

### 3\_\_calculate\_\_and\_\_display\_\_det\_\_curves

February 7, 2020

## 1 Generate DET Curves specific to the different subgroups of the Balance Faces in the Wild (BFW) dataset.

Uses the data in data/bfw-datatable.pkl to evaluate DET curves of different attributes.

```
[14]: %load_ext autoreload
      %autoreload 2
      import pathlib
      import pandas as pd
      import numpy as np
      import matplotlib.pyplot as plt
      import matplotlib.ticker as mtick

      import seaborn as sns

      sns.set(font_scale=1.1)
      # Load out custom tool for loading and processing the data
      from facebias.iotools import load_bfw_datatable, mkdir
      from facebias.visualization import draw_det_curve
      from facebias.metrics import calculate_det_curves

      %matplotlib inline
```

The autoreload extension is already loaded. To reload it, use:

```
%reload_ext autoreload
```

### 1.1 Setings for notebook run

set values per preferences for current session

```
[27]: fontsize=12

      # plotting
      sns.set_style("whitegrid")
      sns.set_context("paper", rc={"font.size": fontsize, "axes.titlesize": fontsize,
      ↪ "axes.labelsize": fontsize})
```

```

# parameters and filepaths
ticks_to_use_x=(1e-5, 1e-4, 1e-3, 1e-2, 1e-1, 1e-0)

# datatable (See Load Data)
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}/"
mkdir(dir_results)

save_plots = True # save plots to disc, in folder 'dir_out'
save_intermediate = True # save data to replot det curves without waiting for_
    ↪ calculations
overwrite_existing = False # only save if files do not exist

opts = [{'color': 'g', 'alpha': 0.7, 'norm_hist': True}, {'color': 'r', 'alpha':
    ↪ 0.7, 'norm_hist': True}] # currently not used

```

```

/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 display the first few rows.

More information and process to build datatable is exemplified in [0\\_prepare\\_datatable.ipynb](#).

Scores for pairs are assumed to be calculated and added as column of datatable. The process for adding this column is demonstrated in [1\\_compare\\_features.ipynb](#)

**Note** that the demo uses scores from setnet50, as it creates a column *score* with the respective values. Just set *score* column to any set of scores that are intended for analysis.

```

[28]: data = load_bfw_datatable(f_datatable)
      data['score'] = data[use_feature]
      data.head()

```

```

[28]:  fold                                p1                                p2 \
0     1  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
2     1  asian_females/n000009/0010_01.jpg  asian_females/n000009/0122_02.jpg
3     1  asian_females/n000009/0010_01.jpg  asian_females/n000009/0188_01.jpg
4     1  asian_females/n000009/0010_01.jpg  asian_females/n000009/0205_01.jpg

```

	label	id1	id2	att1	att2	vgg16	resnet50	senet50	\
0	1	0	0	asian_females	asian_females	0.820039	0.703258	0.679089	
1	1	0	0	asian_females	asian_females	0.719199	0.523613	0.594268	
2	1	0	0	asian_females	asian_females	0.732029	0.527567	0.643680	
3	1	0	0	asian_females	asian_females	0.607093	0.348211	0.458883	
4	1	0	0	asian_females	asian_females	0.629153	0.384273	0.494913	

	a1	a2	g1	g2	e1	e2	sphereface	score
0	AF	AF	F	F	A	A	0.392526	0.392526
1	AF	AF	F	F	A	A	0.354262	0.354262
2	AF	AF	F	F	A	A	0.302028	0.302028
3	AF	AF	F	F	A	A	-0.009217	-0.009217
4	AF	AF	F	F	A	A	0.132534	0.132534

```
[29]: classes_abbreviated = np.unique(list(np.unique(data.a1)) + list(np.unique(data.
→a2)))
classes_abbreviated.sort()

print(f"there are {len(classes_abbreviated)} types: {classes_abbreviated}")
```

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

```
[30]: subgroups = data.groupby('a1')
li_subgroups = subgroups.groups
```

```
[31]: def set_det_labels(ax, f_out, save_plots, overwrite):
    ax.xaxis.set_major_formatter(mtick.FormatStrFormatter('%e'))
    plt.minorticks_off()
    ax.set_ylabel('FNR (%)', fontsize=fontsize+2)
    ax.set_xlabel('FPR', fontsize=fontsize+2)
    ax.legend(fontsize=fontsize)
    ax.set_xlim([1e-4, 1])
    ax.set_ylim([0, 30])
    for tick in ax.xaxis.get_major_ticks():
        tick.label.set_fontsize(12)
    plt.grid(False)
    if save_plots and overwrite_existing:
        plt.savefig(f"{f_out}.pdf")
        plt.savefig(f"{f_out}.png")
```

```
[32]: fig = plt.figure(figsize=(8, 8), constrained_layout=True)
gs = fig.add_gridspec(1, 3)

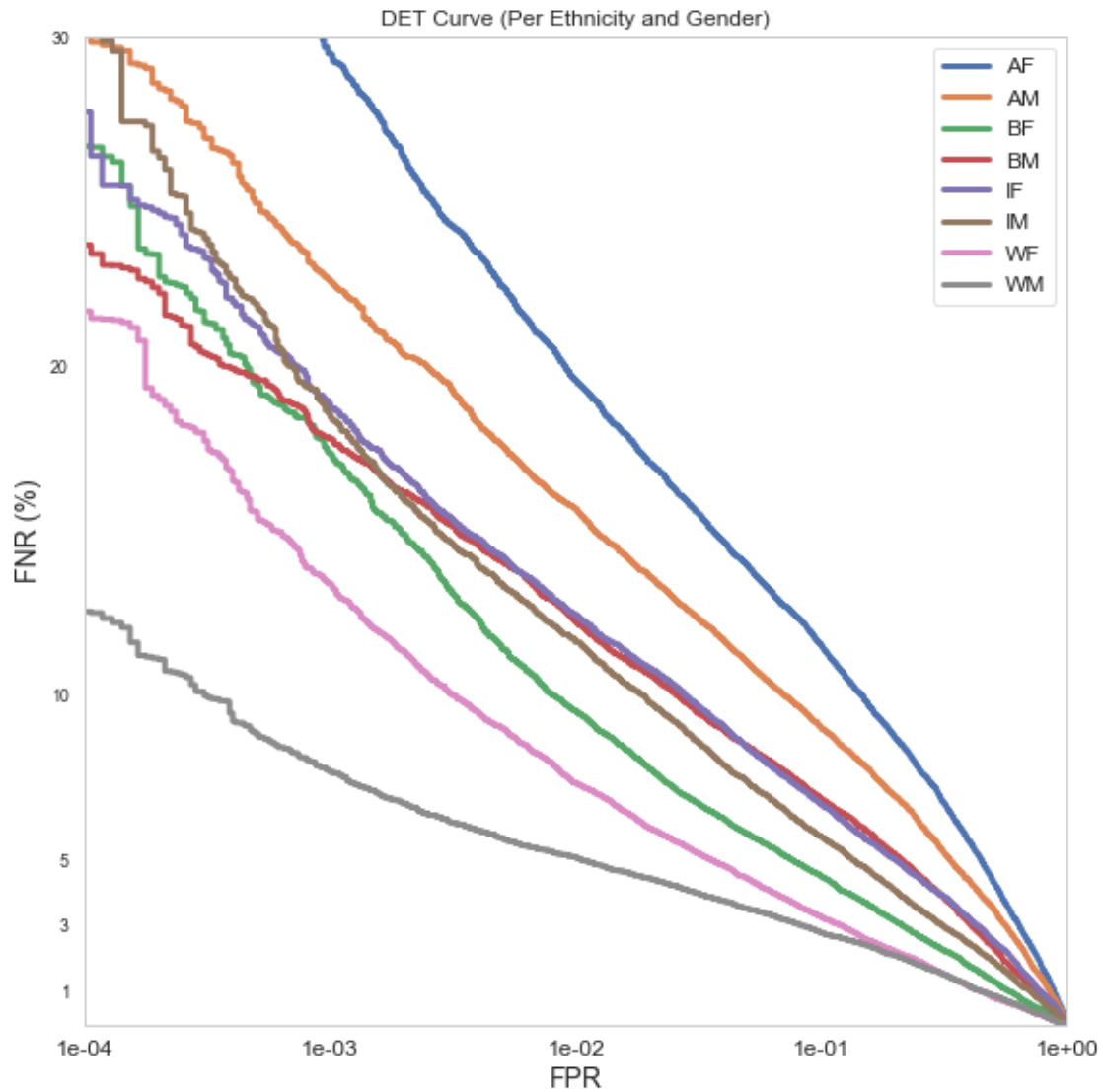
ax1 = fig.add_subplot(gs[0, :])
for i, subgroup in enumerate(li_subgroups):
    # for each subgroup
    fout = f"{dir_results}/det_data_{subgroup}.pkl"
```

```

    if pathlib.Path(fout).is_file() and not overwrite_existing:
        det_data = pd.read_pickle(fout)
        fpr, fnr, thresholds = det_data['fpr'], det_data['fnr'],
    det_data['thresholds']
    else:
        df_subgroup = subgroups.get_group(subgroup)
        labels, scores = df_subgroup['label'].values.astype(int),
    df_subgroup['score'].values
        fpr, fnr, thresholds = calculate_det_curves(labels, scores)
        if save_intermediate:
            pd.to_pickle({'fpr': fpr, 'fnr': fnr, 'thresholds': thresholds},
    fout)
        ax1 = draw_det_curve(fpr, fnr, ax=ax1, label=subgroup,
    fontsize=fontsize, title='DET Curve (Per Ethnicity and Gender)')

set_det_labels(ax0, f"{dir_results}curve_subgroups", save_plots,
    overwrite_existing)

```



```
[33]: subgroups = data.groupby('g1')
li_subgroups = subgroups.groups
classes_abbreviated=list(li_subgroups.keys())
print(f"there are {len(classes_abbreviated)} types: {classes_abbreviated}")
```

there are 2 types: ['F', 'M']

```
[34]: fig = plt.figure(figsize=(8, 8), constrained_layout=True)
gs = fig.add_gridspec(1, 3)

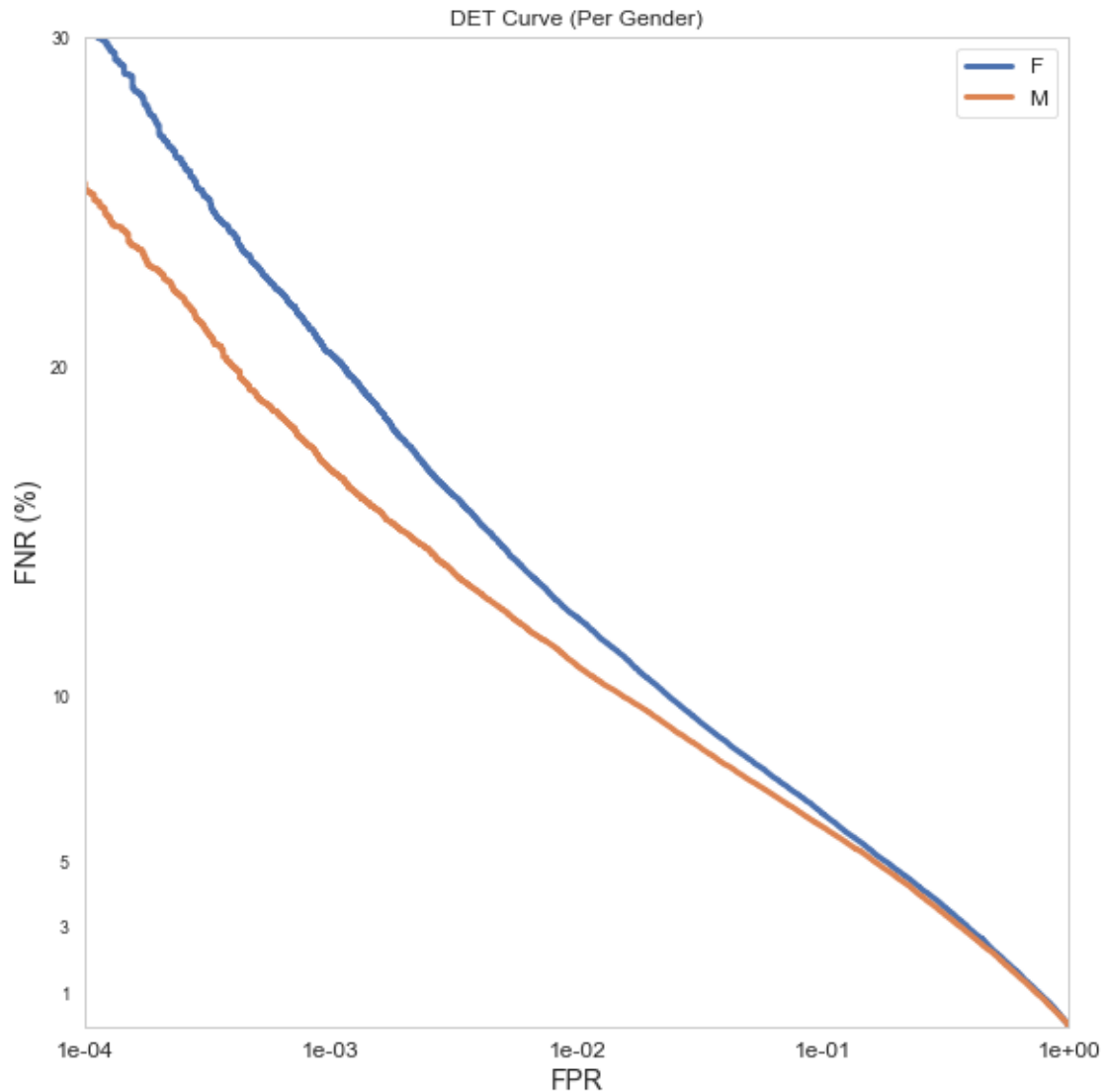
ax1 = fig.add_subplot(gs[0, :])
for i, subgroup in enumerate(li_subgroups):
    # for each subgroup
```

```

fout = f"{dir_results}/det_data_{subgroup}.pkl"
if pathlib.Path(fout).is_file() and not overwrite_existing:
    det_data = pd.read_pickle(fout)
    fpr, fnr, thresholds = det_data['fpr'], det_data['fnr'],
↪det_data['thresholds']
    else:
        df_subgroup = subgroups.get_group(subgroup)
        labels, scores = df_subgroup['label'].values.astype(int),
↪df_subgroup['score'].values
        fpr, fnr, thresholds = calculate_det_curves(labels, scores)
        if save_intermediate:
            pd.to_pickle({'fpr': fpr, 'fnr': fnr, 'thresholds': thresholds},
↪fout)
        ax1 = draw_det_curve(fpr, fnr, ax=ax1, label=subgroup, fontsize=fontsize,
↪title='DET Curve (Per Gender)')

set_det_labels(ax1, f"{dir_results}curves_gender", save_plots,
↪overwrite_existing)

```



```
[35]: subgroups = data.groupby('e1')
li_subgroups = subgroups.groups
classes_abbreviated=list(li_subgroups.keys())
print(f"there are {len(classes_abbreviated)} types: {classes_abbreviated}")
```

there are 4 types: ['A', 'B', 'I', 'W']

```
[36]: fig = plt.figure(figsize=(8, 8), constrained_layout=True)
gs = fig.add_gridspec(1, 3)

ax1 = fig.add_subplot(gs[0, :])
for i, subgroup in enumerate(li_subgroups):
    # for each subgroup
```

```

fout = f"{dir_results}/det_data_{subgroup}.pkl"
if pathlib.Path(fout).is_file() and not overwrite_existing:
    det_data = pd.read_pickle(fout)
    fpr, fnr, thresholds = det_data['fpr'], det_data['fnr'],
    det_data['thresholds']
else:
    df_subgroup = subgroups.get_group(subgroup)
    labels, scores = df_subgroup['label'].values.astype(int),
    df_subgroup['score'].values
    fpr, fnr, thresholds = calculate_det_curves(labels, scores)
    if save_intermediate:
        pd.to_pickle({'fpr': fpr, 'fnr': fnr, 'thresholds': thresholds},
    fout)
    ax1 = draw_det_curve(fpr, fnr, ax=ax1, label=subgroup, fontsize=fontsize,
    title='DET Curve (Per Ethnicity)')

set_det_labels(ax1, f"{dir_results}curve_ethnicity", save_plots,
    overwrite_existing)

```



