

2__create__sdm__curves

February 6, 2020

1 Analyze score distributions of pairs of the Balance Faces in the Wild (BFW) dataset.

Load table in data/bfw-datatable.pkl to extract all features and store in the datatable. Overwrites the table to data/bfw-datatable.pkl. using fundamental signal detection theory lists of feature pairs

1.1 Add project code to PYTHONPATH, if not already there

Check that *path_package* is set to *code* directory on respective system

```
[1]: import pathlib
path_package=f'../'
import sys
if path_package not in sys.path:
    sys.path.append(path_package)
```

```
[2]: %matplotlib inline
import warnings
import matplotlib.pyplot as plt
import seaborn as sns
import numpy as np

# Load out custom tool for loading and processing the data
from facebias.iotools import load_bfw_datatable, mkdir
```

```
[3]: font = {'font.family': 'serif',
            'font.serif' : 'Times New Roman',
            'font.color': 'darkred',
            'font.weight': 'normal',
            'font.size': 16,
            }
sns.set(style="white", rc={"axes.facecolor": (0, 0, 0, 0)})
sns.set_style('whitegrid', font)
```

```
[4]: dir_dsavfiga = '../..data/bfw-data/bfw/'
dir_features = f'{dir_data}features/sphereface/'
f_datatable = f'{dir_data}meta/bfw-v0.1.5-datatable.pkl'
```

```
use_feature = 'sphereface'

dir_results = f"../../results/{use_feature}/"
mkdir(dir_results)
```

```
/Users/jrobby/WORK/src/facebias/code/facebias/iotools.py:20: UserWarning:
Directory ../../results/sphereface/ exists
  warnings.warn(f"Directory {din} exists")
```

1.2 Load the data

Read in the data as a pandas.DataFrame and show the first few rows.

```
[5]: data = load_bfw_datatable(f_datatable , cols=['p1', 'p2', 'a1', 'a2', 'label', 'g1', 'g2', use_feature])
data['score'] = data[use_feature]
del data[use_feature]
data.head()
```

```
[5]:
```

	p1	p2	label	\
0	asian_females/n000009/0010_01.jpg	asian_females/n000009/0043_01.jpg	1	
1	asian_females/n000009/0010_01.jpg	asian_females/n000009/0120_01.jpg	1	
2	asian_females/n000009/0010_01.jpg	asian_females/n000009/0122_02.jpg	1	
3	asian_females/n000009/0010_01.jpg	asian_females/n000009/0188_01.jpg	1	
4	asian_females/n000009/0010_01.jpg	asian_females/n000009/0205_01.jpg	1	

	a1	a2	g1	g2	score
0	AF	AF	F	F	0.392526
1	AF	AF	F	F	0.354262
2	AF	AF	F	F	0.302028
3	AF	AF	F	F	-0.009217
4	AF	AF	F	F	0.132534

```
[6]: if 'score' not in data:
      warnings.warn('scores not stored in table. See Demo 1 in notebooks/ before_
      →proceedings')
```

```
[7]: classes = np.unique(list(np.unique(data.a1)) + list(np.unique(data.a2)))
n_classes = len(classes)
xlabels = {'A': 'Asian', 'B': 'Black', 'I': 'Indian', 'W': 'White'}
ylabels = {'M': 'Male', 'F': 'Female'}
abbr_attributes = []
for e in xlabels.keys():
    for g in ylabels.keys():
        abbr_attributes.append(e+g)
abbr_attributes.sort()
```

```

opts = [{'color': 'g', 'alpha': 0.7, 'norm_hist': True}, {'color': 'r', 'alpha':
→ 0.7, 'norm_hist': True}]
print(f"there are {n_classes} types: {classes}")

```

there are 8 types: ['AF' 'AM' 'BF' 'BM' 'IF' 'IM' 'WF' 'WM']

```

[8]: fig, ax = plt.subplots(2, int(n_classes / 2), sharex='all', sharey='all',
→ figsize=(17, 2 * n_classes / 2), constrained_layout=True)

for i, (cur_class, axi) in enumerate(zip(classes, ax.flat)):
    print("Processing: {}".format(cur_class))
    df_cur = data.loc[data.a1==cur_class][['label', 'score']]
    sns.distplot(df_cur.loc[df_cur.label == 1, 'score'], np.linspace(-1.0, 1.0,
→ 100), ax=axi, *opts[0])
    sns.distplot(df_cur.loc[df_cur.label == 0, 'score'], np.linspace(-1.0, 1.0,
→ 100), ax=axi, *opts[1])
    #axi.set_xticks((0.0,0.25,0.5,0.75,1.0))
    axi.set_xlim((-1.0,1.0))
    if i > 3:
        axi.set_xlabel(xlabels[cur_class[0]])

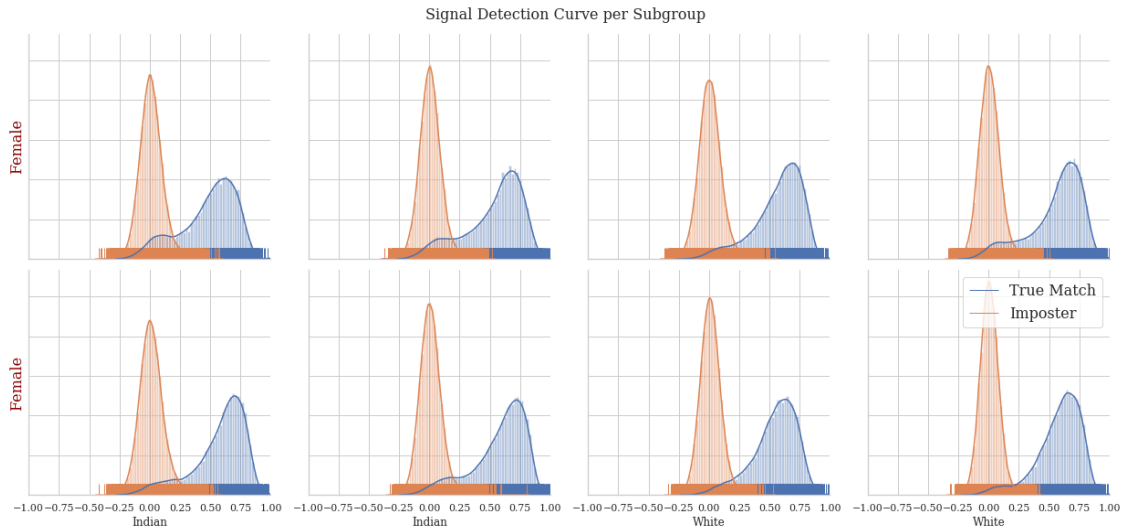
    else:
        axi.set_xlabel(None)
    for tick in axi.yaxis.get_major_ticks():
        tick.label1.set_visible(False)
    if not np.mod(i, int(n_classes / 2)):
        axi.set_ylabel(ylabels[cur_class[1]], fontdict={k.replace('font.', ''):
→ v for k, v in font.items() if k != 'font.serif'})

    sns.despine(ax=axi)

plt.legend(['True Match', 'Imposter'], fontsize=font['font.size'], loc='best')
fig.suptitle('Signal Detection Curve per Subgroup', fontsize=font['font.size'])
plt.savefig(f'{dir_results}sdm_plots.pdf', transparent=True)

```

Processing: AF
Processing: AM
Processing: BF
Processing: BM
Processing: IF
Processing: IM
Processing: WF
Processing: WM



1.3 Aligned SDM Curves

As means of viewing shifts in plots, hinting the optimal thresholds are variable, the following figure uses a single column.

```
[10]: # Initialize the FacetGrid object
pal = sns.cubehelix_palette(10, rot=-.25, light=.7)
g = sns.FacetGrid(data, row="a1", hue="label", aspect=15, height=.5, palette={1:
    ↪ "blue", 0: "orange"})

# Draw the densities in a few steps
g.map(sns.kdeplot, "score", clip_on=False, shade=True, alpha=1, lw=1.5, bw=.2)
g.map(sns.kdeplot, "score", clip_on=False, color="w", lw=2, bw=.2)
g.map(plt.axhline, y=0, lw=2, clip_on=False)

ax = plt.gca()

dims = plt.gcf().get_size_inches() # (width, height)
step_size = np.linspace(.2, dims[1]*1.5, len(abbr_attributes))
[ax.text(.2, step_size[i], txt, fontweight="bold", color='k', ha="left",
    ↪va="center", transform=ax.transAxes) for i, txt in
    ↪enumerate(reversed(abbr_attributes))]
type(abbr_attributes)

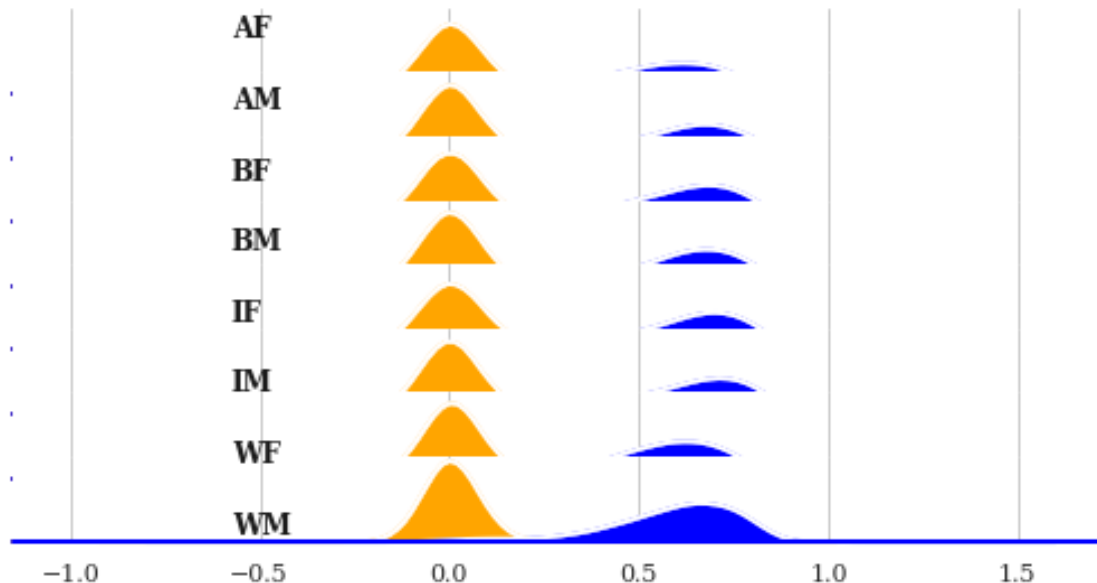
# Set the subplots to overlap
g.fig.subplots_adjust(hspace=-.25)

# Remove axes details that don't play well with overlap
g.set_titles("")
```

```
g.set(yticks=[])
g.despine(bottom=True, left=True)
plt.savefig(f'{dir_results}sdm_plots_view2.pdf', transparent=True)
```

/Users/jrobby/miniconda3/envs/fairness/lib/python3.7/site-packages/seaborn/axisgrid.py:848: UserWarning: Tight layout not applied. tight_layout cannot make axes height small enough to accommodate all axes decorations

```
self.fig.tight_layout()
```

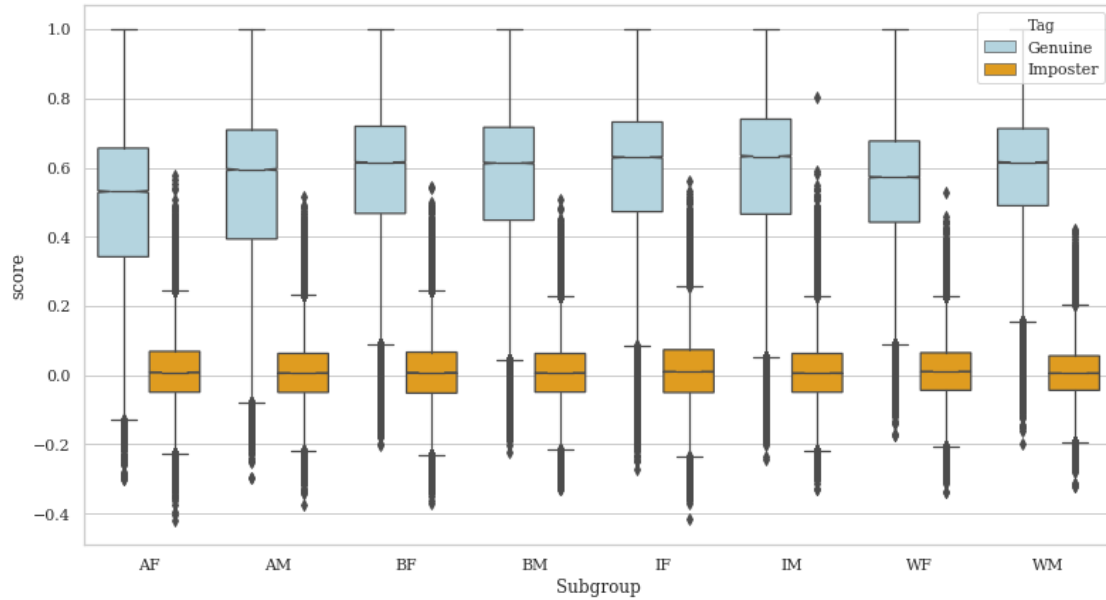


2 Box plots

Depict median, 25 and 75 percentile, max, min, and outliers.

```
[11]: new_labels = ['Imposter', 'Genuine']
palette={new_labels[0]: "orange", new_labels[1]: "lightblue"}
data.label = data.label.astype(int)
data['Tag'] = data.label
data.loc[data.label==0, 'Tag'] = new_labels[0]
data.loc[data.label==1, 'Tag'] = new_labels[1]
```

```
[12]: fig, ax = plt.subplots(1,1,figsize=(13,7))
sns.boxplot(x="a1", y="score", hue="Tag", data=data,linewidth=1.25, dodge=True,
↳ notch=True, palette=palette, ax=ax)
plt.xlabel('Subgroup')
plt.savefig(f'{dir_results}boxplots.pdf', transparent=True)
```



3 Violin Plot

```
[13]: fig, ax = plt.subplots(1,1,figsize=(13,7))
sns.violinplot(x="a1", y="score", hue="Tag", data=data,linewidth=1.25,
               ↪dodge=True, split=True, palette=palette, ax=ax, scale_hue=True,inner=None)
plt.xlabel('Subgroup')
plt.legend(loc='best')
plt.savefig(f'{dir_results}violinplots.pdf', transparent=True)
```

