swish')(x)
x = layers.BatchNormalization()(x)
x = layers.SpatialDropout2D(0.2)(x)
x = layers.Flatten()(x)
x = layers.Dense(256, activation='swish')(x)
x = layers.Dropout(0.5)(x)

```

```
x = layers.Dense(64, activation='swish'))(x)
gender = layers.Dense(3, name='gender_out'))(x)

x = layers.Conv2D(filters=8, kernel_size=(3,3), padding='same', activation='swish'))
x = layers.Conv2D(filters=8, kernel_size=(3,3), padding='same', activation='swish'))
x = layers.BatchNormalization()(x)
x = layers.SpatialDropout2D(0.2)(x)
x = layers.MaxPool2D(pool_size=(2, 2))(x)
x = layers.Conv2D(filters=16, kernel_size=(3,3), padding='same', activation='swish')
x = layers.Conv2D(filters=16, kernel_size=(3,3), padding='same', activation='swish')
x = layers.BatchNormalization()(x)
x = layers.SpatialDropout2D(0.2)(x)
x = layers.MaxPool2D(pool_size=(2, 2))(x)
x = layers.Conv2D(filters=32, kernel_size=(3,3), padding='same', activation='swish')
x = layers.Conv2D(filters=32, kernel_size=(3,3), padding='same', activation='swish')
x = layers.BatchNormalization()(x)
x = layers.SpatialDropout2D(0.2)(x)
x = layers.Flatten()(x)
x = layers.Dense(256, activation='swish'))(x)
x = layers.Dropout(0.5)(x)
x = layers.Dense(64, activation='swish'))(x)
tortyp = layers.Dense(3, name='tortyp_out'))(x)

x = layers.Conv2D(filters=8, kernel_size=(3,3), padding='same', activation='relu'))(i
x = layers.Conv2D(filters=8, kernel_size=(3,3), padding='same', activation='relu'))(x
x = layers.BatchNormalization()(x)
x = layers.SpatialDropout2D(0.2)(x)
x = layers.MaxPool2D(pool_size=(2, 2))(x)
x = layers.Conv2D(filters=16, kernel_size=(3,3), padding='same', activation='relu'))
x = layers.Conv2D(filters=16, kernel_size=(3,3), padding='same', activation='relu'))
x = layers.BatchNormalization()(x)
x = layers.SpatialDropout2D(0.2)(x)
x = layers.MaxPool2D(pool_size=(2, 2))(x)
x = layers.Conv2D(filters=32, kernel_size=(3,3), padding='same', activation='relu'))
x = layers.Conv2D(filters=32, kernel_size=(3,3), padding='same', activation='relu'))
x = layers.BatchNormalization()(x)
x = layers.SpatialDropout2D(0.2)(x)
x = layers.Flatten()(x)
x = layers.Dense(256, activation='relu'))(x)
x = layers.Dropout(0.5)(x)
x = layers.Dense(64, activation='relu'))(x)
torcol = layers.Dense(11, name='torcol_out'))(x)

x = layers.Conv2D(filters=8, kernel_size=(3,3), padding='same', activation='relu'))(i
x = layers.Conv2D(filters=8, kernel_size=(3,3), padding='same', activation='relu'))(x
x = layers.BatchNormalization()(x)
x = layers.SpatialDropout2D(0.2)(x)
x = layers.MaxPool2D(pool_size=(2, 2))(x)
x = layers.Conv2D(filters=16, kernel_size=(3,3), padding='same', activation='relu'))
x = layers.Conv2D(filters=16, kernel_size=(3,3), padding='same', activation='relu'))
x = layers.BatchNormalization()(x)
x = layers.SpatialDropout2D(0.2)(x)
x = layers.MaxPool2D(pool_size=(2, 2))(x)
x = layers.Conv2D(filters=32, kernel_size=(3,3), padding='same', activation='relu'))
x = layers.Conv2D(filters=32, kernel_size=(3,3), padding='same', activation='relu'))
x = layers.BatchNormalization()(x)
x = layers.SpatialDropout2D(0.2)(x)
x = layers.Flatten()(x)
x = layers.Dense(256, activation='relu'))(x)
x = layers.Dropout(0.5)(x)
x = layers.Dense(64, activation='relu'))(x)
legtyp = layers.Dense(3, name='legtyp_out'))(x)

x = layers.Conv2D(filters=8, kernel_size=(3,3), padding='same', activation='relu'))(i
x = layers.Conv2D(filters=8, kernel_size=(3,3), padding='same', activation='relu'))(x
```

```

x = layers.BatchNormalization()(x)
x = layers.SpatialDropout2D(0.2)(x)
x = layers.MaxPool2D(pool_size=(2, 2))(x)
x = layers.Conv2D(filters=16, kernel_size=(3,3), padding='same', activation='relu')(x)
x = layers.Conv2D(filters=16, kernel_size=(3,3), padding='same', activation='relu')(x)
x = layers.BatchNormalization()(x)
x = layers.SpatialDropout2D(0.2)(x)
x = layers.MaxPool2D(pool_size=(2, 2))(x)
x = layers.Conv2D(filters=32, kernel_size=(3,3), padding='same', activation='relu')(x)
x = layers.Conv2D(filters=32, kernel_size=(3,3), padding='same', activation='relu')(x)
x = layers.BatchNormalization()(x)
x = layers.SpatialDropout2D(0.2)(x)
x = layers.Flatten()(x)
x = layers.Dense(256, activation='relu')(x)
x = layers.Dropout(0.5)(x)
x = layers.Dense(64, activation='relu')(x)
legcol = layers.Dense(11, name='legocol_out')(x)

x = layers.Conv2D(filters=8, kernel_size=(3,3), padding='same', activation='relu')(x)
x = layers.Conv2D(filters=8, kernel_size=(3,3), padding='same', activation='relu')(x)
x = layers.BatchNormalization()(x)
x = layers.SpatialDropout2D(0.2)(x)
x = layers.MaxPool2D(pool_size=(2, 2))(x)
x = layers.Conv2D(filters=16, kernel_size=(3,3), padding='same', activation='relu')(x)
x = layers.Conv2D(filters=16, kernel_size=(3,3), padding='same', activation='relu')(x)
x = layers.BatchNormalization()(x)
x = layers.SpatialDropout2D(0.2)(x)
x = layers.MaxPool2D(pool_size=(2, 2))(x)
x = layers.Conv2D(filters=32, kernel_size=(3,3), padding='same', activation='relu')(x)
x = layers.Conv2D(filters=32, kernel_size=(3,3), padding='same', activation='relu')(x)
x = layers.BatchNormalization()(x)
x = layers.SpatialDropout2D(0.2)(x)
x = layers.Flatten()(x)
x = layers.Dense(256, activation='relu')(x)
x = layers.Dropout(0.5)(x)
x = layers.Dense(64, activation='relu')(x)
luggage = layers.Dense(3, name='luggage_out')(x)

model_cnn = keras.Model(inputs=inputs, outputs=[gender, tortyp, torcol, legc

# inputs = keras.Input(shape=(50, 50, 3, ), name='img')
# x = Layers.Conv2D(filters=8, kernel_size=(3,3), activation='relu', padding='same')
# x = Layers.MaxPool2D(pool_size=(2, 2))(x)
# x = Layers.Conv2D(filters=16, kernel_size=(3,3), activation='relu', padding='same')
# x = Layers.MaxPool2D(pool_size=(2, 2))(x)
# x = Layers.Conv2D(filters=32, kernel_size=(3,3), activation='relu', padding='same')
# x = Layers.Flatten()(x)
# x = Layers.Dense(64, activation='relu')(x)
# outputs = Layers.Dense(11, activation='softmax')(x)

# model_cnn = keras.Model(inputs=inputs, outputs=outputs, name='SVHN_CNN_Model')

model_cnn.summary()

```

batch_normalization_6 (BatchNor	(None, 268, 160, 8)	32	conv2d_13[0][0]
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batch_normalization_9 (BatchNor	(None, 268, 160, 8)	32	conv2d_19[0][0]
---------------------------------	---------------------	----	-----------------

batch_normalization_12 (BatchNo	(None, 268, 160, 8)	32	conv2d_25[0][0]
---------------------------------	---------------------	----	-----------------

batch_normalization_15 (BatchNo	(None, 268, 160, 8)	32	conv2d_31[0][0]
spatial_dropout2d (SpatialDropo	(None, 268, 160, 8)	0	batch_normalization[0][0]
spatial_dropout2d_3 (SpatialDro	(None, 268, 160, 8)	0	batch_normalization_3[0][0]
spatial_dropout2d_6 (SpatialDro	(None, 268, 160, 8)	0	batch_normalization_6[0][0]
spatial_dropout2d_9 (SpatialDro	(None, 268, 160, 8)	0	batch_normalization_9[0][0]
spatial_dropout2d_12 (SpatialDr	(None, 268, 160, 8)	0	batch_normalization_12[0][0]
spatial_dropout2d_15 (SpatialDr	(None, 268, 160, 8)	0	batch_normalization_15[0][0]
max_pooling2d (MaxPooling2D)	(None, 134, 80, 8)	0	spatial_dropout2d[0][0]
max_pooling2d_2 (MaxPooling2D)	(None, 134, 80, 8)	0	spatial_dropout2d_3[0][0]
max_pooling2d_4 (MaxPooling2D)	(None, 134, 80, 8)	0	spatial_dropout2d_6[0][0]
max_pooling2d_6 (MaxPooling2D)	(None, 134, 80, 8)	0	spatial_dropout2d_9[0][0]
max_pooling2d_8 (MaxPooling2D)	(None, 134, 80, 8)	0	spatial_dropout2d_12[0][0]
max_pooling2d_10 (MaxPooling2D)	(None, 134, 80, 8)	0	spatial_dropout2d_15[0][0]
conv2d_2 (Conv2D)	(None, 134, 80, 16)	1168	max_pooling2d[0][0]
conv2d_8 (Conv2D)	(None, 134, 80, 16)	1168	max_pooling2d_2[0]
conv2d_14 (Conv2D)	(None, 134, 80, 16)	1168	max_pooling2d_4[0]
conv2d_20 (Conv2D)	(None, 134, 80, 16)	1168	max_pooling2d_6[0]
conv2d_26 (Conv2D)	(None, 134, 80, 16)	1168	max_pooling2d_8[0]

conv2d_32 (Conv2D) [0]	(None, 134, 80, 16)	1168	max_pooling2d_10[0]
conv2d_3 (Conv2D)	(None, 134, 80, 16)	2320	conv2d_2[0][0]
conv2d_9 (Conv2D)	(None, 134, 80, 16)	2320	conv2d_8[0][0]
conv2d_15 (Conv2D)	(None, 134, 80, 16)	2320	conv2d_14[0][0]
conv2d_21 (Conv2D)	(None, 134, 80, 16)	2320	conv2d_20[0][0]
conv2d_27 (Conv2D)	(None, 134, 80, 16)	2320	conv2d_26[0][0]
conv2d_33 (Conv2D)	(None, 134, 80, 16)	2320	conv2d_32[0][0]
batch_normalization_1 (BatchNor	(None, 134, 80, 16)	64	conv2d_3[0][0]
batch_normalization_4 (BatchNor	(None, 134, 80, 16)	64	conv2d_9[0][0]
batch_normalization_7 (BatchNor	(None, 134, 80, 16)	64	conv2d_15[0][0]
batch_normalization_10 (BatchNo	(None, 134, 80, 16)	64	conv2d_21[0][0]
batch_normalization_13 (BatchNo	(None, 134, 80, 16)	64	conv2d_27[0][0]
batch_normalization_16 (BatchNo	(None, 134, 80, 16)	64	conv2d_33[0][0]
spatial_dropout2d_1 (SpatialDro	(None, 134, 80, 16)	0	batch_normalization _1[0][0]
spatial_dropout2d_4 (SpatialDro	(None, 134, 80, 16)	0	batch_normalization _4[0][0]
spatial_dropout2d_7 (SpatialDro	(None, 134, 80, 16)	0	batch_normalization _7[0][0]
spatial_dropout2d_10 (SpatialDr	(None, 134, 80, 16)	0	batch_normalization _10[0][0]
spatial_dropout2d_13 (SpatialDr	(None, 134, 80, 16)	0	batch_normalization _13[0][0]
spatial_dropout2d_16 (SpatialDr	(None, 134, 80, 16)	0	batch_normalization _16[0][0]
max_pooling2d_1 (MaxPooling2D)	(None, 67, 40, 16)	0	spatial_dropout2d_1 [0][0]

max_pooling2d_3 (MaxPooling2D)	(None, 67, 40, 16)	0	spatial_dropout2d_4[0][0]
max_pooling2d_5 (MaxPooling2D)	(None, 67, 40, 16)	0	spatial_dropout2d_7[0][0]
max_pooling2d_7 (MaxPooling2D)	(None, 67, 40, 16)	0	spatial_dropout2d_10[0][0]
max_pooling2d_9 (MaxPooling2D)	(None, 67, 40, 16)	0	spatial_dropout2d_13[0][0]
max_pooling2d_11 (MaxPooling2D)	(None, 67, 40, 16)	0	spatial_dropout2d_16[0][0]
conv2d_4 (Conv2D)	(None, 67, 40, 32)	4640	max_pooling2d_1[0]
conv2d_10 (Conv2D)	(None, 67, 40, 32)	4640	max_pooling2d_3[0]
conv2d_16 (Conv2D)	(None, 67, 40, 32)	4640	max_pooling2d_5[0]
conv2d_22 (Conv2D)	(None, 67, 40, 32)	4640	max_pooling2d_7[0]
conv2d_28 (Conv2D)	(None, 67, 40, 32)	4640	max_pooling2d_9[0]
conv2d_34 (Conv2D)	(None, 67, 40, 32)	4640	max_pooling2d_11[0]
conv2d_5 (Conv2D)	(None, 67, 40, 32)	9248	conv2d_4[0][0]
conv2d_11 (Conv2D)	(None, 67, 40, 32)	9248	conv2d_10[0][0]
conv2d_17 (Conv2D)	(None, 67, 40, 32)	9248	conv2d_16[0][0]
conv2d_23 (Conv2D)	(None, 67, 40, 32)	9248	conv2d_22[0][0]
conv2d_29 (Conv2D)	(None, 67, 40, 32)	9248	conv2d_28[0][0]
conv2d_35 (Conv2D)	(None, 67, 40, 32)	9248	conv2d_34[0][0]
batch_normalization_2 (BatchNor	(None, 67, 40, 32)	128	conv2d_5[0][0]
batch_normalization_5 (BatchNor	(None, 67, 40, 32)	128	conv2d_11[0][0]

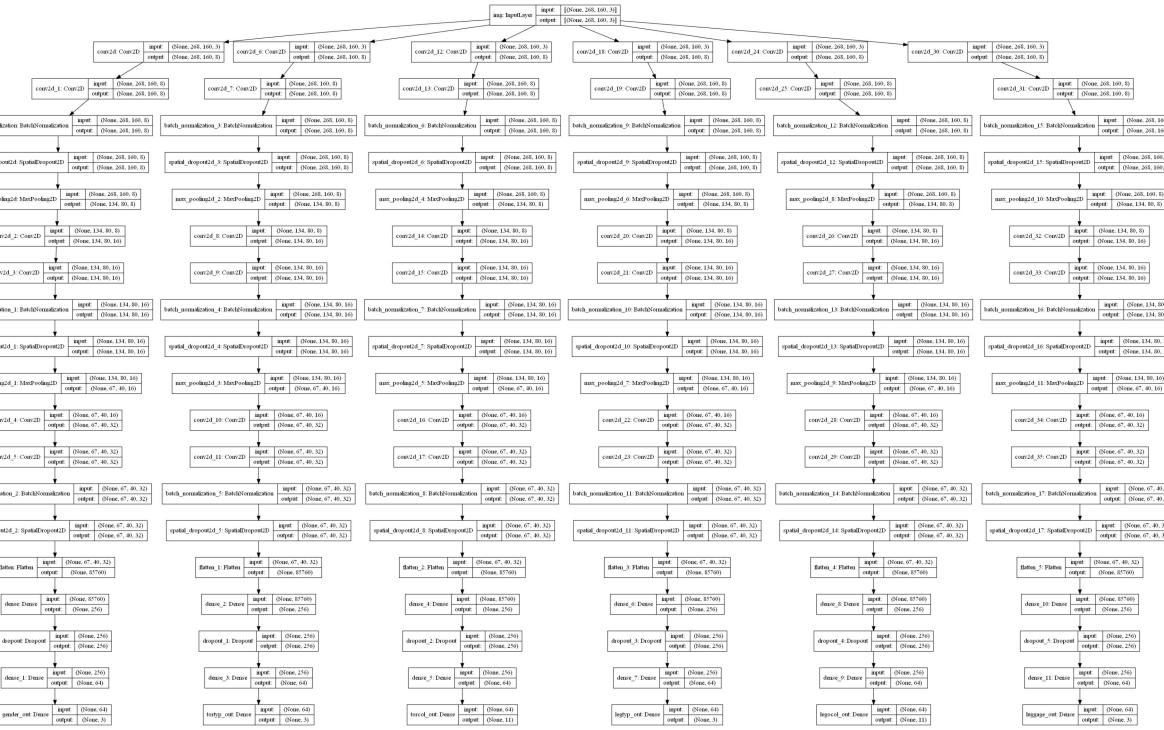
batch_normalization_8 (BatchNor (None, 67, 40, 32)	128	conv2d_17[0][0]
batch_normalization_11 (BatchNo (None, 67, 40, 32)	128	conv2d_23[0][0]
batch_normalization_14 (BatchNo (None, 67, 40, 32)	128	conv2d_29[0][0]
batch_normalization_17 (BatchNo (None, 67, 40, 32)	128	conv2d_35[0][0]
spatial_dropout2d_2 (SpatialDro (None, 67, 40, 32)	0	batch_normalization_2[0][0]
spatial_dropout2d_5 (SpatialDro (None, 67, 40, 32)	0	batch_normalization_5[0][0]
spatial_dropout2d_8 (SpatialDro (None, 67, 40, 32)	0	batch_normalization_8[0][0]
spatial_dropout2d_11 (SpatialDr (None, 67, 40, 32)	0	batch_normalization_11[0][0]
spatial_dropout2d_14 (SpatialDr (None, 67, 40, 32)	0	batch_normalization_14[0][0]
spatial_dropout2d_17 (SpatialDr (None, 67, 40, 32)	0	batch_normalization_17[0][0]
flatten (Flatten)	(None, 85760)	0
[0][0]		spatial_dropout2d_2
flatten_1 (Flatten)	(None, 85760)	0
[0][0]		spatial_dropout2d_5
flatten_2 (Flatten)	(None, 85760)	0
[0][0]		spatial_dropout2d_8
flatten_3 (Flatten)	(None, 85760)	0
[0][0]		spatial_dropout2d_1
flatten_4 (Flatten)	(None, 85760)	0
[0][0]		spatial_dropout2d_1
flatten_5 (Flatten)	(None, 85760)	0
[0][0]		spatial_dropout2d_1
dense (Dense)	(None, 256)	21954816
		flatten[0][0]
dense_2 (Dense)	(None, 256)	21954816
		flatten_1[0][0]
dense_4 (Dense)	(None, 256)	21954816
		flatten_2[0][0]

dense_6 (Dense)	(None, 256)	21954816	flatten_3[0][0]
dense_8 (Dense)	(None, 256)	21954816	flatten_4[0][0]
dense_10 (Dense)	(None, 256)	21954816	flatten_5[0][0]
dropout (Dropout)	(None, 256)	0	dense[0][0]
dropout_1 (Dropout)	(None, 256)	0	dense_2[0][0]
dropout_2 (Dropout)	(None, 256)	0	dense_4[0][0]
dropout_3 (Dropout)	(None, 256)	0	dense_6[0][0]
dropout_4 (Dropout)	(None, 256)	0	dense_8[0][0]
dropout_5 (Dropout)	(None, 256)	0	dense_10[0][0]
dense_1 (Dense)	(None, 64)	16448	dropout[0][0]
dense_3 (Dense)	(None, 64)	16448	dropout_1[0][0]
dense_5 (Dense)	(None, 64)	16448	dropout_2[0][0]
dense_7 (Dense)	(None, 64)	16448	dropout_3[0][0]
dense_9 (Dense)	(None, 64)	16448	dropout_4[0][0]
dense_11 (Dense)	(None, 64)	16448	dropout_5[0][0]
gender_out (Dense)	(None, 3)	195	dense_1[0][0]
tortyp_out (Dense)	(None, 3)	195	dense_3[0][0]
torcol_out (Dense)	(None, 11)	715	dense_5[0][0]
legtyp_out (Dense)	(None, 3)	195	dense_7[0][0]
legocol_out (Dense)	(None, 11)	715	dense_9[0][0]
luggage_out (Dense)	(None, 3)	195	dense_11[0][0]
<hr/> <hr/>			
Total params: 131,940,242			
Trainable params: 131,939,570			
Non-trainable params: 672			

In [11]:

```
plot_model(model_cnn, to_file='test_keras_plot_model.png', show_shapes=True)
IPython.display.Image('test_keras_plot_model.png')
```

Out[11]:



In [12]:

```
model_cnn.compile(loss=['mean_squared_error'], keras.losses.SparseCategoricalCrossent
optimizer=keras.optimizers.RMSprop(), metrics=['accuracy'])
```

In [13]:

```
history = model_cnn.fit(train_img, [train_gender, train_tortyp, train_torcol, train_
batch_size=64,
epochs=20,
validation_data=(test_img, [test_gender, test_tortyp, test_torco
```

Epoch 1/20

WARNING:tensorflow:Gradients do not exist for variables ['conv2d_12/kernel:0', 'conv2d_12/bias:0', 'conv2d_18/kernel:0', 'conv2d_18/bias:0', 'conv2d_24/kernel:0', 'conv2d_24/bias:0', 'conv2d_30/kernel:0', 'conv2d_30/bias:0', 'conv2d_13/kernel:0', 'conv2d_13/bias:0', 'conv2d_19/kernel:0', 'conv2d_19/bias:0', 'conv2d_25/kernel:0', 'conv2d_25/bias:0', 'conv2d_31/kernel:0', 'conv2d_31/bias:0', 'batch_normalization_6/gamma:0', 'batch_normalization_6/beta:0', 'batch_normalization_9/gamma:0', 'batch_normalization_9/beta:0', 'batch_normalization_12/gamma:0', 'batch_normalization_12/beta:0', 'batch_normalization_15/gamma:0', 'batch_normalization_15/beta:0', 'conv2d_14/kernel:0', 'conv2d_14/bias:0', 'conv2d_20/kernel:0', 'conv2d_20/bias:0', 'conv2d_26/kernel:0', 'conv2d_26/bias:0', 'conv2d_32/kernel:0', 'conv2d_32/bias:0', 'conv2d_15/kernel:0', 'conv2d_15/bias:0', 'conv2d_21/kernel:0', 'conv2d_21/bias:0', 'conv2d_27/kernel:0', 'conv2d_27/bias:0', 'conv2d_33/kernel:0', 'conv2d_33/bias:0', 'batch_normalization_7/gamma:0', 'batch_normalization_7/beta:0', 'batch_normalization_10/gamma:0', 'batch_normalization_10/beta:0', 'batch_normalization_13/gamma:0', 'batch_normalization_13/beta:0', 'batch_normalization_16/gamma:0', 'batch_normalization_16/beta:0', 'conv2d_16/kernel:0', 'conv2d_16/bias:0', 'conv2d_22/kernel:0', 'conv2d_22/bias:0', 'conv2d_28/kernel:0', 'conv2d_28/bias:0', 'conv2d_34/kernel:0', 'conv2d_34/bias:0', 'conv2d_17/kernel:0', 'conv2d_17/bias:0', 'conv2d_23/kernel:0', 'conv2d_23/bias:0', 'conv2d_29/kernel:0', 'conv2d_29/bias:0', 'conv2d_35/kernel:0', 'conv2d_35/bias:0', 'batch_normalization_8/gamma:0', 'batch_normalization_8/beta:0', 'batch_normalization_11/gamma:0', 'batch_normalization_11/beta:0', 'batch_normalization_14/gamma:0', 'batch_normalization_14/beta:0', 'batch_normalization_17/gamma:0', 'batch_normalization_17/beta:0', 'dense_4/kernel:0', 'dense_4/bias:0', 'dense_6/kernel:0', 'dense_6/bias:0', 'dense_8/kernel:0', 'dense_8/bias:0', 'dense_10/kernel:0', 'dense_10/bias:0', 'dense_5/kernel:0', 'dense_5/bias:0', 'dense_7/kernel:0', 'dense_7/bias:0', 'dense_9/kernel:0', 'dense_9/bias:0', 'dense_11/kernel:0', 'dense_11/bias:0', 'torcol_out/kernel:0', 'torcol_out/bias:0', 'legotyp_out/kernel:0', 'legotyp_out/bias:0', 'legocol_out/kernel:0', 'legocol_out/bias:0', 'luggage_out/kernel:0', 'luggage_out/bias:0']

```

0'] when minimizing the loss.
WARNING:tensorflow:Gradients do not exist for variables ['conv2d_12/kernel:0', 'conv2d_12/bias:0', 'conv2d_18/kernel:0', 'conv2d_18/bias:0', 'conv2d_24/kernel:0', 'conv2d_24/bias:0', 'conv2d_30/kernel:0', 'conv2d_30/bias:0', 'conv2d_13/kernel:0', 'conv2d_13/bias:0', 'conv2d_19/kernel:0', 'conv2d_19/bias:0', 'conv2d_25/kernel:0', 'conv2d_25/bias:0', 'conv2d_31/kernel:0', 'conv2d_31/bias:0', 'batch_normalization_6/gamma:0', 'batch_normalization_6/beta:0', 'batch_normalization_9/gamma:0', 'batch_normalization_9/beta:0', 'batch_normalization_12/gamma:0', 'batch_normalization_12/beta:0', 'batch_normalization_15/gamma:0', 'batch_normalization_15/beta:0', 'conv2d_14/kernel:0', 'conv2d_14/bias:0', 'conv2d_20/kernel:0', 'conv2d_20/bias:0', 'conv2d_26/kernel:0', 'conv2d_26/bias:0', 'conv2d_32/kernel:0', 'conv2d_32/bias:0', 'conv2d_15/kernel:0', 'conv2d_15/bias:0', 'conv2d_21/kernel:0', 'conv2d_21/bias:0', 'conv2d_27/kernel:0', 'conv2d_27/bias:0', 'conv2d_33/kernel:0', 'conv2d_33/bias:0', 'batch_normalization_7/gamma:0', 'batch_normalization_7/beta:0', 'batch_normalization_10/gamma:0', 'batch_normalization_10/beta:0', 'batch_normalization_13/gamma:0', 'batch_normalization_13/beta:0', 'batch_normalization_16/gamma:0', 'batch_normalization_16/beta:0', 'conv2d_16/kernel:0', 'conv2d_16/bias:0', 'conv2d_22/kernel:0', 'conv2d_22/bias:0', 'conv2d_28/kernel:0', 'conv2d_28/bias:0', 'conv2d_34/kernel:0', 'conv2d_34/bias:0', 'conv2d_17/kernel:0', 'conv2d_17/bias:0', 'conv2d_23/kernel:0', 'conv2d_23/bias:0', 'conv2d_29/kernel:0', 'conv2d_29/bias:0', 'conv2d_35/kernel:0', 'conv2d_35/bias:0', 'batch_normalization_8/gamma:0', 'batch_normalization_8/beta:0', 'batch_normalization_11/gamma:0', 'batch_normalization_11/beta:0', 'batch_normalization_14/gamma:0', 'batch_normalization_14/beta:0', 'batch_normalization_17/gamma:0', 'batch_normalization_17/beta:0', 'dense_4/kernel:0', 'dense_4/bias:0', 'dense_6/kernel:0', 'dense_6/bias:0', 'dense_8/kernel:0', 'dense_8/bias:0', 'dense_10/kernel:0', 'dense_10/bias:0', 'dense_5/kernel:0', 'dense_5/bias:0', 'dense_7/kernel:0', 'dense_7/bias:0', 'dense_9/kernel:0', 'dense_9/bias:0', 'dense_11/kernel:0', 'dense_11/bias:0', 'torcol_out/kernel:0', 'torcol_out/bias:0', 'legotyp_out/kernel:0', 'legotyp_out/bias:0', 'legocol_out/kernel:0', 'legocol_out/bias:0', 'luggage_out/kernel:0', 'luggage_out/bias:0'] when minimizing the loss.

9/9 [=====] - 38s 4s/step - loss: 685.1964 - gender_out_loss: 668.8911 - tortyp_out_loss: 16.3054 - gender_out_accuracy: 0.3519 - tortyp_out_accuracy: 0.4827 - torcol_out_accuracy: 0.1096 - legotyp_out_accuracy: 0.1115 - legocol_out_accuracy: 0.1596 - luggage_out_accuracy: 0.1654 - val_loss: 1.3725 - val_gender_out_loss: 0.6103 - val_tortyp_out_loss: 0.7622 - val_gender_out_accuracy: 0.0000e+00 - val_tortyp_out_accuracy: 0.6173 - val_torcol_out_accuracy: 0.0816 - val_legotyp_out_accuracy: 0.0102 - val_legocol_out_accuracy: 0.1071 - val_luggage_out_accuracy: 0.0408

Epoch 2/20
9/9 [=====] - 33s 4s/step - loss: 138.9341 - gender_out_loss: 132.3923 - tortyp_out_loss: 6.5418 - gender_out_accuracy: 0.3558 - tortyp_out_accuracy: 0.5673 - torcol_out_accuracy: 0.0942 - legotyp_out_accuracy: 0.1500 - legocol_out_accuracy: 0.1519 - luggage_out_accuracy: 0.1962 - val_loss: 1.3203 - val_gender_out_loss: 0.5989 - val_tortyp_out_loss: 0.7215 - val_gender_out_accuracy: 0.0000e+00 - val_tortyp_out_accuracy: 0.6173 - val_torcol_out_accuracy: 0.0765 - val_legotyp_out_accuracy: 0.0714 - val_legocol_out_accuracy: 0.0255 - val_luggage_out_accuracy: 0.2347

Epoch 3/20
9/9 [=====] - 32s 4s/step - loss: 48.8480 - gender_out_loss: 44.2301 - tortyp_out_loss: 4.6179 - gender_out_accuracy: 0.3500 - tortyp_out_accuracy: 0.5654 - torcol_out_accuracy: 0.1000 - legotyp_out_accuracy: 0.1327 - legocol_out_accuracy: 0.1904 - luggage_out_accuracy: 0.1981 - val_loss: 1.3568 - val_gender_out_loss: 0.6302 - val_tortyp_out_loss: 0.7266 - val_gender_out_accuracy: 0.0000e+00 - val_tortyp_out_accuracy: 0.3827 - val_torcol_out_accuracy: 0.1378 - val_legotyp_out_accuracy: 0.2143 - val_legocol_out_accuracy: 0.0051 - val_luggage_out_accuracy: 0.4847

Epoch 4/20
9/9 [=====] - 33s 4s/step - loss: 29.0974 - gender_out_loss: 25.6433 - tortyp_out_loss: 3.4541 - gender_out_accuracy: 0.3538 - tortyp_out_accuracy: 0.5962 - torcol_out_accuracy: 0.1365 - legotyp_out_accuracy: 0.1096 - legocol_out_accuracy: 0.1635 - luggage_out_accuracy: 0.2019 - val_loss: 1.5976 - val_gender_out_loss: 0.6024 - val_tortyp_out_loss: 0.9953 - val_gender_out_accuracy: 0.1224 - val_tortyp_out_accuracy: 0.3827 - val_torcol_out_accuracy: 0.1939 - val_legotyp_out_accuracy: 0.3418 - val_legocol_out_accuracy: 0.0051 - val_luggage_out_accuracy: 0.5969

Epoch 5/20
9/9 [=====] - 32s 4s/step - loss: 21.0972 - gender_out_loss: 18.2634 - tortyp_out_loss: 2.8338 - gender_out_accuracy: 0.3269 - tortyp_out_accuracy: 0.6038 - torcol_out_accuracy: 0.1269 - legotyp_out_accuracy: 0.1404 - legocol_out_accuracy: 0.1577 - luggage_out_accuracy: 0.1981 - val_loss: 1.4471 - val_gender_out_accuracy: 0.3418 - val_legocol_out_accuracy: 0.0051 - val_luggage_out_accuracy: 0.5969

```

```
ut_loss: 0.5811 - val_tortyp_out_loss: 0.8659 - val_gender_out_accuracy: 0.5000 - va  
l_tortyp_out_accuracy: 0.3827 - val_torcol_out_accuracy: 0.2245 - val_legotyp_out_acc  
uracy: 0.4337 - val_legocol_out_accuracy: 0.0051 - val_luggage_out_accuracy: 0.6327  
Epoch 6/20  
9/9 [=====] - 33s 4s/step - loss: 8.9105 - gender_out_loss:  
6.6734 - tortyp_out_loss: 2.2371 - gender_out_accuracy: 0.3500 - tortyp_out_accuracy:  
0.6154 - torcol_out_accuracy: 0.1288 - legotyp_out_accuracy: 0.1327 - legocol_out_ac  
curacy: 0.1692 - luggage_out_accuracy: 0.1904 - val_loss: 1.2542 - val_gender_out_los  
s: 0.5466 - val_tortyp_out_loss: 0.7076 - val_gender_out_accuracy: 0.5000 - val_t  
ortyp_out_accuracy: 0.3827 - val_torcol_out_accuracy: 0.2245 - val_legotyp_out_accur  
acy: 0.4745 - val_legocol_out_accuracy: 0.0051 - val_luggage_out_accuracy: 0.6429  
Epoch 7/20  
9/9 [=====] - 33s 4s/step - loss: 5.2348 - gender_out_loss:  
3.2984 - tortyp_out_loss: 1.9364 - gender_out_accuracy: 0.3000 - tortyp_out_accuracy:  
0.6423 - torcol_out_accuracy: 0.1058 - legotyp_out_accuracy: 0.1519 - legocol_out_ac  
curacy: 0.1500 - luggage_out_accuracy: 0.2019 - val_loss: 1.1942 - val_gender_out_los  
s: 0.5088 - val_tortyp_out_loss: 0.6854 - val_gender_out_accuracy: 0.5000 - val_t  
ortyp_out_accuracy: 0.6173 - val_torcol_out_accuracy: 0.2296 - val_legotyp_out_accur  
acy: 0.4847 - val_legocol_out_accuracy: 0.0051 - val_luggage_out_accuracy: 0.6429  
Epoch 8/20  
9/9 [=====] - 33s 4s/step - loss: 3.6165 - gender_out_loss:  
1.6301 - tortyp_out_loss: 1.9863 - gender_out_accuracy: 0.3250 - tortyp_out_accuracy:  
0.6385 - torcol_out_accuracy: 0.1231 - legotyp_out_accuracy: 0.1462 - legocol_out_ac  
curacy: 0.1788 - luggage_out_accuracy: 0.2096 - val_loss: 1.5365 - val_gender_out_los  
s: 0.5258 - val_tortyp_out_loss: 1.0107 - val_gender_out_accuracy: 0.5000 - val_t  
ortyp_out_accuracy: 0.3827 - val_torcol_out_accuracy: 0.2296 - val_legotyp_out_accur  
acy: 0.4694 - val_legocol_out_accuracy: 0.0051 - val_luggage_out_accuracy: 0.6429  
Epoch 9/20  
9/9 [=====] - 33s 4s/step - loss: 2.3035 - gender_out_loss:  
1.1435 - tortyp_out_loss: 1.1599 - gender_out_accuracy: 0.2635 - tortyp_out_accuracy:  
0.6846 - torcol_out_accuracy: 0.1327 - legotyp_out_accuracy: 0.1385 - legocol_out_ac  
curacy: 0.1288 - luggage_out_accuracy: 0.1750 - val_loss: 2.3796 - val_gender_out_los  
s: 1.6809 - val_tortyp_out_loss: 0.6987 - val_gender_out_accuracy: 0.5000 - val_t  
ortyp_out_accuracy: 0.3827 - val_torcol_out_accuracy: 0.2245 - val_legotyp_out_accur  
acy: 0.4643 - val_legocol_out_accuracy: 0.0051 - val_luggage_out_accuracy: 0.6429  
Epoch 10/20  
9/9 [=====] - 32s 4s/step - loss: 1.9065 - gender_out_loss:  
0.7941 - tortyp_out_loss: 1.1125 - gender_out_accuracy: 0.2365 - tortyp_out_accuracy:  
0.7019 - torcol_out_accuracy: 0.1058 - legotyp_out_accuracy: 0.1212 - legocol_out_ac  
curacy: 0.1519 - luggage_out_accuracy: 0.1500 - val_loss: 1.4545 - val_gender_out_los  
s: 0.7424 - val_tortyp_out_loss: 0.7121 - val_gender_out_accuracy: 0.5000 - val_t  
ortyp_out_accuracy: 0.3827 - val_torcol_out_accuracy: 0.2398 - val_legotyp_out_accur  
acy: 0.4082 - val_legocol_out_accuracy: 0.0051 - val_luggage_out_accuracy: 0.6429  
Epoch 11/20  
9/9 [=====] - 33s 4s/step - loss: 1.9955 - gender_out_loss:  
0.6594 - tortyp_out_loss: 1.3361 - gender_out_accuracy: 0.1212 - tortyp_out_accuracy:  
0.6827 - torcol_out_accuracy: 0.1154 - legotyp_out_accuracy: 0.1673 - legocol_out_ac  
curacy: 0.1673 - luggage_out_accuracy: 0.1962 - val_loss: 1.4139 - val_gender_out_los  
s: 0.7180 - val_tortyp_out_loss: 0.6960 - val_gender_out_accuracy: 0.5000 - val_t  
ortyp_out_accuracy: 0.4031 - val_torcol_out_accuracy: 0.2347 - val_legotyp_out_accur  
acy: 0.3776 - val_legocol_out_accuracy: 0.0051 - val_luggage_out_accuracy: 0.6429  
Epoch 12/20  
9/9 [=====] - 32s 4s/step - loss: 1.7898 - gender_out_loss:  
0.4804 - tortyp_out_loss: 1.3095 - gender_out_accuracy: 0.1577 - tortyp_out_accuracy:  
0.6769 - torcol_out_accuracy: 0.1269 - legotyp_out_accuracy: 0.0981 - legocol_out_ac  
curacy: 0.1269 - luggage_out_accuracy: 0.1769 - val_loss: 1.3780 - val_gender_out_los  
s: 0.5771 - val_tortyp_out_loss: 0.8010 - val_gender_out_accuracy: 0.5000 - val_t  
ortyp_out_accuracy: 0.3827 - val_torcol_out_accuracy: 0.2347 - val_legotyp_out_accur  
acy: 0.3622 - val_legocol_out_accuracy: 0.0051 - val_luggage_out_accuracy: 0.6429  
Epoch 13/20  
9/9 [=====] - 32s 4s/step - loss: 1.3396 - gender_out_loss:  
0.4062 - tortyp_out_loss: 0.9334 - gender_out_accuracy: 0.1673 - tortyp_out_accuracy:  
0.7135 - torcol_out_accuracy: 0.1135 - legotyp_out_accuracy: 0.1442 - legocol_out_ac  
curacy: 0.1635 - luggage_out_accuracy: 0.1923 - val_loss: 1.1065 - val_gender_out_los  
s: 0.3906 - val_tortyp_out_loss: 0.7159 - val_gender_out_accuracy: 0.0000e+00 - v  
al_tortyp_out_accuracy: 0.3827 - val_torcol_out_accuracy: 0.2398 - val_legotyp_out_ac  
curacy: 0.3469 - val_legocol_out_accuracy: 0.0051 - val_luggage_out_accuracy: 0.6429  
Epoch 14/20  
9/9 [=====] - 33s 4s/step - loss: 1.1128 - gender_out_loss:
```

```
0.3818 - tortyp_out_loss: 0.7310 - gender_out_accuracy: 0.0596 - tortyp_out_accuracy: 0.7865 - torcol_out_accuracy: 0.1173 - legtyp_out_accuracy: 0.1346 - legocol_out_accuracy: 0.1596 - luggage_out_accuracy: 0.2327 - val_loss: 1.0729 - val_gender_out_loss: 0.4067 - val_tortyp_out_loss: 0.6661 - val_gender_out_accuracy: 0.4592 - val_tortyp_out_accuracy: 0.6173 - val_torcol_out_accuracy: 0.2398 - val_legtyp_out_accuracy: 0.3367 - val_legocol_out_accuracy: 0.0051 - val_luggage_out_accuracy: 0.6429  
Epoch 15/20  
9/9 [=====] - 33s 4s/step - loss: 0.9705 - gender_out_loss: 0.3300 - tortyp_out_loss: 0.6405 - gender_out_accuracy: 0.0442 - tortyp_out_accuracy: 0.7885 - torcol_out_accuracy: 0.0904 - legtyp_out_accuracy: 0.1519 - legocol_out_accuracy: 0.1827 - luggage_out_accuracy: 0.1846 - val_loss: 1.0626 - val_gender_out_loss: 0.3667 - val_tortyp_out_loss: 0.6959 - val_gender_out_accuracy: 0.4592 - val_tortyp_out_accuracy: 0.3878 - val_torcol_out_accuracy: 0.2296 - val_legtyp_out_accuracy: 0.3214 - val_legocol_out_accuracy: 0.0051 - val_luggage_out_accuracy: 0.6429  
Epoch 16/20  
9/9 [=====] - 32s 4s/step - loss: 0.9160 - gender_out_loss: 0.3211 - tortyp_out_loss: 0.5949 - gender_out_accuracy: 0.0173 - tortyp_out_accuracy: 0.8058 - torcol_out_accuracy: 0.1308 - legtyp_out_accuracy: 0.1346 - legocol_out_accuracy: 0.1538 - luggage_out_accuracy: 0.1788 - val_loss: 1.0612 - val_gender_out_loss: 0.3662 - val_tortyp_out_loss: 0.6950 - val_gender_out_accuracy: 0.4592 - val_tortyp_out_accuracy: 0.6173 - val_torcol_out_accuracy: 0.2296 - val_legtyp_out_accuracy: 0.3112 - val_legocol_out_accuracy: 0.0051 - val_luggage_out_accuracy: 0.6429  
Epoch 17/20  
9/9 [=====] - 33s 4s/step - loss: 0.9245 - gender_out_loss: 0.3254 - tortyp_out_loss: 0.5991 - gender_out_accuracy: 0.0327 - tortyp_out_accuracy: 0.8077 - torcol_out_accuracy: 0.1308 - legtyp_out_accuracy: 0.1231 - legocol_out_accuracy: 0.1442 - luggage_out_accuracy: 0.1673 - val_loss: 1.1279 - val_gender_out_loss: 0.4397 - val_tortyp_out_loss: 0.6883 - val_gender_out_accuracy: 0.0000e+00 - val_tortyp_out_accuracy: 0.6173 - val_torcol_out_accuracy: 0.2296 - val_legtyp_out_accuracy: 0.2755 - val_legocol_out_accuracy: 0.0051 - val_luggage_out_accuracy: 0.6429  
Epoch 18/20  
9/9 [=====] - 32s 4s/step - loss: 0.8435 - gender_out_loss: 0.4218 - tortyp_out_loss: 0.4218 - gender_out_accuracy: 0.0538 - tortyp_out_accuracy: 0.8404 - torcol_out_accuracy: 0.0904 - legtyp_out_accuracy: 0.1096 - legocol_out_accuracy: 0.1654 - luggage_out_accuracy: 0.1865 - val_loss: 1.0542 - val_gender_out_loss: 0.3888 - val_tortyp_out_loss: 0.6654 - val_gender_out_accuracy: 0.0561 - val_tortyp_out_accuracy: 0.6173 - val_torcol_out_accuracy: 0.2296 - val_legtyp_out_accuracy: 0.2653 - val_legocol_out_accuracy: 0.0051 - val_luggage_out_accuracy: 0.6429  
Epoch 19/20  
9/9 [=====] - 34s 4s/step - loss: 0.8214 - gender_out_loss: 0.3026 - tortyp_out_loss: 0.5188 - gender_out_accuracy: 0.0173 - tortyp_out_accuracy: 0.8404 - torcol_out_accuracy: 0.0981 - legtyp_out_accuracy: 0.1404 - legocol_out_accuracy: 0.1481 - luggage_out_accuracy: 0.1731 - val_loss: 1.0614 - val_gender_out_loss: 0.3431 - val_tortyp_out_loss: 0.7184 - val_gender_out_accuracy: 0.1276 - val_tortyp_out_accuracy: 0.3827 - val_torcol_out_accuracy: 0.2296 - val_legtyp_out_accuracy: 0.2602 - val_legocol_out_accuracy: 0.0051 - val_luggage_out_accuracy: 0.6429  
Epoch 20/20  
9/9 [=====] - 33s 4s/step - loss: 0.7890 - gender_out_loss: 0.2794 - tortyp_out_loss: 0.5097 - gender_out_accuracy: 0.0135 - tortyp_out_accuracy: 0.8558 - torcol_out_accuracy: 0.1096 - legtyp_out_accuracy: 0.1288 - legocol_out_accuracy: 0.1288 - luggage_out_accuracy: 0.1904 - val_loss: 1.0545 - val_gender_out_loss: 0.3832 - val_tortyp_out_loss: 0.6713 - val_gender_out_accuracy: 0.4541 - val_tortyp_out_accuracy: 0.6173 - val_torcol_out_accuracy: 0.2245 - val_legtyp_out_accuracy: 0.2449 - val_legocol_out_accuracy: 0.0051 - val_luggage_out_accuracy: 0.6378
```

In []: