

CNN-FFA-30E-13L-shift-test-03

March 24, 2021

1 Are Relations Relevant in CNNs? *A Study Based on a Facial Dataset*

1.1 Testing CNN with Features Further Apart (*30 Epochs - 13 Layers*)

1.1.1 Imports, Seed, GPU integration

```
[1]: import numpy as np
import random
import tensorflow as tf
```

```
[2]: # Seeds for better reproducibility
seed = 42
np.random.seed(seed)
random.seed(seed)
tf.random.set_seed(seed)
```

```
[3]: from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from sklearn.metrics import confusion_matrix
import itertools
import matplotlib.pyplot as plt
import warnings
warnings.simplefilter(action='ignore', category=FutureWarning)
%matplotlib inline
```

```
[4]: physical_devices = tf.config.experimental.list_physical_devices('GPU')
print("Num GPUs Available: ", len(physical_devices))
tf.config.experimental.set_memory_growth(physical_devices[0], True)
```

Num GPUs Available: 1

1.1.2 Data preparation

```
[5]: test_path = '../.../picasso_dataset/FFA-data/shifted/test'
```

```
[6]: test_batches = ImageDataGenerator(preprocessing_function=tf.keras.applications.
    ↪vgg16.preprocess_input) \
```

```
.flow_from_directory(directory=test_path, target_size=(224,224),  
→classes=['no_face', 'face'], batch_size=10, shuffle=False)
```

Found 3000 images belonging to 2 classes.

```
[7]: assert test_batches.n == 3000  
assert test_batches.num_classes == 2
```

1.1.3 Loading the trained CNN

```
[8]: filename='../models/CNN-FFA-30E-13L-03.h5'  
loaded_model = load_model(filename)
```

1.1.4 Accuracy and loss of the trained model

```
[9]: scores = loaded_model.evaluate(test_batches, verbose=2)  
print("Accuracy: %.2f%%" % (scores[1]*100))  
print("Loss: %.2f%%" % (scores[0]*100))
```

```
300/300 - 7s - loss: 1.7291 - accuracy: 0.6790  
Accuracy: 67.90%  
Loss: 172.91%
```

1.1.5 Testing the CNN

```
[10]: predictions = loaded_model.predict(x=test_batches, steps=len(test_batches),  
→verbose=0)
```

1.1.6 Index of wrongly predicted pictures

```
[11]: y_true=test_batches.classes  
y_pred=np.argmax(predictions, axis=-1)  
cm = confusion_matrix(y_true = y_true, y_pred = y_pred)
```

```
[12]: face_but_predicted_no_face=[]  
no_face_but_predicted_face=[]  
  
for i in range(len(predictions)):  
    if y_true[i] != y_pred[i]:  
        if y_true[i] == 1:  
            face_but_predicted_no_face.append(i+8001-1500) #Index of file  
→on disk  
        else:  
            no_face_but_predicted_face.append(i+8001) #Index of file on disk
```

```

print("Data from class 'face', that was wrongly predicted as 'no-face' [",
      len(face_but_predicted_no_face), "] :")
print(face_but_predicted_no_face)
print("-----")
print("Data from class 'no-face', that was wrongly predicted as 'face' [",
      len(no_face_but_predicted_face), "] :")
print(no_face_but_predicted_face)

```

```

Data from class 'face', that was wrongly predicted as 'no-face' [ 723 ] :
[8001, 8002, 8003, 8006, 8007, 8009, 8011, 8014, 8019, 8020, 8021, 8022, 8023,
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8043, 8044, 8045, 8046, 8047, 8050, 8053, 8054, 8055, 8056, 8057, 8058, 8060,
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9478, 9480, 9481, 9482, 9483, 9484, 9485, 9486, 9487, 9488, 9489, 9490, 9491,
9492, 9493, 9494, 9495, 9496, 9497, 9498, 9500]

```

```

-----
Data from class 'no-face', that was wrongly predicted as 'face' [ 240 ] :
[8001, 8003, 8011, 8018, 8020, 8021, 8026, 8048, 8051, 8059, 8064, 8069, 8077,
8078, 8080, 8084, 8090, 8096, 8105, 8112, 8113, 8119, 8133, 8141, 8164, 8167,
8170, 8174, 8176, 8182, 8186, 8190, 8191, 8193, 8197, 8204, 8211, 8216, 8217,
8218, 8222, 8224, 8247, 8249, 8252, 8257, 8279, 8281, 8288, 8294, 8295, 8297,
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9017, 9018, 9019, 9020, 9022, 9023, 9030, 9031, 9041, 9042, 9044, 9045, 9048,
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9451, 9454, 9455, 9456, 9457, 9458, 9461, 9462, 9463, 9476, 9479, 9484, 9487,
9488, 9489, 9491, 9493, 9497, 9500]

```

1.1.7 Confusion matrix

```

[13]: def plot_confusion_matrix(cm, classes,
                                normalize=False,
                                title='Confusion matrix',
                                cmap=plt.cm.Blues):

```

```

plt.imshow(cm, interpolation='nearest', cmap=cmap)
plt.title(title)
plt.colorbar()
tick_marks = np.arange(len(classes))
plt.xticks(tick_marks, classes, rotation=45)
plt.yticks(tick_marks, classes)

if normalize:
    cm = cm.astype('float') / cm.sum(axis=1)[:, np.newaxis]
    print("Normalized confusion matrix")
else:
    print('Confusion matrix, without normalization')

print(cm)

thresh = cm.max() / 2.
for i, j in itertools.product(range(cm.shape[0]), range(cm.shape[1])):
    plt.text(j, i, cm[i, j],
             horizontalalignment="center",
             color="white" if cm[i, j] > thresh else "black")

plt.tight_layout()
plt.ylabel('True label')
plt.xlabel('Predicted label')

```

```
[14]: test_batches.class_indices
```

```
[14]: {'no_face': 0, 'face': 1}
```

```
[15]: cm_plot_labels = ['no_face', 'face']
plot_confusion_matrix(cm=cm, classes=cm_plot_labels, title='Confusion Matrix')
```

```

Confusion matrix, without normalization
[[1260  240]
 [ 723  777]]

```

