Plots_CWRU

November 16, 2023

```python
[1]: from tqdm import tqdm
     import os
     import pandas as pd
     import polars as pl
     import numpy as np
     from sklearn.svm import OneClassSVM
     import plotly.graph_objects as go
     from plotly.subplots import make_subplots
     import plotly.express as px
     from sklearn.preprocessing import RobustScaler
     from collections import Counter
     from matplotlib import pyplot as plt
     from sklearn.metrics import mean_absolute_percentage_error as MAPE
     plt.rcParams["figure.figsize"] = (10,10)


     from sklearn.decomposition import PCA
     import glob

     # from he_svm import preprocess_a_sample, he_svm, preprocess_a_sample_encrypted
```

```python
[2]: errors_dfs = {}
     files_with_mismatches = []

     for file in sorted(glob.glob('results/CWRU/Errors*.csv')):
         df = pl.read_csv(file)
         errors_dfs[file] = df
         mismatches = len(df.filter(pl.col("Correct?") == False))
         print(f'Case {file}, #mismatches: {mismatches} over {len(df)}')
         if mismatches > 0:
             files_with_mismatches.append(file)
```

```
Case results/CWRU/Errors_0_007_ball_0.csv, #mismatches: 0 over 242
Case results/CWRU/Errors_0_007_ball_1.csv, #mismatches: 0 over 241
Case results/CWRU/Errors_0_007_ball_2.csv, #mismatches: 0 over 243
Case results/CWRU/Errors_0_007_ball_3.csv, #mismatches: 0 over 242
Case results/CWRU/Errors_0_007_inner_0.csv, #mismatches: 0 over 243
Case results/CWRU/Errors_0_007_inner_1.csv, #mismatches: 0 over 242
```

```
Case results/CWRU/Errors_0_007_inner_2.csv, #mismatches: 0 over 242
Case results/CWRU/Errors_0_007_inner_3.csv, #mismatches: 0 over 243
Case results/CWRU/Errors_0_007_outer_0.csv, #mismatches: 0 over 241
Case results/CWRU/Errors_0_007_outer_1.csv, #mismatches: 0 over 242
Case results/CWRU/Errors_0_007_outer_2.csv, #mismatches: 0 over 243
Case results/CWRU/Errors_0_007_outer_3.csv, #mismatches: 0 over 243
Case results/CWRU/Errors_0_014_ball_0.csv, #mismatches: 0 over 244
Case results/CWRU/Errors_0_014_ball_1.csv, #mismatches: 0 over 243
Case results/CWRU/Errors_0_014_ball_2.csv, #mismatches: 0 over 244
Case results/CWRU/Errors_0_014_ball_3.csv, #mismatches: 0 over 242
Case results/CWRU/Errors_0_014_inner_0.csv, #mismatches: 0 over 242
Case results/CWRU/Errors_0_014_inner_1.csv, #mismatches: 0 over 242
Case results/CWRU/Errors_0_014_inner_2.csv, #mismatches: 0 over 242
Case results/CWRU/Errors_0_014_inner_3.csv, #mismatches: 0 over 242
Case results/CWRU/Errors_0_014_outer_0.csv, #mismatches: 0 over 243
Case results/CWRU/Errors_0_014_outer_1.csv, #mismatches: 0 over 242
Case results/CWRU/Errors_0_014_outer_2.csv, #mismatches: 0 over 241
Case results/CWRU/Errors_0_014_outer_3.csv, #mismatches: 0 over 241
Case results/CWRU/Errors_0_021_ball_0.csv, #mismatches: 0 over 242
Case results/CWRU/Errors_0_021_ball_1.csv, #mismatches: 0 over 242
Case results/CWRU/Errors_0_021_ball_2.csv, #mismatches: 0 over 243
Case results/CWRU/Errors_0_021_ball_3.csv, #mismatches: 0 over 241
Case results/CWRU/Errors_0_021_inner_0.csv, #mismatches: 0 over 242
Case results/CWRU/Errors_0_021_inner_1.csv, #mismatches: 0 over 242
Case results/CWRU/Errors_0_021_inner_2.csv, #mismatches: 0 over 241
Case results/CWRU/Errors_0_021_inner_3.csv, #mismatches: 0 over 242
Case results/CWRU/Errors_0_021_outer_1.csv, #mismatches: 0 over 241
Case results/CWRU/Errors_0_021_outer_2.csv, #mismatches: 0 over 241
Case results/CWRU/Errors_0_021_outer_3.csv, #mismatches: 0 over 242
```

[3]:
```python
if len(files_with_mismatches) == 0:
    print("No mismatches! The processing is equal between encrypted and plain.")
```

```
No mismatches! The processing is equal between encrypted and plain.
```

[4]:
```python
sum([len(pd.read_csv(f)) for f in glob.glob('results/CWRU/Errors*.csv')])
```

[4]: 8474

[5]:
```python
for file in files_with_mismatches:
    print(errors_dfs[file].filter(pl.col("Correct?") == False).write_csv())
```
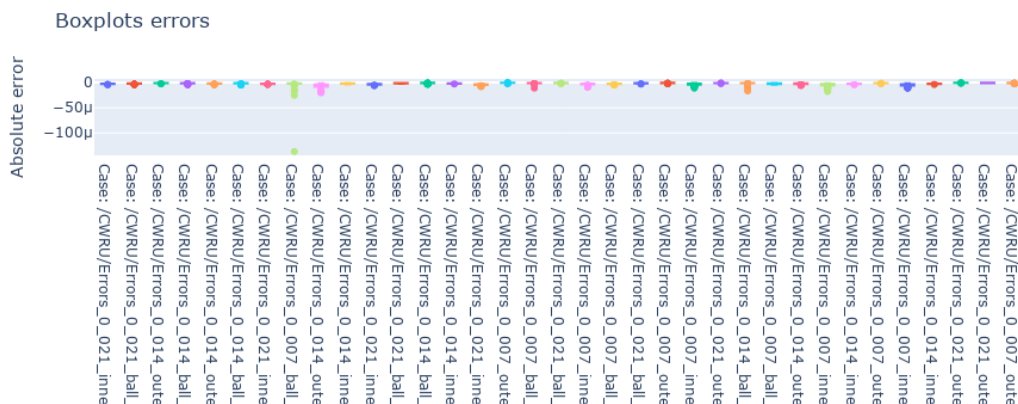
[6]:
```python
fig = go.Figure()

for file in glob.glob('results/CWRU/Errors*.csv'):
    df = errors_dfs[file]
    fig.add_trace(go.Box(y=df.select(pl.col('Expected') - pl.col('Predicted
 (enc)')).to_numpy().flatten(),
```

```
                           name=f'Case: {file[7:]}'))


fig.update_layout(title_text=f"Boxplots errors", showlegend=False)
fig.update_yaxes(title_text='Absolute error')
fig.show()
```
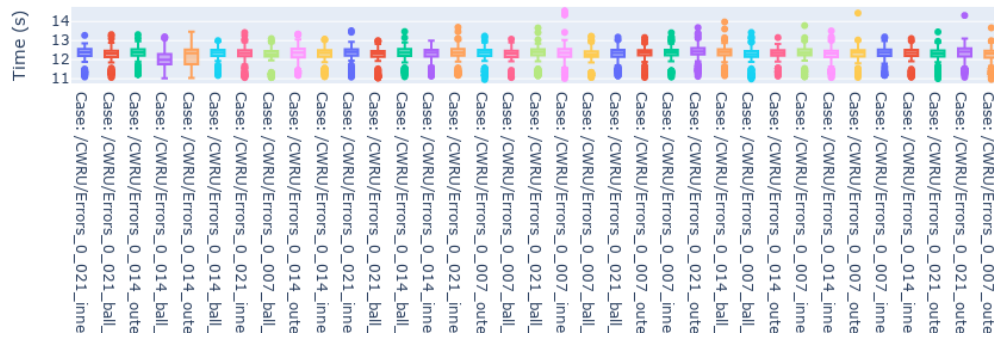

Boxplots errors

```
[ ]:

[7]: fig = go.Figure()

     for file in glob.glob('results/CWRU/Errors*.csv'):
         df = errors_dfs[file]
         fig.add_trace(go.Box(y=df.select(pl.col('Time enc (s)')).to_numpy().
      ↪flatten(),
                           name=f'Case: {file[7:]}'))


     fig.update_layout(title_text=f"Boxplots times", showlegend=False)
     fig.update_yaxes(title_text='Time (s)')
     fig.show()
```

Boxplots times


```python
[8]: times = np.array([])
     for file in glob.glob('results/CWRU/Errors*.csv'):
         df = errors_dfs[file]
         times = np.append(times, df.select(pl.col('Time enc (s)'))[:, 0].to_numpy())
```

```python
[9]: times = np.array(times)
     print(f'Mean: {times.mean()}')
     print(f'Var: {times.var()}')
```

```
Mean: 12.27128055138003
Var: 0.1682642761481309
```

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[ ]:
```