2_create_sdm_curves

February 7, 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 fundalmental 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]:
```
%load_ext autoreload
%autoreload 2
```

[8]:
```
%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, makedir
from facebias.visualization import set_defaults
```

[9]:
```
set_defaults()
```

[19]:
```
bfw_version = "0.1.5"
dir_data = '../../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}/"
makedir(dir_results)
```

```
/Users/jrobby/WORK/src/facebias/code/facebias/iotools.py:21: 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.

[13]:
```
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()
```

[13]:

	p1	p2	label	a1	a2	g1	g2	score
0	asian_females/n000009/0010_01.jpg	asian_females/n000009/0043_01.jpg	1	AF	AF	F	F	0.392526
1	asian_females/n000009/0010_01.jpg	asian_females/n000009/0120_01.jpg	1	AF	AF	F	F	0.354262
2	asian_females/n000009/0010_01.jpg	asian_females/n000009/0122_02.jpg	1	AF	AF	F	F	0.302028
3	asian_females/n000009/0010_01.jpg	asian_females/n000009/0188_01.jpg	1	AF	AF	F	F	-0.009217
4	asian_females/n000009/0010_01.jpg	asian_females/n000009/0205_01.jpg	1	AF	AF	F	F	0.132534

[14]:
```
if 'score' not in data:
    warnings.warn('scores not stored in table. See Demo 1 in notebooks/ before␣
↪proceedings')
```

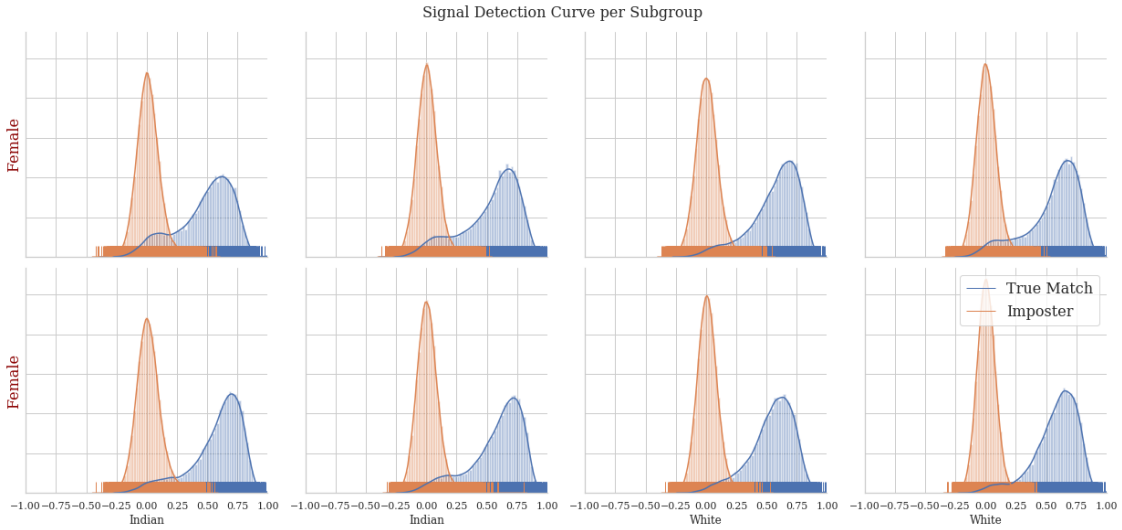
[15]:
```
classes = np.unique(list(np.unique(data.a1)) + list(np.unique(data.a2)))
n_classes = len(classes)
xlabels = {'A': 'Asian', 'B': 'Black', 'I': 'Indian', 'W': 'White'}
ylabels = {'M': 'Male', 'F': 'Female'}
abbr_attributes = []
for e in xlabels.keys():
    for g in ylabels.keys():
        abbr_attributes.append(e+g)
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']
```

[16]:
```
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.tight_layout()
plt.savefig(f'{dir_results}sdm-plots-v{bfw_version}.pdf', transparent=True)
```

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



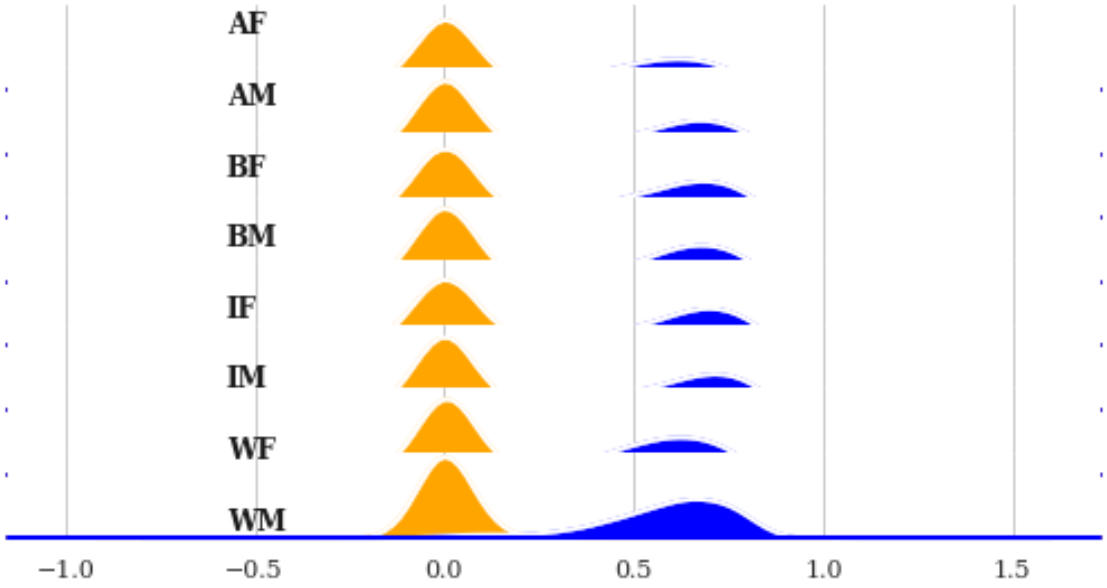
1.3 Aligned SDM Curves

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

[20]:
```
# 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-v{bfw_version}.pdf',␣
 ↪transparent=True)
```

```
/Users/jrobby/miniconda3/envs/fairness/lib/python3.7/site-
packages/ipykernel_launcher.py:24: UserWarning: Tight layout not applied.
tight_layout cannot make axes height small enough to accommodate all axes
decorations
```

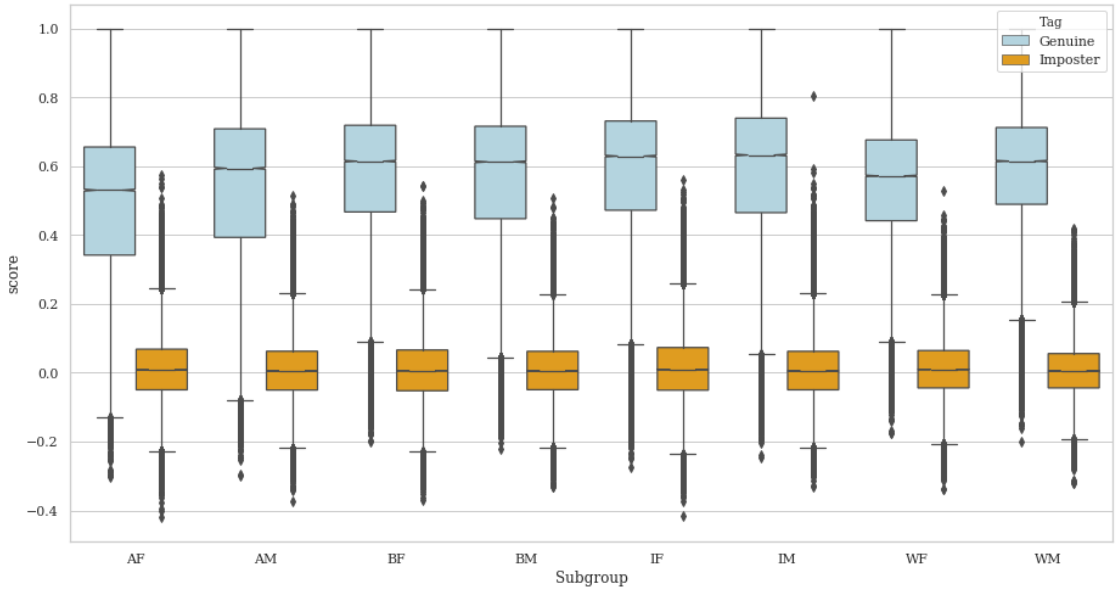


2 Box plots

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

[24]:
```
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]
```

[25]:
```
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.tight_layout()
plt.savefig(f'{dir_results}boxplots-v{bfw_version}.pdf', transparent=True)
```



3 Violin Plot

[26]:
```
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.tight_layout()
plt.savefig(f'{dir_results}violinplots-{bfw_version}.pdf', transparent=True)
```