MSPA_CNN

March 26, 2021

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2 Machine Learning - Facial Recognition Project

3 CNN

[ ]:
```
from google.colab import drive
drive.mount('/content/gdrive')
```

```
Go to this URL in a browser: https://accounts.google.com/o/oauth2/auth?client_id
=947318989803-6bn6qk8qdgf4n4g3pfee6491hc0brc4i.apps.googleusercontent.com&redire
ct_uri=urn%3Aietf%3Awg%3Aoauth%3A2.0%3Aoob&scope=email%20https%3A%2F%2Fwww.googl
eapis.com%2Fauth%2Fdocs.test%20https%3A%2F%2Fwww.googleapis.com%2Fauth%2Fdrive%2
0https%3A%2F%2Fwww.googleapis.com%2Fauth%2Fdrive.photos.readonly%20https%3A%2F%2
Fwww.googleapis.com%2Fauth%2Fpeopleapi.readonly&response_type=code

Enter your authorization code:
··········
Mounted at /content/gdrive
```

[ ]:
```
%reset
```

```
Once deleted, variables cannot be recovered. Proceed (y/[n])? y
```

[ ]:
```
from __future__ import print_function
import keras
from keras import backend as K
from keras import layers, models, Sequential
from keras.layers import Dense, Conv2D, BatchNormalization, Activation,␣
↪AveragePooling2D, Input, Flatten
from keras.layers import Conv2D as C2D
from keras.layers import MaxPooling2D as MP2D
from keras.layers import Dropout as DO

from keras.layers import LSTM#, sequential
from keras.optimizers import Adam
```

```
from keras.callbacks import ModelCheckpoint, LearningRateScheduler,␣
 ↪ReduceLROnPlateau, History
from keras.preprocessing.image import ImageDataGenerator as ImgDataGen
from keras.preprocessing.image import img_to_array, load_img
from keras.regularizers import l2
from keras.models import Model
#-   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -
from keras.utils import to_categorical
from keras.utils.vis_utils import plot_model
from keras.wrappers.scikit_learn import KerasRegressor
#-   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -
from sklearn.model_selection import ShuffleSplit, train_test_split
#-   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -
import glob
import cv2
#-   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -
import pydot
#-   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -
import matplotlib.pyplot as plt
from matplotlib.pyplot import figure
import h5py
#-   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -
import warnings
warnings.filterwarnings("ignore")
#-   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -
import os
from os import listdir
from os.path import isfile, join
import pandas as pd
import numpy as np
from PIL import Image
#from keras import metrics
```

```
Using TensorFlow backend.
```

[ ]:
```
path                        = r'/content/gdrive/My Drive/Colab_Datasets'
os.chdir(path)

seed                        = 7
np.random.seed(seed)

save_dir = os.path.join(os.getcwd(), 'NueralNetworksSavedModels')
if not os.path.isdir(save_dir):
    os.makedirs(save_dir)

RevNo,i                       = 0,0
```

4 Programme Code

```
[ ]: df                                  = pd.read_csv('Train_baseball.csv')
df['Image_Name']          = df['Image_Name'] + '.jpg'
test_size                       = 0.05
validationSplit          = 0.2
df_trn, df_tst                  = train_test_split(df, test_size=test_size,␣
 ↪random_state=seed)
df_subtrn, df_val          = train_test_split(df_trn, test_size=validationSplit,␣
 ↪random_state=seed)
'-------------------------------------------------------------------------------'
'Generator Parameters'
interpolationMethod          = 'nearest'                                        ␣
 ↪    #Interpolation method used to resample the image if the target size is␣
 ↪different from that of the loaded image.Supported methods are `"nearest"`,␣
 ↪`"bilinear"`, and `"bicubic"`
'----'
dataType                            = 'float32'
shuffle                            = True
class_mode                            = 'other'
inputDirectory                    = './TrainPictures'
color_mode                             = "rgb"
has_ext                            = False
'Visuals'
model_type                            = 'TrustworthyCnn_Rev %d' % (RevNo)
model_name                            = 'CNN_%s_model.{epoch:03d}.h5' % model_type
print(model_type)
monitor                            = 'val_acc'
verbose                            = 1
save_best_only                        = True

filepath                            = os.path.join(save_dir, model_name)

################################################################################
RevNo                                 = i + 1
outputDirectory             = './AugmentedPics/Rev1'
'----'
test_size                       = 0.05
validationSplit          = 0.2

xColName             = 'Image_Name'
yColName                           = 'Trustworthy_Score'

img_height                   = 128
img_width                    = 85
img_channels                   = 3
reshapeSize                  = (img_width, img_height)
```

```
input_shape                  = (img_width, img_height, img_channels)
 ↪          # (batch_size, imageside1, imageside2, channels)

A1,A2,A3,A4              = 'relu','relu','relu','relu'
K1,K2,K3,K4          = (2,2),        (4,4),(3,3),(4,4)
S1,S2,S3,S4          = (1,1),        (1,1),(1,1),(1,1)
F1,F2,F3,F4          = 32,            32,32,64
P1,P2,P3             = (2,2),        (2,2),(2,2)
DO1,DO2              = 0.5,0.5
U1,U2                = 128,1
DA1,DA2              = 'relu','linear'

rescale                              = (1./255.)
rotation_range                       = 5
featurewise_std_normalization                    = False
samplewise_std_normalization         = True
'------------------------------'
#zca_epsilon
#zca_whitening
#width_shift_range
#height_shift_range
#brightness_range
#shear_range
#horizontal_flip
#vertical_flip

'Compiling Parameters'
epochs                                = 10
batch_size                        = 32
steps_per_epoch          = 15
valStepsPerEpoch          = 4
tstStepsPerEpoch          = len(df_tst)
loss                                 = 'mean_squared_error'
metrics                       = ['mae', 'acc']
 ↪         # metrics.mae, metrics.acc
 ↪
optimizer                        = 'adagrad'

def cnn1():
        cnn = Sequential()
        cnn.add(C2D(filters= F1, kernel_size= K1, activation= A1,
 ↪input_shape=input_shape,strides= S1))
        cnn.add(MP2D(pool_size=P1))
        cnn.add(DO(DO1))

        #cnn.add(C2D(filters= F2, kernel_size= K2, activation= A2,strides= S2))
        #cnn.add(C2D(filters= F3, kernel_size= K3, activation= A3))
```

```
        #cnn.add(MP2D(pool_size=P2))
        #cnn.add(DO(DO2))

        #cnn.add(MP2D(pool_size=P3))

        #cnn.add(C2D(filters= F4, kernel_size= K4, activation= A4))

        cnn.add(Flatten())

        cnn.add(Dense(units = U1, activation= DA1))
        cnn.add(Dense(units = U2, activation= DA2))

        cnn.compile(loss= loss, optimizer= optimizer,metrics=metrics)
        return cnn
```

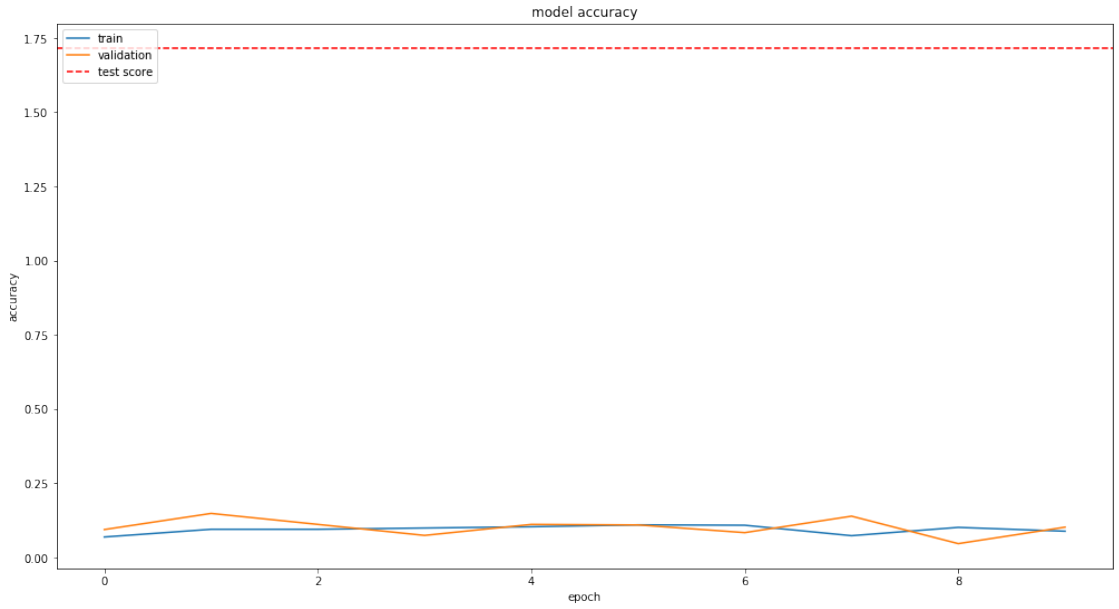
```
#lr_reducer = ReduceLROnPlateau(factor=np.sqrt(0.1),
#                                cooldown=0,
#                                patience=5,
#                                min_lr=0.5e-6)
#checkpoint = ModelCheckpoint(filepath=filepath,
#                             monitor = monitor,
#                             verbose = verbose,
#                             save_best_only = save_best_only)
#callbacks = [checkpoint, lr_reducer]


'#%% configuring data-generators'
dg_subtrn         = ImgDataGen(rescale= rescale,\
                                validation_split= validationSplit,\
                                dtype = dataType,\
                                featurewise_std_normalization =␣
 ↪featurewise_std_normalization,\
                        rotation_range = rotation_range)
dg_tst          = ImgDataGen(rescale= rescale,\
                                dtype = dataType,\
                                featurewise_std_normalization =␣
 ↪featurewise_std_normalization,\
                         rotation_range = rotation_range)


'PreProcessing Training Dataset'
df_subtrn = dg_subtrn.flow_from_dataframe(dataframe = df_trn,\
                                directory = inputDirectory,\
                                x_col = xColName,\
                                y_col = yColName,\
                                batch_size = batch_size,\
                                seed = seed,\
                                shuffle = True,\
                                color_mode = color_mode,\
```

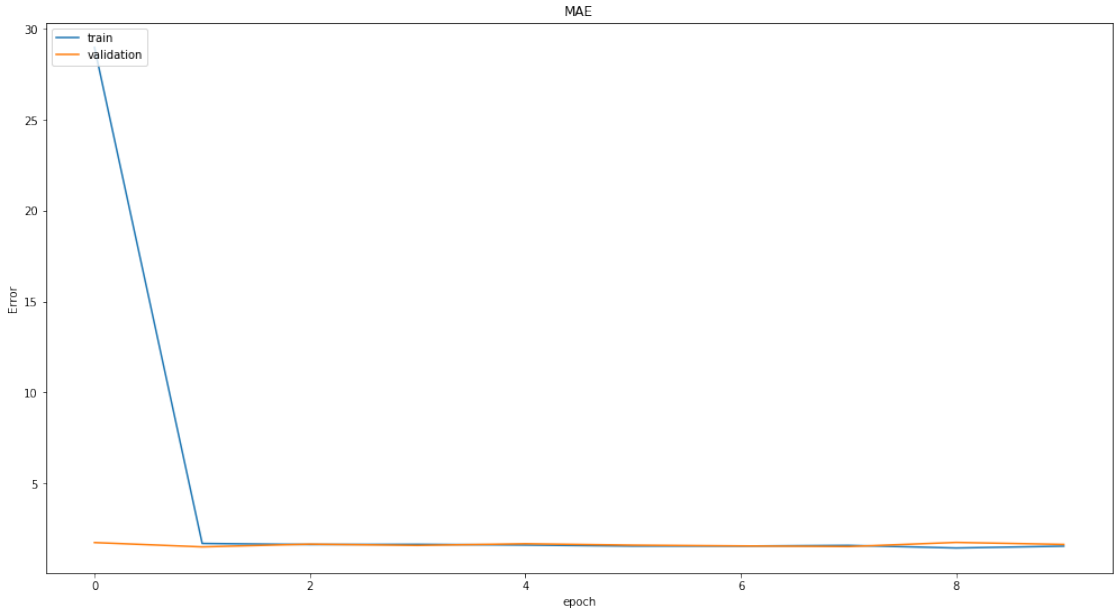
```
                                    class_mode = class_mode,\
                                    target_size = reshapeSize,\
                                    has_ext = has_ext,\
                                    subset = 'training',\
                                    interpolation = interpolationMethod)#,\
                    #save_to_dir = outputDirectory)
'PreProcessing Validation Dataset'
df_val = dg_subtrn.flow_from_dataframe(dataframe = df_trn,\
                                            directory = inputDirectory,\
                                            x_col = xColName,\
                                            y_col= yColName,\
                                            batch_size = batch_size,\
                                            seed = seed,\
                                            shuffle = True,\
                                            color_mode = color_mode,\
                                            class_mode = class_mode,\
                                            target_size = reshapeSize,\
                                            has_ext = has_ext,\
                                            subset = 'validation',\
                                            interpolation = interpolationMethod)
'PreProcessing Test Dataset '
df_tst1 = dg_tst.flow_from_dataframe(dataframe = df_tst,\
                                            directory=inputDirectory,\
                                            x_col= xColName,\
                                            y_col= yColName,\
                                            batch_size=batch_size,\
                                            seed = seed,\
                                            shuffle=shuffle,\
                                            has_ext = has_ext,\
                                            class_mode=class_mode,\
                                            target_size=reshapeSize,\
                                            interpolation = interpolationMethod)

model = cnn1()

#lr_reducer = ReduceLROnPlateau(factor=np.sqrt(0.1),
#                               cooldown=0,
#                               patience=5,
#                               min_lr=0.5e-6)

#checkpoint = ModelCheckpoint(filepath=filepath,
#                             monitor = monitor,
#                             verbose = verbose,
#                             save_best_only = save_best_only)

history = model.fit_generator(df_subtrn,\
                              steps_per_epoch = steps_per_epoch,\
```

```
                                epochs = epochs,\
                                validation_data = df_val,\
                                validation_steps = valStepsPerEpoch)#,\
                                #callbacks = callbacks)

acc_tst = model.evaluate_generator(generator= df_tst1,
                                                        steps= tstStepsPerEpoch)




'#  "Accuracy" '
fig = plt.gcf()
fig.set_size_inches(17, 9)
fig.show()
plt.plot(history.history['acc'])
plt.plot(history.history['val_acc'])
plt.axhline(y=acc_tst[1], color='r', linestyle='--')
# -- -- -- --
plt.title('model accuracy')
plt.ylabel('accuracy')
plt.xlabel('epoch')
plt.legend(['train', 'validation','test score'], loc='upper left')
plt.show()
# fig.savefig('test2png.png', dpi=100)

'#  "MAE" '
fig = plt.gcf()
fig.set_size_inches(17, 9)
fig.show()
plt.plot(history.history['mean_absolute_error'])
plt.plot(history.history['val_mean_absolute_error'])
#plt.axhline(y=mae_tst[1], color='r', linestyle='--')
# -- -- -- --
plt.title('MAE')
plt.ylabel('Error')
plt.xlabel('epoch')
plt.legend(['train', 'validation','test score'], loc='upper left')
plt.show()

# fig.savefig('test2png.png', dpi=100)
```

```
TrustworthyCnn_Rev 1
Found 561 images.
Found 140 images.
```

```
Found 37 images.
Epoch 1/10
15/15 [==============================] - 3s 174ms/step - loss: 10747.8418 -
mean_absolute_error: 28.9775 - acc: 0.0688 - val_loss: 4.6458 -
val_mean_absolute_error: 1.7449 - val_acc: 0.0938
Epoch 2/10
15/15 [==============================] - 7s 483ms/step - loss: 4.4285 -
mean_absolute_error: 1.6905 - acc: 0.0919 - val_loss: 3.5738 -
val_mean_absolute_error: 1.5083 - val_acc: 0.1481
Epoch 3/10
15/15 [==============================] - 2s 129ms/step - loss: 4.1003 -
mean_absolute_error: 1.6416 - acc: 0.0936 - val_loss: 4.0743 -
val_mean_absolute_error: 1.6583 - val_acc: 0.1111
Epoch 4/10
15/15 [==============================] - 2s 128ms/step - loss: 4.1987 -
mean_absolute_error: 1.6506 - acc: 0.0977 - val_loss: 3.6246 -
val_mean_absolute_error: 1.5889 - val_acc: 0.0741
Epoch 5/10
15/15 [==============================] - 7s 494ms/step - loss: 4.1150 -
mean_absolute_error: 1.6266 - acc: 0.1036 - val_loss: 4.0859 -
val_mean_absolute_error: 1.6801 - val_acc: 0.1111
Epoch 6/10
15/15 [==============================] - 2s 127ms/step - loss: 3.7112 -
mean_absolute_error: 1.5534 - acc: 0.1099 - val_loss: 4.0301 -
val_mean_absolute_error: 1.6041 - val_acc: 0.1094
Epoch 7/10
15/15 [==============================] - 7s 495ms/step - loss: 3.7073 -
mean_absolute_error: 1.5537 - acc: 0.1083 - val_loss: 3.6450 -
val_mean_absolute_error: 1.5626 - val_acc: 0.0833
Epoch 8/10
15/15 [==============================] - 2s 129ms/step - loss: 3.8382 -
mean_absolute_error: 1.5906 - acc: 0.0710 - val_loss: 3.3847 -
val_mean_absolute_error: 1.5261 - val_acc: 0.1389
Epoch 9/10
15/15 [==============================] - 2s 126ms/step - loss: 3.1723 -
mean_absolute_error: 1.4403 - acc: 0.1067 - val_loss: 4.5233 -
val_mean_absolute_error: 1.7527 - val_acc: 0.0463
Epoch 10/10
15/15 [==============================] - 8s 502ms/step - loss: 3.7105 -
mean_absolute_error: 1.5621 - acc: 0.0873 - val_loss: 3.7184 -
val_mean_absolute_error: 1.6429 - val_acc: 0.1019
```






```
[ ]: save_dir = os.path.join(os.getcwd(), '/AugmentedPics/rev1')
     if not os.path.isdir(save_dir):
         os.makedirs(save_dir)
```

5 Visuals

[ ]:
```
plot_model(model, to_file='./ResnetModel.png',\
           show_shapes=True,\
           show_layer_names=True,\
           rankdir='LR')
# model.summary()
```