Friedman3

June 13, 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['Stats Model MAE'].data,nb.scraps['Catboost MAE'].data]
    baseLine_data.append(nbList)
df = pd.DataFrame(baseLine_data, columns = ["Stats Model","Catboost"])
baseline_data = np.array(baseLine_data)
stats = median(baseline_data[:,0])
catboost = median(baseline_data[:,1])
```

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)

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 0x7fd49812e640>
```

```
MEDIAN:
MSE                    0.363331
MAE                    0.447715
Euclidean Distance     2.693012
Manhattan Distance     8.954302
dtype: float64
0.4477151076152455
```

3 ABC_GAN Analysis

3.1 ABC Pre-generator - Catboost

[5]:
```
book = sb.read_notebooks("./ABC_GAN_Catboost")
paramVal = [[1,1],[1,0.1],[1,0.01],[0.1,1],[0.1,0.1],[0.1,0.01],[0.01,1],[0.
 ↪01,0.1],[0.01,0.01]]
abc_mae = [[] for i in range(9)]
abc_mae_skip = [[] for i in range(9)]
abc_mae_mean = [[] for i in range(9)]
abc_mae_skip_mean = [[] for i in range(9)]
abc_weights = [[] for i in range(9)]
prior_model = [[] for i in range(9)]
abc_pre_generator = [[] for i in range(9)]

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[0]['value'])
    paramBias = float(nb.papermill_dataframe.iloc[1]['value'])
    #Divide data according to parameters
    for i in range(9):
        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(9)]
for i in range(9):
    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	0.55349	1.07389	0.88728	
1	1	1	0.49695	1.47991	0.12838	
2	1	1	0.46301	1.09640	0.11156	
3	1	1	0.37491	1.20632	0.14740	
4	1	1	0.25901	1.39730	0.12584	
5	1	1	0.42910	1.32755	0.59361	
6	1	1	0.25064	1.21604	0.90036	
7	1	1	0.31530	1.47608	0.12112	
8	1	1	0.39262	1.35637	0.32640	
9	1	1	0.29455	1.13716	0.21418	

	ABC GAN MAE	ABC_GAN MAE (skip connection)
0	0.39999	0.35076
1	0.49533	0.51881
2	0.62987	0.55632
3	0.31533	0.33148
4	0.27767	0.33092
5	0.42387	0.40647
6	0.31985	0.27739
7	0.35676	0.37147
8	0.45790	0.51406
9	0.37550	0.33416

```
Variance                    1.000000
Bias                        1.000000
Prior Model MAE             0.383768
ABC pre-generator MAE       1.271793
Skip Node weight            0.180790
ABC GAN MAE                 0.387748
```

```
ABC_GAN MAE (skip connection)    0.361115
dtype: float64
------------------------------------------------------------
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight	ABC GAN MAE	ABC_GAN MAE (skip connection)
0	1	0.1	0.33982	0.99085	0.73196	0.35385	0.31337
1	1	0.1	0.36078	0.96710	0.42287	0.39859	0.37761
2	1	0.1	0.35341	1.20779	0.08241	0.36900	0.36547
3	1	0.1	0.29915	1.06911	0.08746	0.30682	0.30456
4	1	0.1	0.53808	1.13153	0.15200	0.58616	0.53587
5	1	0.1	0.52993	1.21257	0.52067	0.50569	0.48261
6	1	0.1	0.23190	0.91021	0.72811	0.23282	0.22546
7	1	0.1	0.46407	0.79147	0.06695	0.42181	0.47998
8	1	0.1	0.40931	0.97473	0.08642	0.37943	0.39480
9	1	0.1	0.25540	0.86825	0.07913	0.25027	0.26485

```
Variance                         1.000000
Bias                             0.100000
Prior Model MAE                  0.357096
ABC pre-generator MAE            0.982791
Skip Node weight                 0.119727
ABC GAN MAE                      0.374218
ABC_GAN MAE (skip connection)    0.371540
dtype: float64
------------------------------------------------------------
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight
0	1	0.01	0.19182	0.94674	0.08454
1	1	0.01	0.33837	1.08540	0.07246
2	1	0.01	0.61920	1.28079	0.06696
3	1	0.01	0.42694	1.13053	0.09642
4	1	0.01	0.35704	1.01274	0.76609
5	1	0.01	0.39605	1.17703	0.07694
6	1	0.01	0.23136	0.89273	0.36493
7	1	0.01	0.39765	1.11745	0.07427
8	1	0.01	0.60597	1.29207	0.06909
9	1	0.01	0.41245	1.05936	0.08070

```
   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.18860                        0.21433
1      0.35540                        0.36636
2      0.60762                        0.60012
3      0.43520                        0.42548
4      0.35261                        0.36901
5      0.38179                        0.41878
6      0.29091                        0.24130
7      0.34863                        0.40664
8      0.59141                        0.65434
9      0.43538                        0.41649

Variance                          1.000000
Bias                              0.010000
Prior Model MAE                   0.396854
ABC pre-generator MAE             1.101427
Skip Node weight                  0.078823
ABC GAN MAE                       0.368590
ABC_GAN MAE (skip connection)     0.411566
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0       0.1     1          0.44355                0.93825           0.19504
1       0.1     1          0.33733                0.97410           0.94731
2       0.1     1          0.53141                0.90917           0.18535
3       0.1     1          0.52344                0.95988           0.19841
4       0.1     1          0.35908                0.99645           0.36981
5       0.1     1          0.24180                0.60585           0.45198
6       0.1     1          0.34376                0.83138           0.27098
7       0.1     1          0.69918                1.08749           0.80777
8       0.1     1          0.30807                0.68183           0.19440
9       0.1     1          0.45076                0.88202           0.92793

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.52095                        0.54467
1      0.34799                        0.47004
2      0.39227                        0.45380
3      0.54389                        0.52574
4      0.44419                        0.46829
5      0.28643                        0.30646
6      0.29525                        0.27337
7      0.64926                        0.72885
8      0.46274                        0.45162
9      0.39831                        0.40029

Variance                          0.100000
Bias                              1.000000
```

```
Prior Model MAE                  0.401313
ABC pre-generator MAE            0.923711
Skip Node weight                 0.320396
ABC GAN MAE                      0.421251
ABC_GAN MAE (skip connection)    0.461044
dtype: float64
------------------------------------------------------------
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight	ABC GAN MAE	ABC_GAN MAE (skip connection)
0	0.1	0.1	0.48521	0.49516	0.42236	0.47018	0.49758
1	0.1	0.1	0.42198	0.44762	0.17766	0.42187	0.43543
2	0.1	0.1	0.37103	0.40611	0.11748	0.39183	0.35301
3	0.1	0.1	0.28395	0.34739	0.46384	0.33538	0.30777
4	0.1	0.1	0.31840	0.31547	0.15693	0.35089	0.31495
5	0.1	0.1	0.25629	0.25924	0.11373	0.26756	0.26324
6	0.1	0.1	0.31856	0.32447	0.12191	0.30586	0.28880
7	0.1	0.1	0.43340	0.51264	0.07154	0.43847	0.46338
8	0.1	0.1	0.18438	0.18535	0.10086	0.19990	0.20868
9	0.1	0.1	0.44524	0.46988	0.14702	0.51996	0.50652

```
Variance                         0.100000
Bias                             0.100000
Prior Model MAE                  0.344796
ABC pre-generator MAE            0.376749
Skip Node weight                 0.134466
ABC GAN MAE                      0.371360
ABC_GAN MAE (skip connection)    0.333982
dtype: float64
------------------------------------------------------------
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight
0	0.1	0.01	0.48635	0.46747	0.06486
1	0.1	0.01	0.72721	0.73822	0.07148
2	0.1	0.01	0.38121	0.36242	0.06480
3	0.1	0.01	0.39256	0.40627	0.06387
4	0.1	0.01	0.25910	0.27401	0.03888
5	0.1	0.01	0.45537	0.47982	0.12060

```
6       0.1  0.01          0.20045                0.18354           0.06223
7       0.1  0.01          0.46530                0.45927           0.15143
8       0.1  0.01          0.51858                0.52908           0.35577
9       0.1  0.01          0.55905                0.57888           0.59082

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.49798                        0.48154
1      0.68951                        0.72545
2      0.40144                        0.38736
3      0.40063                        0.38924
4      0.28314                        0.25411
5      0.44765                        0.44046
6      0.20828                        0.20713
7      0.47832                        0.46716
8      0.53154                        0.50484
9      0.56353                        0.55172

Variance                         0.100000
Bias                             0.010000
Prior Model MAE                  0.460338
ABC pre-generator MAE            0.463369
Skip Node weight                 0.068173
ABC GAN MAE                      0.462983
ABC_GAN MAE (skip connection)    0.453812
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0      0.01     1          0.49074                0.98341           0.14829
1      0.01     1          0.30582                1.07661           0.13859
2      0.01     1          0.40760                1.12822           0.98394
3      0.01     1          0.41272                0.85661           0.20137
4      0.01     1          0.33472                0.97188           0.88398
5      0.01     1          0.42780                1.16855           0.90054
6      0.01     1          0.36342                1.14467           0.79338
7      0.01     1          0.49722                0.65774           0.15495
8      0.01     1          0.38186                1.06331           0.14788
9      0.01     1          0.28260                0.77761           0.77086

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.57054                        0.58423
1      0.35546                        0.45770
2      0.57490                        0.49541
3      0.52824                        0.48841
4      0.42478                        0.39342
5      0.48665                        0.52362
6      0.40927                        0.41868
7      0.45248                        0.38027
8      0.40990                        0.40441
```

```
9      0.35585                         0.39131

Variance                          0.010000
Bias                              1.000000
Prior Model MAE                   0.394727
ABC pre-generator MAE             1.023361
Skip Node weight                  0.486114
ABC GAN MAE                       0.438633
ABC_GAN MAE (skip connection)     0.438191
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0      0.01   0.1          0.38063                0.37627           0.56189
1      0.01   0.1          0.29615                0.28527           0.15988
2      0.01   0.1          0.51166                0.51358           0.23061
3      0.01   0.1          0.39900                0.37510           0.20257
4      0.01   0.1          0.39202                0.40724           0.16257
5      0.01   0.1          0.43905                0.46808           0.75343
6      0.01   0.1          0.41002                0.40900           0.26527
7      0.01   0.1          0.34874                0.36578           0.00000
8      0.01   0.1          0.41720                0.44560           0.49396
9      0.01   0.1          0.51847                0.55573           0.29779

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.37685                         0.38667
1      0.30385                         0.31401
2      0.47840                         0.52289
3      0.45131                         0.46101
4      0.40694                         0.40043
5      0.42816                         0.41135
6      0.43447                         0.45689
7      0.35072                         0.35708
8      0.43446                         0.39402
9      0.54807                         0.55994

Variance                          0.010000
Bias                              0.100000
Prior Model MAE                   0.404513
ABC pre-generator MAE             0.408118
Skip Node weight                  0.247944
ABC GAN MAE                       0.431306
ABC_GAN MAE (skip connection)     0.405891
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0      0.01  0.01          0.33028                0.33461           0.03296
1      0.01  0.01          0.31899                0.32740           0.04498
2      0.01  0.01          0.32634                0.32176           0.09027
```

```
3      0.01  0.01          0.52266                0.51851          0.05373
4      0.01  0.01          0.41068                0.41065          0.00000
5      0.01  0.01          0.36300                0.35787          0.02500
6      0.01  0.01          0.31797                0.31724          0.00000
7      0.01  0.01          0.63367                0.63322          0.11209
8      0.01  0.01          0.43524                0.43527          0.06754
9      0.01  0.01          0.51606                0.51143          0.06383
```

```
   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.30637                        0.32798
1      0.33665                        0.31979
2      0.34715                        0.33142
3      0.51330                        0.53628
4      0.43096                        0.41030
5      0.34682                        0.36348
6      0.31611                        0.31655
7      0.63902                        0.63554
8      0.45189                        0.43657
9      0.54559                        0.54408
```

```
Variance                          0.010000
Bias                              0.010000
Prior Model MAE                   0.386840
ABC pre-generator MAE             0.384259
Skip Node weight                  0.049354
ABC GAN MAE                       0.389054
ABC_GAN MAE (skip connection)     0.386888
dtype: float64
------------------------------------------------------------
```

[7]:
```
# Display Catboost Summary Tables
data = np.array(data)
catboostData = []
for i in range(9):
    catboostData.append([paramVal[i][0],␣
 ↪paramVal[i][1],catboost,median(data[i][:,3]),median(data[i][:
 ↪,5]),median(data[i][:,6]),median(data[i][:,4])])
df = pd.DataFrame(catboostData, columns = ['Variance','Bias','Catboost','Prior␣
 ↪Model MAE','mGAN','skipGAN','Skip Node weight'])
display(df.round(5))
```

```
   Variance  Bias  Catboost  Prior Model MAE     mGAN  skipGAN  \
0      1.00  1.00   0.35587          1.27179  0.38775  0.36111
1      1.00  0.10   0.35587          0.98279  0.37422  0.37154
2      1.00  0.01   0.35587          1.10143  0.36859  0.41157
3      0.10  1.00   0.35587          0.92371  0.42125  0.46104
4      0.10  0.10   0.35587          0.37675  0.37136  0.33398
5      0.10  0.01   0.35587          0.46337  0.46298  0.45381
```

```
6      0.01  1.00   0.35587          1.02336  0.43863  0.43819
7      0.01  0.10   0.35587          0.40812  0.43131  0.40589
8      0.01  0.01   0.35587          0.38426  0.38905  0.38689
```

```
   Skip Node weight
0           0.18079
1           0.11973
2           0.07882
3           0.32040
4           0.13447
5           0.06817
6           0.48611
7           0.24794
8           0.04935
```

3.2 ABC Pre-generator - Stats

[8]:
```
book = sb.read_notebooks("./ABC_GAN_Stats")
paramVal = [[1,1],[0.1,1],[0.01,1],[1,0.1],[0.1,0.1],[0.01,0.1],[1,0.01],[0.1,0.
↪01],[0.01,0.01]]
abc_mae = [[] for i in range(9)]
abc_mae_skip = [[] for i in range(9)]
abc_mae_mean = [[] for i in range(9)]
abc_mae_skip_mean = [[] for i in range(9)]
abc_weights = [[] for i in range(9)]
prior_model = [[] for i in range(9)]
abc_pre_generator = [[] for i in range(9)]

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[0]['value'])
    paramBias = float(nb.papermill_dataframe.iloc[1]['value'])
    #Divide data according to parameters
    for i in range(9):
        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,:]))
```

[9]:
```
data = [[] for i in range(9)]
for i in range(9):
```

```
    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	ABC GAN MAE	ABC_GAN MAE (skip connection)
0	1	1	0.45321	1.37373	0.98985	0.46898	0.40212
1	1	1	0.46372	1.50672	0.97564	0.40372	0.29641
2	1	1	0.58514	1.16563	0.99841	0.44245	0.42443
3	1	1	0.52032	1.42406	1.00000	0.68059	0.77544
4	1	1	0.66686	1.11099	0.99498	0.51811	0.51083
5	1	1	0.59179	1.56344	0.99157	0.97788	0.71474
6	1	1	0.49935	1.69111	1.00000	0.46297	0.32696
7	1	1	0.44243	1.40947	0.98950	0.34726	0.28979
8	1	1	0.49656	1.25013	1.00000	0.61839	0.49452
9	1	1	0.55986	1.11980	0.99020	0.51472	0.60578

```
Variance                        1.000000
Bias                            1.000000
Prior Model MAE                 0.509832
ABC pre-generator MAE           1.391597
Skip Node weight                0.993273
ABC GAN MAE                     0.491848
ABC_GAN MAE (skip connection)   0.459476
dtype: float64
------------------------------------------------------------
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight	\
0	0.1	1	0.56628	1.09693	0.98871	

```
1       0.1     1          0.64543               1.14204           0.99631
2       0.1     1          0.46983               0.87978           1.00000
3       0.1     1          0.43445               0.87695           0.99956
4       0.1     1          0.66464               1.07654           0.99542
5       0.1     1          0.47202               0.91590           0.99953
6       0.1     1          0.43826               1.11128           0.99706
7       0.1     1          0.38618               0.73310           0.99848
8       0.1     1          0.58504               0.92217           0.99854
9       0.1     1          0.49714               0.93450           1.00000

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.53355                        0.46986
1      0.64390                        0.86049
2      0.47337                        0.36084
3      0.43586                        0.36840
4      0.36400                        0.42828
5      0.39912                        0.46462
6      0.33126                        0.36497
7      0.42586                        0.34843
8      0.53167                        0.69129
9      0.48852                        0.44818

Variance                        0.100000
Bias                            1.000000
Prior Model MAE                 0.484579
ABC pre-generator MAE           0.928335
Skip Node weight                0.998511
ABC GAN MAE                     0.454615
ABC_GAN MAE (skip connection)   0.438231
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0      0.01     1          0.52735                0.88408           0.99728
1      0.01     1          0.49734                0.82135           0.99989
2      0.01     1          0.71581                0.84162           0.99677
3      0.01     1          0.60416                1.24250           0.99780
4      0.01     1          0.35647                0.87529           1.00000
5      0.01     1          0.53557                0.83153           1.00000
6      0.01     1          0.42949                0.75890           0.99731
7      0.01     1          0.66363                0.88791           0.97753
8      0.01     1          0.48557                1.00044           0.97891
9      0.01     1          0.51627                0.94253           1.00000

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.53225                        0.53593
1      0.44240                        0.54811
2      0.68773                        0.68961
3      0.58669                        0.61441
```

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4      0.47759                          0.39850
5      0.37981                          0.36269
6      0.35582                          0.39652
7      0.52959                          0.63537
8      0.70407                          0.58905
9      0.64813                          0.54281

Variance                          0.010000
Bias                              1.000000
Prior Model MAE                   0.521810
ABC pre-generator MAE             0.879687
Skip Node weight                  0.997553
ABC GAN MAE                       0.530920
ABC_GAN MAE (skip connection)     0.545463
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0         1   0.1          0.49666                0.97503           0.65040
1         1   0.1          0.34444                1.15102           0.49673
2         1   0.1          0.52253                1.09027           0.55306
3         1   0.1          0.65495                1.17778           0.63340
4         1   0.1          0.55298                0.99800           0.79998
5         1   0.1          0.41945                0.96008           0.53853
6         1   0.1          0.45702                1.13148           0.71873
7         1   0.1          0.48078                0.93613           0.68116
8         1   0.1          0.49762                1.10178           0.80324
9         1   0.1          0.49122                1.11605           0.68719

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.65128                         0.55556
1      0.68853                         0.40891
2      0.42552                         0.32026
3      0.70891                         0.71962
4      0.39579                         0.40052
5      0.53043                         0.44123
6      0.39832                         0.48503
7      0.48170                         0.44009
8      0.43675                         0.37400
9      0.56866                         0.40666

Variance                          1.000000
Bias                              0.100000
Prior Model MAE                   0.493940
ABC pre-generator MAE             1.096027
Skip Node weight                  0.665780
ABC GAN MAE                       0.506069
ABC_GAN MAE (skip connection)     0.424501
dtype: float64
```

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------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0       0.1   0.1          0.56484                0.56716           0.28413
1       0.1   0.1          0.47589                0.50338           0.47540
2       0.1   0.1          0.61824                0.62408           0.75665
3       0.1   0.1          0.50811                0.54184           0.40798
4       0.1   0.1          0.62039                0.60978           0.22225
5       0.1   0.1          0.47623                0.47478           0.67082
6       0.1   0.1          0.65257                0.65590           0.57746
7       0.1   0.1          0.56224                0.54549           0.70165
8       0.1   0.1          0.42323                0.49448           0.50202
9       0.1   0.1          0.55557                0.54320           0.19723

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.66251                        0.38217
1      0.54635                        0.48815
2      0.50824                        0.42242
3      0.52121                        0.60617
4      0.91113                        0.55651
5      0.55672                        0.50154
6      0.72276                        0.55546
7      0.61892                        0.72986
8      0.54142                        0.44295
9      0.56206                        0.47822

Variance                         0.100000
Bias                             0.100000
Prior Model MAE                  0.558905
ABC pre-generator MAE            0.544347
Skip Node weight                 0.488711
ABC GAN MAE                      0.559392
ABC_GAN MAE (skip connection)    0.494845
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0      0.01   0.1          0.51659                0.53017           0.27844
1      0.01   0.1          0.47934                0.47985           0.40315
2      0.01   0.1          0.46465                0.50323           0.27094
3      0.01   0.1          0.51597                0.49841           0.24035
4      0.01   0.1          0.60559                0.59758           0.23521
5      0.01   0.1          0.57285                0.57108           0.20970
6      0.01   0.1          0.56041                0.54468           0.18111
7      0.01   0.1          0.51594                0.52984           0.39069
8      0.01   0.1          0.30555                0.33567           0.69118
9      0.01   0.1          0.56230                0.58217           0.38494

   ABC GAN MAE  ABC_GAN MAE (skip connection)
```

```
0      0.52370                        0.32378
1      0.56483                        0.46745
2      0.34764                        0.44929
3      0.51693                        0.42082
4      0.51468                        0.55375
5      0.74356                        0.36602
6      0.45670                        0.56743
7      0.50063                        0.44934
8      0.35404                        0.44647
9      0.45950                        0.57172

Variance                          0.010000
Bias                              0.100000
Prior Model MAE                   0.516278
ABC pre-generator MAE             0.530005
Skip Node weight                  0.274691
ABC GAN MAE                       0.507653
ABC_GAN MAE (skip connection)     0.449316
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0         1  0.01          0.62588                1.18596           0.35418
1         1  0.01          0.52304                1.01815           0.33965
2         1  0.01          0.74975                1.05210           0.29646
3         1  0.01          0.52429                0.95581           0.32946
4         1  0.01          0.48338                1.00998           0.32076
5         1  0.01          0.58723                1.14215           0.32050
6         1  0.01          0.58388                1.15237           0.47708
7         1  0.01          0.49451                0.76121           0.34719
8         1  0.01          0.50876                1.05500           0.41988
9         1  0.01          0.67886                1.39967           0.35270

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.54323                        0.46617
1      0.61959                        0.49882
2      0.58510                        0.72495
3      0.45701                        0.46782
4      0.32568                        0.35579
5      0.57248                        0.59535
6      0.48084                        0.44876
7      0.29037                        0.42110
8      0.40448                        0.41576
9      0.66499                        0.71340

Variance                          1.000000
Bias                              0.010000
Prior Model MAE                   0.554083
ABC pre-generator MAE             1.053550
```

```
Skip Node weight                0.343423
ABC GAN MAE                     0.512035
ABC_GAN MAE (skip connection)   0.466998
dtype: float64
------------------------------------------------------------
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight	\
0	0.1	0.01	0.52713	0.53239	0.24743	
1	0.1	0.01	0.60158	0.58374	0.15920	
2	0.1	0.01	0.63817	0.62046	0.20914	
3	0.1	0.01	0.56911	0.56816	0.18413	
4	0.1	0.01	0.64806	0.61719	0.16301	
5	0.1	0.01	0.61426	0.61155	0.21559	
6	0.1	0.01	0.52819	0.53986	0.21552	
7	0.1	0.01	0.43284	0.40754	0.32789	
8	0.1	0.01	0.47584	0.48683	0.21928	
9	0.1	0.01	0.41747	0.39251	0.20267	

	ABC GAN MAE	ABC_GAN MAE (skip connection)
0	0.49321	0.52259
1	0.48550	0.52312
2	0.55401	0.54453
3	0.38670	0.46995
4	0.36521	0.36476
5	0.67290	0.44144
6	0.65886	0.39668
7	0.27239	0.27265
8	0.51177	0.46258
9	0.43027	0.39745

```
Variance                        0.100000
Bias                            0.010000
Prior Model MAE                 0.548651
ABC pre-generator MAE           0.554013
Skip Node weight                0.212334
ABC GAN MAE                     0.489353
ABC_GAN MAE (skip connection)   0.452011
dtype: float64
------------------------------------------------------------
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight	\
0	0.01	0.01	0.31832	0.32375	0.19151	
1	0.01	0.01	0.54027	0.53400	0.17197	
2	0.01	0.01	0.43639	0.43214	0.17381	
3	0.01	0.01	0.49849	0.49781	0.19117	
4	0.01	0.01	0.61684	0.61271	0.13287	
5	0.01	0.01	0.58378	0.57790	0.20367	
6	0.01	0.01	0.48061	0.48210	0.18303	
7	0.01	0.01	0.54218	0.53840	0.17850	

```
8      0.01  0.01          0.58031                0.57566           0.21411
9      0.01  0.01          0.51799                0.51483           0.21570

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.30129                        0.27470
1      0.43375                        0.50622
2      0.46646                        0.39244
3      0.36862                        0.46545
4      0.87588                        0.57286
5      0.53713                        0.35204
6      0.46122                        0.39844
7      0.56682                        0.58491
8      0.52019                        0.54366
9      0.42981                      108.15121

Variance                          0.010000
Bias                              0.010000
Prior Model MAE                   0.529130
ABC pre-generator MAE             0.524417
Skip Node weight                  0.187100
ABC GAN MAE                       0.463838
ABC_GAN MAE (skip connection)     0.485838
dtype: float64
------------------------------------------------------------
```

[10]:
```
# Display Stats Summary Tables
data = np.array(data)
catboostData = []
for i in range(9):
    catboostData.append([gan_median,stats,paramVal[i][0],␣
 ↪paramVal[i][1],median(data[i][:,3]),median(data[i][:,5]),median(data[i][:
 ↪,6]),median(data[i][:,4])])
df = pd.DataFrame(catboostData, columns =␣
 ↪['GAN','Stats','Variance','Bias','Prior Model','mGAN','skipGAN','Weight'])
display(df.round(5))
```

	GAN	Stats	Variance	Bias	Prior Model	mGAN	skipGAN	Weight
0	0.44772	0.48174	1.00	1.00	1.39160	0.49185	0.45948	0.99327
1	0.44772	0.48174	0.10	1.00	0.92834	0.45461	0.43823	0.99851
2	0.44772	0.48174	0.01	1.00	0.87969	0.53092	0.54546	0.99755
3	0.44772	0.48174	1.00	0.10	1.09603	0.50607	0.42450	0.66578
4	0.44772	0.48174	0.10	0.10	0.54435	0.55939	0.49485	0.48871
5	0.44772	0.48174	0.01	0.10	0.53001	0.50765	0.44932	0.27469
6	0.44772	0.48174	1.00	0.01	1.05355	0.51204	0.46700	0.34342
7	0.44772	0.48174	0.10	0.01	0.55401	0.48935	0.45201	0.21233
8	0.44772	0.48174	0.01	0.01	0.52442	0.46384	0.48584	0.18710