Friedman3_LR0.02

July 5, 2022

```
[1]: import warnings
     warnings.filterwarnings('ignore')
```

```
[2]: import scrapbook as sb
     import pandas as pd
     import numpy as np
     import seaborn as sns
     import numpy as np
     from statistics import mean , median
     import matplotlib.pyplot as plt
```

1 Baseline

```
[3]: books = sb.read_notebooks("./BaseLine_Model_Output")
     baseLine_data = []
     for nb in books.notebooks:
         nbList=[nb.scraps['TabNet MAE'].data]
         baseLine_data.append(nbList)
     df = pd.DataFrame(baseLine_data, columns = ["TabNet(LR=0.02)"])
     baseline_data = np.array(baseLine_data)
     tabnet = median(baseline_data[:,0])
```

2 GAN Model

```
[4]: book = sb.read_notebooks("./GAN_Output")
     gan_data = []
     gan_mse = []
     for nb in book.notebooks:
         metrics = nb.scraps['GAN_1 Metrics'].data
         for i in range(1000):
             gan_mse.append(metrics[0][i])
         nbList = [nb.scraps['GAN Model MSE'].data,
                   nb.scraps['GAN Model MAE'].data,
                   nb.scraps['GAN Model Euclidean distance'].data,
                   nb.scraps['GAN Model Manhattan Distance'].data]
         gan_data.append(nbList)
```

```python
df = pd.DataFrame(gan_data, columns = ['MSE','MAE','Euclidean␣
 ↪Distance','Manhattan Distance'])
display(df.style)
print("MEDIAN:")
print(df.median(axis = 0))
gan_data = np.array(gan_data)
gan_median = median(gan_data[:,1])
print(gan_median)
```

```
<pandas.io.formats.style.Styler at 0x7fcc1167d1c0>
```

```
MEDIAN:
MSE                 0.268850
MAE                 0.422420
Euclidean Distance  2.318020
Manhattan Distance  8.448406
dtype: float64
0.4224202967224643
```

3 ABC_GAN Analysis

3.1 ABC Pre-generator - TabNet

```python
[5]: book = sb.read_notebooks("./ABC_GAN_TabNet")
paramVal = [[1,1],[1,0.1],[1,0.01],[1,0],[0.1,1],[0.1,0.1],[0.1,0.01],[0.
 ↪1,0],[0.01,1],[0.01,0.1],[0.01,0.01],[0.01,0]]
abc_mae = [[] for i in range(12)]
abc_mae_skip = [[] for i in range(12)]
abc_mae_mean = [[] for i in range(12)]
abc_mae_skip_mean = [[] for i in range(12)]
abc_weights = [[] for i in range(12)]
prior_model = [[] for i in range(12)]
abc_pre_generator = [[] for i in range(12)]

for nb in book.notebooks:
    metrics1 = np.array(nb.scraps['ABC_GAN_1 Metrics'].data)
    metrics3 = np.array(nb.scraps['ABC_GAN_3 Metrics'].data)
    paramVar = float(nb.papermill_dataframe.iloc[1]['value'])
    paramBias = float(nb.papermill_dataframe.iloc[0]['value'])
    # #Divide data according to parameters
    for i in range(12):
        if paramVar == paramVal[i][0] and paramBias == paramVal[i][1]:
            for j in range(100):
                abc_mae[i].append(metrics1[1,j])
                abc_mae_skip[i].append(metrics3[1,j])
            abc_weights[i].append(nb.scraps['Skip Connection Weight'].data)
```

```
            prior_model[i].append(nb.scraps['Prior Model MSE'].data)
            abc_pre_generator[i].append(nb.scraps['ABC Pre-generator MSE'].data)
            abc_mae_skip_mean[i].append(mean(metrics3[1,:]))
            abc_mae_mean[i].append(mean(metrics1[1,:]))
```

```
[6]: data = [[] for i in range(12)]
     for i in range(12):
         for j in range(len(abc_weights[i])):
             data[i].append([paramVal[i][0], paramVal[i][1],prior_model[i][j],
                ␣
       ↪abc_pre_generator[i][j],abc_weights[i][j],abc_mae_mean[i][j],abc_mae_skip_mean[i][j]])
         df = pd.DataFrame(data[i], columns = ['Variance','Bias','Prior Model MAE',
                                    'ABC pre-generator MAE','Skip Node␣
       ↪weight','ABC GAN MAE','ABC_GAN MAE (skip connection)'])
         display(df.round(5))
         print(df.median(axis=0))
         print("-----------------------------------------------------------")
```

```
   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0         1     1          0.26224                1.27267           0.12315
1         1     1          0.25144                1.07432           0.14760
2         1     1          0.41890                1.24208           0.12715
3         1     1          0.51930                1.16254           0.45957
4         1     1          0.44460                1.28810           0.12771
5         1     1          0.32573                1.19235           0.28127
6         1     1          0.22804                1.20343           0.12735
7         1     1          0.23102                1.45562           0.14964
8         1     1          0.53576                1.28282           0.94479

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.32825                        0.32203
1      0.31595                        0.26913
2      0.40338                        0.39426
3      0.63657                        0.58900
4      0.37620                        0.45012
5      0.41018                        0.50470
6      0.30351                        0.40672
7      0.38760                        0.44308
8      0.41346                        0.44656

Variance                       1.000000
Bias                           1.000000
Prior Model MAE                0.325734
ABC pre-generator MAE          1.242078
Skip Node weight               0.147605
ABC GAN MAE                    0.387603
ABC_GAN MAE (skip connection)  0.443077
dtype: float64
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight	\
0	1	0.1	0.35488	0.78704	0.17125	
1	1	0.1	0.32466	0.87304	0.91601	
2	1	0.1	0.34348	0.80941	0.20607	
3	1	0.1	0.25704	0.94214	0.81797	
4	1	0.1	0.46143	0.77057	0.87207	
5	1	0.1	0.28672	0.80604	0.75429	
6	1	0.1	0.35837	0.61847	0.74792	
7	1	0.1	0.36707	0.95131	0.15140	
8	1	0.1	0.30916	0.66621	0.77060	

	ABC GAN MAE	ABC_GAN MAE (skip connection)
0	0.35666	0.30502
1	0.48066	0.30332
2	0.46908	0.39461
3	0.23783	0.22467
4	0.67852	0.62076
5	0.29414	0.24885
6	0.46754	0.47843
7	0.36826	0.35278
8	0.30507	0.28372

```
Variance                        1.000000
Bias                            0.100000
Prior Model MAE                 0.343482
ABC pre-generator MAE           0.806040
Skip Node weight                0.754294
ABC GAN MAE                     0.368264
ABC_GAN MAE (skip connection)   0.305021
dtype: float64
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight	\
0	1	0.01	0.36756	0.81512	0.49201	
1	1	0.01	0.36758	0.89253	0.14603	
2	1	0.01	0.33931	0.80807	0.51593	
3	1	0.01	0.36606	0.91895	0.47661	
4	1	0.01	0.33845	0.83928	0.53094	
5	1	0.01	0.49218	0.81003	0.22425	
6	1	0.01	0.41328	0.84767	0.21794	
7	1	0.01	0.37879	0.75985	0.99369	
8	1	0.01	0.43971	0.99345	0.96467	

	ABC GAN MAE	ABC_GAN MAE (skip connection)
0	0.44731	0.29406
1	0.31764	0.38864
2	0.30160	0.25019

```
3        0.35218                        0.32829
4        0.32283                        0.33518
5        0.50500                        0.36572
6        0.40953                        0.44265
7        0.33536                        0.38595
8        0.46655                        0.52038
Variance                       1.000000
Bias                           0.010000
Prior Model MAE                0.367583
ABC pre-generator MAE          0.839285
Skip Node weight               0.492011
ABC GAN MAE                    0.352176
ABC_GAN MAE (skip connection)  0.365719
dtype: float64
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight	\
0	1	0	0.30224	0.82939	0.19565	
1	1	0	0.28636	0.76944	0.25298	
2	1	0	0.36374	1.16685	0.19978	
3	1	0	0.28232	0.67214	0.90695	
4	1	0	0.30011	0.79224	0.15636	
5	1	0	0.40675	0.96640	0.54161	
6	1	0	0.44748	0.63623	0.72261	
7	1	0	0.31801	0.98743	0.17195	
8	1	0	0.37774	0.86082	0.17342	

	ABC GAN MAE	ABC_GAN MAE (skip connection)
0	0.32307	0.32283
1	0.35123	0.36422
2	0.42634	0.56308
3	0.33374	0.38774
4	0.30337	0.30934
5	0.39059	0.38551
6	0.45544	0.48635
7	0.26200	0.30238
8	0.41422	0.34995

```
Variance                       1.000000
Bias                           0.000000
Prior Model MAE                0.318015
ABC pre-generator MAE          0.829387
Skip Node weight               0.199783
ABC GAN MAE                    0.351234
ABC_GAN MAE (skip connection)  0.364223
dtype: float64
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight	\

0	0.1	1	0.29111	0.77469	0.62749
1	0.1	1	0.52418	0.87545	0.11390
2	0.1	1	0.32478	0.98204	0.11363
3	0.1	1	0.47642	1.04031	0.66740
4	0.1	1	0.53412	1.24429	0.56379
5	0.1	1	0.46425	0.88024	0.75464
6	0.1	1	0.49534	1.10523	0.11544
7	0.1	1	0.42269	1.22662	0.48783
8	0.1	1	0.69312	1.21353	0.38721

	ABC GAN MAE	ABC_GAN MAE (skip connection)
0	0.32577	0.34152
1	0.43034	0.38303
2	0.30166	0.31600
3	0.58580	0.50100
4	0.52147	0.56731
5	0.45532	0.41256
6	0.34506	0.44616
7	0.45874	0.48113
8	0.70186	0.71003

```
Variance                       0.100000
Bias                           1.000000
Prior Model MAE                0.476416
ABC pre-generator MAE          1.040309
Skip Node weight               0.487834
ABC GAN MAE                    0.455324
ABC_GAN MAE (skip connection)  0.446155
dtype: float64
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight	\
0	0.1	0.1	0.33890	0.33164	0.16884	
1	0.1	0.1	0.40527	0.42417	0.16416	
2	0.1	0.1	0.22530	0.26488	0.95100	
3	0.1	0.1	0.46241	0.46884	0.32872	
4	0.1	0.1	0.42003	0.40519	0.61856	
5	0.1	0.1	0.39054	0.43130	0.23177	
6	0.1	0.1	0.40297	0.40299	0.11625	
7	0.1	0.1	0.34911	0.35909	0.55760	
8	0.1	0.1	0.28944	0.30447	0.20110	

	ABC GAN MAE	ABC_GAN MAE (skip connection)
0	0.49810	0.38393
1	0.41150	0.43755
2	0.28544	0.22867
3	0.39055	0.31078
4	0.44226	0.46556
5	0.44167	0.42319

```
6        0.48521                      0.54893
7        0.33668                      0.40793
8        0.46559                      0.37388

Variance                  0.100000
Bias                      0.100000
Prior Model MAE           0.390544
ABC pre-generator MAE     0.402991
Skip Node weight          0.231775
ABC GAN MAE               0.441673
ABC_GAN MAE (skip connection)    0.407928
dtype: float64
------------------------------------------------------------
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight	\
0	0.1	0.01	0.45885	0.49842	0.06315	
1	0.1	0.01	0.36190	0.35044	0.11220	
2	0.1	0.01	0.37379	0.36397	0.25978	
3	0.1	0.01	0.50766	0.57272	0.27772	
4	0.1	0.01	0.36731	0.36897	0.46381	
5	0.1	0.01	0.37702	0.35897	0.05986	
6	0.1	0.01	0.29964	0.35918	0.67025	
7	0.1	0.01	0.31993	0.29089	0.10650	
8	0.1	0.01	0.31684	0.33237	0.19165	

	ABC GAN MAE	ABC_GAN MAE (skip connection)
0	0.44543	0.46618
1	0.31535	0.36375
2	0.39433	0.33937
3	0.50614	0.51783
4	0.33581	0.42748
5	0.50320	25.74966
6	0.40299	0.45073
7	0.39045	0.46550
8	0.34599	0.36092

```
Variance                  0.100000
Bias                      0.010000
Prior Model MAE           0.367308
ABC pre-generator MAE     0.359176
Skip Node weight          0.191651
ABC GAN MAE               0.394334
ABC_GAN MAE (skip connection)    0.450728
dtype: float64
------------------------------------------------------------
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight	\
0	0.1	0	0.38570	0.41052	0.60485	
1	0.1	0	0.45819	0.43946	0.06950	
2	0.1	0	0.48308	0.47132	0.05121	

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight
3	0.1	0	0.35299	0.34414	0.08104
4	0.1	0	0.33375	0.35683	0.00000
5	0.1	0	0.33104	0.33737	0.30528
6	0.1	0	0.44511	0.47035	0.73552
7	0.1	0	0.29831	0.27244	0.07218
8	0.1	0	0.35805	0.37565	0.04522

	ABC GAN MAE	ABC_GAN MAE (skip connection)
0	0.45641	0.46248
1	0.43391	0.39901
2	0.53381	13.11740
3	0.50551	0.54632
4	0.41373	0.34544
5	0.49741	0.47964
6	0.50297	0.51325
7	0.36621	0.36870
8	0.42576	12.22154

```
Variance                        0.100000
Bias                            0.000000
Prior Model MAE                 0.358050
ABC pre-generator MAE           0.375655
Skip Node weight                0.072177
ABC GAN MAE                     0.456408
ABC_GAN MAE (skip connection)   0.479638
dtype: float64
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight
0	0.01	1	0.61028	1.04074	0.32656
1	0.01	1	0.56538	1.32502	0.13755
2	0.01	1	0.41642	1.14973	0.85105
3	0.01	1	0.31729	0.97637	0.11704
4	0.01	1	0.40903	1.03853	0.19117
5	0.01	1	0.27117	1.02937	0.12269
6	0.01	1	0.39891	0.90763	0.09889
7	0.01	1	0.42114	0.98713	0.82241
8	0.01	1	0.48365	1.06418	0.64058

	ABC GAN MAE	ABC_GAN MAE (skip connection)
0	0.55082	0.60523
1	0.57429	0.64330
2	0.53674	0.45692
3	0.26510	0.34305
4	0.47557	0.55545
5	0.32293	0.36248
6	0.49571	0.51086
7	0.50938	0.46778
8	0.56357	0.44793

```
Variance                        0.010000
Bias                            1.000000
Prior Model MAE                 0.416424
ABC pre-generator MAE           1.038532
Skip Node weight                0.191165
ABC GAN MAE                     0.509380
ABC_GAN MAE (skip connection)   0.467776
dtype: float64
----------------------------------------------------------------
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight	\
0	0.01	0.1	0.23085	0.25941	0.74110	
1	0.01	0.1	0.35381	0.37860	0.11472	
2	0.01	0.1	0.45516	0.50017	0.54931	
3	0.01	0.1	0.48277	0.47195	0.61459	
4	0.01	0.1	0.56948	0.62516	0.11598	
5	0.01	0.1	0.27366	0.30952	0.29303	
6	0.01	0.1	0.44535	0.45269	0.46618	
7	0.01	0.1	0.40434	0.40670	0.40868	
8	0.01	0.1	0.55577	0.57182	0.10872	

	ABC GAN MAE	ABC_GAN MAE (skip connection)
0	0.27876	0.24930
1	0.39574	0.45028
2	0.49565	0.45415
3	0.52586	0.56952
4	0.61619	0.62907
5	0.36969	0.36188
6	0.44009	0.47855
7	0.39191	0.43287
8	0.62657	0.62871

```
Variance                        0.010000
Bias                            0.100000
Prior Model MAE                 0.445348
ABC pre-generator MAE           0.452693
Skip Node weight                0.408681
ABC GAN MAE                     0.440095
ABC_GAN MAE (skip connection)   0.454146
dtype: float64
----------------------------------------------------------------
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight	\
0	0.01	0.01	0.40036	0.40386	0.07461	
1	0.01	0.01	0.35101	0.35347	0.00000	
2	0.01	0.01	0.42777	0.42462	0.07418	
3	0.01	0.01	0.37902	0.37354	0.00000	
4	0.01	0.01	0.61890	0.62194	0.00000	
5	0.01	0.01	0.26605	0.26287	0.42099	

```
6     0.01  0.01        0.52063              0.52033              0.28321
7     0.01  0.01        0.31698              0.30942              0.00000
8     0.01  0.01        0.49732              0.49221              0.04085
```

	ABC GAN MAE	ABC_GAN MAE (skip connection)
0	0.35641	0.39069
1	0.45542	0.35285
2	0.44800	34.02934
3	0.35164	0.37601
4	0.59456	0.62372
5	0.33500	0.31544
6	0.55084	0.56689
7	0.35166	0.31309
8	0.55354	0.52319

```
Variance                      0.010000
Bias                          0.010000
Prior Model MAE               0.400363
ABC pre-generator MAE         0.403856
Skip Node weight              0.040846
ABC GAN MAE                   0.448003
ABC_GAN MAE (skip connection) 0.390693
dtype: float64
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight \
0	0.01	0	0.40635	0.40738	0.75797
1	0.01	0	0.34282	0.34160	0.00000
2	0.01	0	0.33980	0.33718	0.74654
3	0.01	0	0.29645	0.29604	0.00000
4	0.01	0	0.28270	0.28167	0.00000
5	0.01	0	0.43707	0.43997	0.14055
6	0.01	0	0.42221	0.42350	0.00000
7	0.01	0	0.32543	0.32810	0.54242
8	0.01	0	0.30592	0.30860	0.04881

	ABC GAN MAE	ABC_GAN MAE (skip connection)
0	0.43538	0.42300
1	0.44832	0.34297
2	0.32080	0.32708
3	0.44265	0.29663
4	0.22045	0.28288
5	0.42578	0.40822
6	0.37111	0.42248
7	0.32254	0.32615
8	0.24309	7.33745

```
Variance                      0.010000
Bias                          0.000000
```

```
Prior Model MAE              0.339801
ABC pre-generator MAE        0.337181
Skip Node weight             0.048808
ABC GAN MAE                  0.371106
ABC_GAN MAE (skip connection) 0.342971
dtype: float64
-------------------------------------------------------------
```

```python
[7]: # Display TabNet Summary Tables
     data = np.array(data)
     tabnetData = []
     for i in range(12):
         data[i] = np.array(data[i])
         tabnetData.append([paramVal[i][0], paramVal[i][1],tabnet,median(data[i][:
      ↪,3]),median(data[i][:,5]),median(data[i][:,6]),median(data[i][:,4])])
     df = pd.DataFrame(tabnetData, columns = ['Variance','Bias','TabNet','Prior␣
      ↪Model MAE','mGAN','skipGAN','Skip Node weight'])
     display(df.round(5))
```

```
    Variance  Bias   TabNet  Prior Model MAE     mGAN   skipGAN  \
0       1.00  1.00  0.41428          1.24208  0.38760  0.44308
1       1.00  0.10  0.41428          0.80604  0.36826  0.30502
2       1.00  0.01  0.41428          0.83928  0.35218  0.36572
3       1.00  0.00  0.41428          0.82939  0.35123  0.36422
4       0.10  1.00  0.41428          1.04031  0.45532  0.44616
5       0.10  0.10  0.41428          0.40299  0.44167  0.40793
6       0.10  0.01  0.41428          0.35918  0.39433  0.45073
7       0.10  0.00  0.41428          0.37565  0.45641  0.47964
8       0.01  1.00  0.41428          1.03853  0.50938  0.46778
9       0.01  0.10  0.41428          0.45269  0.44009  0.45415
10      0.01  0.01  0.41428          0.40386  0.44800  0.39069
11      0.01  0.00  0.41428          0.33718  0.37111  0.34297

    Skip Node weight
0            0.14760
1            0.75429
2            0.49201
3            0.19978
4            0.48783
5            0.23177
6            0.19165
7            0.07218
8            0.19117
9            0.40868
10           0.04085
11           0.04881
```