Analysis_Out

April 19, 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 0x7fa181945970>
```

```
MEDIAN:
MSE                    0.005936
MAE                    0.060762
Euclidean Distance     0.342953
Manhattan Distance     1.215234
dtype: float64
0.06076171525809913
```

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          0.07855                1.36006           0.11787
1         1     1          0.15301                1.08836           0.10816
2         1     1          0.14898                1.12789           0.90731
3         1     1          0.19753                1.18692           0.11900
4         1     1          0.11723                0.85215           0.88979
5         1     1          0.15040                1.20445           0.09598
6         1     1          0.15466                0.95156           0.31636

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.03983                        0.04973
1      0.05588                        0.06058
2      0.07048                        0.05416
3      0.07974                        0.04311
4      0.09667                        0.08456
5      0.06731                        0.05081
6      0.09388                        0.05459

Variance                          1.000000
Bias                              1.000000
Prior Model MAE                   0.150399
ABC pre-generator MAE             1.127885
Skip Node weight                  0.118999
ABC GAN MAE                       0.070475
ABC_GAN MAE (skip connection)     0.054163
dtype: float64
-----------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0         1   0.1          0.08664                1.08078           0.22811
1         1   0.1          0.12254                0.96230           0.07545
```

```
2         1   0.1          0.09482               0.99885           0.08496
3         1   0.1          0.20895               0.96605           0.62171
4         1   0.1          0.25964               1.14851           0.15538
5         1   0.1          0.10261               1.02987           0.06901
6         1   0.1          0.24933               0.96000           0.07279

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.06467                        0.05341
1      0.09036                        0.08981
2      0.08375                        0.05871
3      0.08128                        0.11557
4      0.11147                        0.12880
5      0.05347                        0.05544
6      0.14778                        0.15382

Variance                         1.000000
Bias                             0.100000
Prior Model MAE                  0.122537
ABC pre-generator MAE            0.998852
Skip Node weight                 0.084956
ABC GAN MAE                      0.083755
ABC_GAN MAE (skip connection)    0.089808
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0         1  0.01          0.10032                1.04452           0.07525
1         1  0.01          0.15789                0.95218           0.86445
2         1  0.01          0.06501                0.99964           0.19704
3         1  0.01          0.10682                0.98862           0.75384
4         1  0.01          0.14664                1.01787           0.07657
5         1  0.01          0.14552                0.97122           0.30354
6         1  0.01          0.10720                0.99729           0.06635

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.07946                        0.09370
1      0.11203                        0.11231
2      0.06338                        0.04880
3      0.05058                        0.04444
4      0.04879                        0.13630
5      0.08534                        0.12470
6      0.07713                        0.09104

Variance                         1.000000
Bias                             0.010000
Prior Model MAE                  0.107199
ABC pre-generator MAE            0.997293
Skip Node weight                 0.197037
ABC GAN MAE                      0.077132
```

```
ABC_GAN MAE (skip connection)    0.093695
dtype: float64
------------------------------------------------------------
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight	\
0	0.1	1	0.10274	0.60203	0.15046	
1	0.1	1	0.18400	0.82051	0.18788	
2	0.1	1	0.13537	0.64484	0.25334	
3	0.1	1	0.21186	0.80396	0.53652	
4	0.1	1	0.22005	0.76347	0.38458	
5	0.1	1	0.10358	0.79639	0.12453	
6	0.1	1	0.19467	0.89972	0.12335	

	ABC GAN MAE	ABC_GAN MAE (skip connection)
0	0.07749	0.06772
1	0.07663	0.04705
2	0.06205	0.07666
3	0.09125	0.06858
4	0.08745	0.05504
5	0.04788	0.04351
6	0.08848	0.07529

```
Variance                        0.100000
Bias                            1.000000
Prior Model MAE                 0.184000
ABC pre-generator MAE           0.796394
Skip Node weight                0.187885
ABC GAN MAE                     0.077491
ABC_GAN MAE (skip connection)   0.067721
dtype: float64
------------------------------------------------------------
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight	\
0	0.1	0.1	0.14531	0.21265	0.08516	
1	0.1	0.1	0.19443	0.26237	0.24546	
2	0.1	0.1	0.19176	0.22195	0.07296	
3	0.1	0.1	0.18345	0.29532	0.04840	
4	0.1	0.1	0.10016	0.17115	0.49182	
5	0.1	0.1	0.16224	0.18113	0.05279	
6	0.1	0.1	0.09559	0.17334	0.38276	

	ABC GAN MAE	ABC_GAN MAE (skip connection)
0	0.09433	0.09047
1	0.08817	0.11063
2	0.05922	0.08006
3	0.06654	0.10326
4	0.07579	0.06508
5	0.05404	0.06656
6	0.08216	0.07818

```
Variance                          0.100000
Bias                              0.100000
Prior Model MAE                   0.162240
ABC pre-generator MAE             0.212655
Skip Node weight                  0.085163
ABC GAN MAE                       0.075793
ABC_GAN MAE (skip connection)     0.080061
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0       0.1  0.01          0.14108                0.20592           0.58303
1       0.1  0.01          0.14328                0.18772           0.32514
2       0.1  0.01          0.12463                0.14043           0.03141
3       0.1  0.01          0.16789                0.18361           0.19254
4       0.1  0.01          0.06525                0.11418           0.03785
5       0.1  0.01          0.11773                0.14043           0.52496
6       0.1  0.01          0.11736                0.15207           0.03082

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.09983                        0.14749
1      0.08184                        0.12781
2      0.10935                        0.13028
3      0.12760                        0.16063
4      0.05233                        0.06712
5      0.11588                        0.10306
6      0.09748                        0.11824

Variance                          0.100000
Bias                              0.010000
Prior Model MAE                   0.124627
ABC pre-generator MAE             0.152072
Skip Node weight                  0.192537
ABC GAN MAE                       0.099832
ABC_GAN MAE (skip connection)     0.127806
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0      0.01     1          0.14403                0.74114           0.72776
1      0.01     1          0.11802                0.82910           0.47447
2      0.01     1          0.15333                0.63561           0.87911
3      0.01     1          0.13681                1.03887           0.64891
4      0.01     1          0.15148                0.75239           0.89693
5      0.01     1          0.16064                0.86782           0.10019
6      0.01     1          0.11206                0.84647           0.18724

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.07486                        0.07345
```

```
1      0.05623                        0.04519
2      0.09225                        0.06239
3      0.05432                        0.04067
4      0.06319                        0.05484
5      0.08251                        0.06306
6      0.05780                        0.05984

Variance                          0.010000
Bias                              1.000000
Prior Model MAE                   0.144034
ABC pre-generator MAE             0.829097
Skip Node weight                  0.648910
ABC GAN MAE                       0.063192
ABC_GAN MAE (skip connection)     0.059837
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0      0.01   0.1          0.08611                0.10014           0.11448
1      0.01   0.1          0.14182                0.16452           0.38924
2      0.01   0.1          0.08366                0.13291           0.85842
3      0.01   0.1          0.15718                0.19995           0.58195
4      0.01   0.1          0.08675                0.14506           0.03570
5      0.01   0.1          0.14809                0.15994           0.15341
6      0.01   0.1          0.17979                0.24141           0.09049

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.03919                        0.04223
1      0.07521                        0.08046
2      0.06312                        0.03845
3      0.09116                        0.09086
4      0.04680                        0.04430
5      0.08700                        0.08208
6      0.09387                        0.06309

Variance                          0.010000
Bias                              0.100000
Prior Model MAE                   0.141818
ABC pre-generator MAE             0.159936
Skip Node weight                  0.153409
ABC GAN MAE                       0.075211
ABC_GAN MAE (skip connection)     0.063094
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0      0.01  0.01          0.19134                0.18994           0.00039
1      0.01  0.01          0.23222                0.23572           0.01917
2      0.01  0.01          0.15958                0.16099           0.65389
3      0.01  0.01          0.07425                0.07819           0.01657
```

```
4      0.01  0.01          0.19488                0.19595           0.00000
5      0.01  0.01          0.13120                0.13433           0.01152
6      0.01  0.01          0.11860                0.12004           0.06184

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.11355                        0.19216
1      0.15256                        0.22942
2      0.12704                        0.14181
3      0.05087                        0.06998
4      0.10992                        0.19472
5      0.10145                        0.13048
6      0.08086                        0.12044

Variance                          0.010000
Bias                              0.010000
Prior Model MAE                   0.159576
ABC pre-generator MAE             0.160987
Skip Node weight                  0.016569
ABC GAN MAE                       0.109923
ABC_GAN MAE (skip connection)     0.141806
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   0.03605          1.12789  0.07048  0.05416
1      1.00  0.10   0.03605          0.99885  0.08375  0.08981
2      1.00  0.01   0.03605          0.99729  0.07713  0.09370
3      0.10  1.00   0.03605          0.79639  0.07749  0.06772
4      0.10  0.10   0.03605          0.21265  0.07579  0.08006
5      0.10  0.01   0.03605          0.15207  0.09983  0.12781
6      0.01  1.00   0.03605          0.82910  0.06319  0.05984
7      0.01  0.10   0.03605          0.15994  0.07521  0.06309
8      0.01  0.01   0.03605          0.16099  0.10992  0.14181

   Skip Node weight
0           0.11900
1           0.08496
```

```
2           0.19704
3           0.18788
4           0.08516
5           0.19254
6           0.64891
7           0.15341
8           0.01657
```

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  \
0         1     1          0.23813                1.28106           0.80094
1         1     1          0.22102                1.14056           0.99307
2         1     1          0.27459                1.08816           0.98481
3         1     1          0.28813                1.31808           0.83078
4         1     1          0.34480                1.12133           0.91197
5         1     1          0.24110                1.03853           0.89858
6         1     1          0.33800                1.08370           0.85938
7         1     1          0.33133                1.30251           0.87432
8         1     1          0.27649                1.56975           0.86954
9         1     1          0.24126                1.44175           0.84671

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.05578                        0.03611
1      0.08598                        0.04595
2      0.07290                        0.05594
3      0.08666                        0.05056
4      0.10008                        0.06026
5      0.06163                        0.06707
6      0.10560                        0.07152
7      0.09254                        0.05680
8      0.08778                        0.05912
9      0.10785                        0.06424

Variance                          1.000000
Bias                              1.000000
Prior Model MAE                   0.275544
ABC pre-generator MAE             1.210808
Skip Node weight                  0.871929
ABC GAN MAE                       0.087218
ABC_GAN MAE (skip connection)     0.057961
dtype: float64
-----------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0       0.1     1          0.25161                1.00356           0.80055
1       0.1     1          0.23106                0.97778           0.94645
2       0.1     1          0.19174                0.85203           0.90555
3       0.1     1          0.32052                0.85877           0.84012
4       0.1     1          0.35152                1.15790           0.96313
5       0.1     1          0.26972                0.88087           0.89831
6       0.1     1          0.22885                1.01589           0.92057
7       0.1     1          0.24305                0.72427           0.97428
```

```
8       0.1     1          0.29900               0.72984           0.88633
9       0.1     1          0.25311               0.99157           0.83004

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.10176                        0.07265
1      0.08995                        0.06388
2      0.06332                        0.05827
3      0.09127                        0.05755
4      0.12788                        0.07187
5      0.15212                        0.04405
6      0.13595                        0.06548
7      0.05745                        0.04699
8      0.07252                        0.06855
9      0.07409                        0.06332

Variance                         0.100000
Bias                             1.000000
Prior Model MAE                  0.252361
ABC pre-generator MAE            0.929323
Skip Node weight                 0.901929
ABC GAN MAE                      0.090611
ABC_GAN MAE (skip connection)    0.063601
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0      0.01     1          0.32042                1.04047           0.81824
1      0.01     1          0.28806                0.95742           0.83305
2      0.01     1          0.29300                0.82354           0.83751
3      0.01     1          0.26589                0.70296           0.99301
4      0.01     1          0.34727                0.83058           0.94527
5      0.01     1          0.28665                0.94167           0.85447
6      0.01     1          0.19762                0.93788           0.85314
7      0.01     1          0.33222                0.96593           0.90723
8      0.01     1          0.31160                0.93358           0.90637
9      0.01     1          0.26259                1.09724           0.90015

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.15056                        0.05376
1      0.09888                        0.06393
2      0.09255                        0.05515
3      0.08804                        0.07910
4      0.11802                        0.11185
5      0.13636                        0.12575
6      0.08796                        0.05882
7      0.17413                        0.06964
8      0.04920                        0.04424
9      0.11388                        0.05591
```

```
Variance                          0.010000
Bias                              1.000000
Prior Model MAE                   0.290531
ABC pre-generator MAE             0.939773
Skip Node weight                  0.877308
ABC GAN MAE                       0.106381
ABC_GAN MAE (skip connection)     0.061378
dtype: float64
------------------------------------------------------------
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight	\
0	1	0.1	0.15848	1.02515	0.35960	
1	1	0.1	0.28747	1.03234	0.48291	
2	1	0.1	0.38027	0.95697	0.41503	
3	1	0.1	0.27555	1.03413	0.36314	
4	1	0.1	0.26304	0.94752	0.40510	
5	1	0.1	0.16404	1.03105	0.45740	
6	1	0.1	0.25512	0.88285	0.39486	
7	1	0.1	0.27934	0.84238	0.33649	
8	1	0.1	0.34714	0.94914	0.37754	
9	1	0.1	0.30716	0.93222	0.56371	

	ABC GAN MAE	ABC_GAN MAE (skip connection)
0	0.09791	0.05751
1	0.05833	0.05602
2	0.14355	0.03443
3	0.16415	0.03652
4	0.09546	0.06707
5	0.04868	0.04967
6	0.07134	0.04868
7	0.09671	0.09255
8	0.16875	0.05799
9	0.07879	0.04365

```
Variance                          1.000000
Bias                              0.100000
Prior Model MAE                   0.277444
ABC pre-generator MAE             0.953058
Skip Node weight                  0.399979
ABC GAN MAE                       0.096082
ABC_GAN MAE (skip connection)     0.052843
dtype: float64
------------------------------------------------------------
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight	\
0	0.1	0.1	0.37586	0.42114	0.21063	
1	0.1	0.1	0.39242	0.39813	0.27957	
2	0.1	0.1	0.26563	0.26669	0.22720	
3	0.1	0.1	0.22658	0.23648	0.24648	

```
4       0.1   0.1          0.25406                0.26922           0.25468
5       0.1   0.1          0.42598                0.44634           0.17733
6       0.1   0.1          0.31496                0.37584           0.22558
7       0.1   0.1          0.35132                0.39539           0.25233
8       0.1   0.1          0.32082                0.32711           0.23721
9       0.1   0.1          0.24014                0.31500           0.26480

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.05882                         0.06852
1      0.10479                         0.07413
2      0.13789                         0.05510
3      0.07450                         0.02703
4      0.06654                         0.02957
5      0.11375                         0.06301
6      0.13400                         0.07093
7      0.19819                         0.04794
8      0.11179                         0.04555
9      0.12667                         0.05867

Variance                         0.100000
Bias                             0.100000
Prior Model MAE                  0.317887
ABC pre-generator MAE            0.351473
Skip Node weight                 0.241844
ABC GAN MAE                      0.112774
ABC_GAN MAE (skip connection)    0.056883
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0      0.01   0.1          0.30467                0.28774           0.24639
1      0.01   0.1          0.22587                0.21911           0.21452
2      0.01   0.1          0.27178                0.30247           0.20897
3      0.01   0.1          0.30021                0.27567           0.22110
4      0.01   0.1          0.29109                0.30339           0.19463
5      0.01   0.1          0.20596                0.21351           0.14792
6      0.01   0.1          0.21403                0.24400           0.22088
7      0.01   0.1          0.20590                0.21720           0.14589
8      0.01   0.1          0.24217                0.30607           0.19146
9      0.01   0.1          0.22632                0.24834           0.25322

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.07274                         0.06261
1      0.09361                         0.04098
2      0.06501                         0.02836
3      0.05942                         0.05442
4      0.06220                         0.05267
5      0.14155                         0.02506
6      0.10826                         0.04503
```

```
7      0.18608                         0.04297
8      0.07680                         0.06166
9      0.08007                         0.04421

Variance                          0.010000
Bias                              0.100000
Prior Model MAE                   0.234245
ABC pre-generator MAE             0.262001
Skip Node weight                  0.211749
ABC GAN MAE                       0.078435
ABC_GAN MAE (skip connection)     0.044621
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0         1  0.01          0.36826                0.91115           0.28229
1         1  0.01          0.34647                1.16487           0.41372
2         1  0.01          0.43305                0.82060           0.30517
3         1  0.01          0.25925                1.12263           0.29223
4         1  0.01          0.26498                0.99650           0.35846
5         1  0.01          0.33890                1.12079           0.31348
6         1  0.01          0.40582                1.08497           0.29170
7         1  0.01          0.28917                0.97165           0.30808
8         1  0.01          0.27076                0.95222           0.35593
9         1  0.01          0.28392                0.99834           0.31930

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.07102                        0.12064
1      0.06715                        0.08955
2      0.09859                        0.06751
3      0.10683                        0.03557
4      0.06766                        0.04818
5      0.14320                        0.06844
6      0.11948                        0.04632
7      0.05702                        0.05320
8      0.10192                        0.04222
9      0.15118                        0.07821

Variance                          1.000000
Bias                              0.010000
Prior Model MAE                   0.314033
ABC pre-generator MAE             0.997419
Skip Node weight                  0.310780
ABC GAN MAE                       0.100257
ABC_GAN MAE (skip connection)     0.060356
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0       0.1  0.01          0.29040                0.30087           0.18846
```

```
1       0.1  0.01          0.20689                0.22834           0.12998
2       0.1  0.01          0.22965                0.27914           0.20615
3       0.1  0.01          0.26198                0.30295           0.30962
4       0.1  0.01          0.24439                0.26979           0.17537
5       0.1  0.01          0.30451                0.33510           0.21017
6       0.1  0.01          0.17371                0.17706           0.13925
7       0.1  0.01          0.27235                0.29969           0.14823
8       0.1  0.01          0.25453                0.26400           0.16646
9       0.1  0.01          0.25111                0.25722           0.10377

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.18791                      105.53128
1      0.09103                        0.05241
2      0.09268                        0.07924
3      0.12064                        0.11256
4      0.07644                        0.05179
5      0.11085                        0.05231
6      0.08194                        0.05806
7      0.08227                        0.07366
8      0.04820                        0.03724
9      0.13528                       43.47140

Variance                         0.100000
Bias                             0.010000
Prior Model MAE                  0.252820
ABC pre-generator MAE            0.274466
Skip Node weight                 0.170914
ABC GAN MAE                      0.091859
ABC_GAN MAE (skip connection)    0.065858
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0      0.01  0.01          0.27701                0.27601           0.15135
1      0.01  0.01          0.33105                0.33298           0.12219
2      0.01  0.01          0.25052                0.25091           0.20049
3      0.01  0.01          0.24286                0.24847           0.16389
4      0.01  0.01          0.26252                0.26526           0.29397
5      0.01  0.01          0.31213                0.31339           0.24219
6      0.01  0.01          0.20266                0.20573           0.17417
7      0.01  0.01          0.26714                0.26767           0.11562
8      0.01  0.01          0.38525                0.37973           0.15593
9      0.01  0.01          0.38200                0.38359           0.20646

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.21197                        0.09347
1      0.08594                        0.09629
2      0.14058                        0.05829
3      0.12005                        0.03961
```

```
4      0.10805                          0.10803
5      0.08427                          0.08858
6      0.10652                          0.05460
7      0.09334                          0.04925
8      0.10218                          0.10349
9      0.12734                          0.10027

Variance                          0.010000
Bias                              0.010000
Prior Model MAE                   0.272074
ABC pre-generator MAE             0.271841
Skip Node weight                  0.169029
ABC GAN MAE                       0.107284
ABC_GAN MAE (skip connection)     0.091025
dtype: float64
------------------------------------------------------------
```

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

```
   Variance  Bias    Stats  Prior Model MAE     mGAN  skipGAN  \
0      1.00  1.00  0.26665          1.21081  0.08722  0.05796
1      0.10  1.00  0.26665          0.92932  0.09061  0.06360
2      0.01  1.00  0.26665          0.93977  0.10638  0.06138
3      1.00  0.10  0.26665          0.95306  0.09608  0.05284
4      0.10  0.10  0.26665          0.35147  0.11277  0.05688
5      0.01  0.10  0.26665          0.26200  0.07843  0.04462
6      1.00  0.01  0.26665          0.99742  0.10026  0.06036
7      0.10  0.01  0.26665          0.27447  0.09186  0.06586
8      0.01  0.01  0.26665          0.27184  0.10728  0.09103

   Skip Node weight
0           0.87193
1           0.90193
2           0.87731
3           0.39998
4           0.24184
5           0.21175
6           0.31078
7           0.17091
8           0.16903
```