Analysis_Out

June 7, 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 0x7fa33156e5b0>
```

```
MEDIAN:
MSE                    0.260455
MAE                    0.397598
Euclidean Distance     2.281899
Manhattan Distance     7.951955
dtype: float64
0.39759777315794487
```

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	0.25488	1.49921	0.95528	
1	1	1	0.30303	1.23703	0.13252	
2	1	1	0.32939	1.49900	0.18995	
3	1	1	0.26696	1.05593	0.66127	
4	1	1	0.25153	1.32671	0.69720	
5	1	1	0.39848	1.06172	0.26413	
6	1	1	0.19024	0.93333	0.12514	
7	1	1	0.39589	1.21225	0.81255	
8	1	1	0.33849	1.19663	0.31259	
9	1	1	0.21904	1.07515	0.15995	

	ABC GAN MAE	ABC_GAN MAE (skip connection)
0	0.21571	0.18767
1	0.17906	0.22285
2	0.14985	0.14433
3	0.13549	0.12794
4	0.12118	0.10116
5	0.26807	0.19571
6	0.16389	0.11737
7	0.21778	0.26979
8	0.18623	0.17056
9	0.16206	0.16269

```
Variance                    1.000000
Bias                        1.000000
Prior Model MAE             0.284993
ABC pre-generator MAE       1.204442
Skip Node weight            0.288360
ABC GAN MAE                 0.171475
```

```
ABC_GAN MAE (skip connection)    0.166622
dtype: float64
------------------------------------------------------------
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight	\
0	1	0.1	0.34962	1.06319	0.06947	
1	1	0.1	0.20779	1.10523	0.06974	
2	1	0.1	0.22064	1.07093	0.07774	
3	1	0.1	0.29095	0.91358	0.08387	
4	1	0.1	0.30788	1.19335	0.08859	
5	1	0.1	0.33834	0.77644	0.07377	
6	1	0.1	0.23483	1.18687	0.09288	
7	1	0.1	0.26212	1.06847	0.08978	
8	1	0.1	0.35787	1.00405	0.65171	
9	1	0.1	0.22332	1.06554	0.08582	

	ABC GAN MAE	ABC_GAN MAE (skip connection)
0	0.28026	0.32690
1	0.17621	0.17678
2	0.16407	0.18702
3	0.20713	0.27912
4	0.14791	0.23631
5	0.26967	0.34508
6	0.19782	0.23874
7	0.17050	0.19537
8	0.32623	0.31562
9	0.18724	0.17234

```
Variance                         1.000000
Bias                             0.100000
Prior Model MAE                  0.276538
ABC pre-generator MAE            1.067004
Skip Node weight                 0.084845
ABC GAN MAE                      0.192530
ABC_GAN MAE (skip connection)    0.237528
dtype: float64
------------------------------------------------------------
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight	\
0	1	0.01	0.32709	0.84864	0.81082	
1	1	0.01	0.45891	0.81567	0.67028	
2	1	0.01	0.24339	1.07164	0.08196	
3	1	0.01	0.25167	1.04811	0.07212	
4	1	0.01	0.46408	1.19326	0.06925	
5	1	0.01	0.32229	0.87658	0.06997	
6	1	0.01	0.35534	0.89418	0.74588	
7	1	0.01	0.23237	0.94366	0.06718	
8	1	0.01	0.33493	1.05017	0.44877	
9	1	0.01	0.34453	0.94762	0.07980	

```
   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.26376                        0.27723
1      0.36142                        0.38088
2      0.26659                        0.24940
3      0.22743                        0.23872
4      0.31908                        0.43010
5      0.31505                        0.30484
6      0.33931                        0.29882
7      0.24522                        0.21321
8      0.31242                        0.30958
9      0.27204                        0.33684

Variance                          1.000000
Bias                              0.010000
Prior Model MAE                   0.331007
ABC pre-generator MAE             0.945640
Skip Node weight                  0.080881
ABC GAN MAE                       0.292230
ABC_GAN MAE (skip connection)     0.301830
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0       0.1     1          0.30583                0.73519           0.17644
1       0.1     1          0.27212                0.78010           0.19014
2       0.1     1          0.20225                0.72173           0.41891
3       0.1     1          0.34330                0.79103           0.21044
4       0.1     1          0.21382                0.90004           0.69699
5       0.1     1          0.20988                0.63613           0.20837
6       0.1     1          0.16672                0.96422           0.17158
7       0.1     1          0.36595                0.84181           0.86494
8       0.1     1          0.30555                0.71677           0.26424
9       0.1     1          0.29075                0.60757           0.31843

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.12587                        0.14965
1      0.15453                        0.15384
2      0.19667                        0.13280
3      0.15116                        0.14571
4      0.11896                        0.13966
5      0.10429                        0.09811
6      0.17491                        0.12633
7      0.30442                        0.23872
8      0.28843                        0.19210
9      0.18428                        0.18667

Variance                          0.100000
Bias                              1.000000
```

```
Prior Model MAE                  0.281432
ABC pre-generator MAE            0.757646
Skip Node weight                 0.237340
ABC GAN MAE                      0.164720
ABC_GAN MAE (skip connection)    0.147678
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0       0.1   0.1          0.30033                0.30693           0.82769
1       0.1   0.1          0.28352                0.34879           0.06638
2       0.1   0.1          0.28581                0.34889           0.13059
3       0.1   0.1          0.35062                0.38963           0.52639
4       0.1   0.1          0.32160                0.35772           0.02737
5       0.1   0.1          0.29010                0.33407           0.14762
6       0.1   0.1          0.26542                0.27923           0.07193
7       0.1   0.1          0.35231                0.33258           0.27975
8       0.1   0.1          0.30285                0.30428           0.88610
9       0.1   0.1          0.32589                0.36726           0.06777

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.17576                        0.22517
1      0.25179                        0.24987
2      0.24330                        0.24953
3      0.25762                        0.29035
4      0.28633                        0.32859
5      0.27382                        0.24741
6      0.18933                        0.22302
7      0.30718                        0.32245
8      0.25173                        0.27100
9      0.25271                        0.22530

Variance                         0.100000
Bias                             0.100000
Prior Model MAE                  0.301590
ABC pre-generator MAE            0.341429
Skip Node weight                 0.139103
ABC GAN MAE                      0.252251
ABC_GAN MAE (skip connection)    0.249700
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0       0.1  0.01          0.27113                0.29163           0.03334
1       0.1  0.01          0.27028                0.30080           0.54650
2       0.1  0.01          0.39136                0.36435           0.10904
3       0.1  0.01          0.26889                0.27521           0.38289
4       0.1  0.01          0.42404                0.41150           0.04013
5       0.1  0.01          0.38682                0.39866           0.04464
```

```
6       0.1  0.01          0.31028                0.33999           0.03516
7       0.1  0.01          0.21600                0.18817           0.01052
8       0.1  0.01          0.31308                0.33149           0.03930
9       0.1  0.01          0.39589                0.40927           0.06060

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.26179                        0.25470
1      0.24027                        0.25245
2      0.33021                        0.39388
3      0.23602                        0.25760
4      0.38447                        0.42894
5      0.33663                        0.38792
6      0.27157                        0.30754
7      0.23328                        0.22171
8      0.25605                        0.31345
9      0.35726                        0.37761

Variance                          0.100000
Bias                              0.010000
Prior Model MAE                   0.311683
ABC pre-generator MAE             0.335738
Skip Node weight                  0.042385
ABC GAN MAE                       0.266681
ABC_GAN MAE (skip connection)     0.310494
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0      0.01     1          0.31032                1.23998           0.33327
1      0.01     1          0.31521                0.73341           0.73756
2      0.01     1          0.31075                0.93774           0.88152
3      0.01     1          0.33239                0.90961           0.15604
4      0.01     1          0.46388                0.79567           0.80075
5      0.01     1          0.32721                0.66437           0.54174
6      0.01     1          0.37812                0.91362           0.17621
7      0.01     1          0.23758                0.92551           0.13761
8      0.01     1          0.34483                0.78379           0.12109
9      0.01     1          0.31612                0.99569           0.91618

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.23986                        0.25019
1      0.20473                        0.20848
2      0.28549                        0.25515
3      0.17479                        0.14806
4      0.19697                        0.20676
5      0.17159                        0.16690
6      0.22880                        0.18498
7      0.19827                        0.14657
8      0.13425                        0.15149
```

```
9      0.19273                         0.13680
```

```
Variance                          0.010000
Bias                              1.000000
Prior Model MAE                   0.321665
ABC pre-generator MAE             0.911615
Skip Node weight                  0.437501
ABC GAN MAE                       0.197620
ABC_GAN MAE (skip connection)     0.175940
dtype: float64
```

```
   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0      0.01   0.1          0.21135                0.21393           0.46296
1      0.01   0.1          0.28823                0.32711           0.65999
2      0.01   0.1          0.27976                0.27476           0.54417
3      0.01   0.1          0.37887                0.38198           0.72997
4      0.01   0.1          0.22537                0.26056           0.11845
5      0.01   0.1          0.29931                0.26039           0.00000
6      0.01   0.1          0.30083                0.32650           0.07792
7      0.01   0.1          0.23985                0.27859           0.11046
8      0.01   0.1          0.33576                0.33190           0.32616
9      0.01   0.1          0.41337                0.42808           0.09309

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.18024                         0.19220
1      0.23833                         0.28216
2      0.29839                         0.21989
3      0.24460                         0.22998
4      0.15408                         0.14684
5      0.26314                         0.31082
6      0.20896                         0.28244
7      0.20689                         0.18685
8      0.25361                         0.23232
9      0.27727                         0.26049
```

```
Variance                          0.010000
Bias                              0.100000
Prior Model MAE                   0.293772
ABC pre-generator MAE             0.302548
Skip Node weight                  0.222309
ABC GAN MAE                       0.241464
ABC_GAN MAE (skip connection)     0.231152
dtype: float64
```

```
   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0      0.01  0.01          0.32289                0.32798           0.01287
1      0.01  0.01          0.21906                0.22080           0.45020
2      0.01  0.01          0.26112                0.26000           0.02386
```

```
3      0.01  0.01          0.28543                0.29436           0.00286
4      0.01  0.01          0.30150                0.30522           0.00000
5      0.01  0.01          0.38629                0.38339           0.69761
6      0.01  0.01          0.27426                0.27511           0.55820
7      0.01  0.01          0.35229                0.34816           0.53971
8      0.01  0.01          0.25156                0.25473           0.03043
9      0.01  0.01          0.31986                0.31906           0.02385

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.30408                        0.32136
1      0.20488                        0.21939
2      0.19111                        0.25670
3      0.25346                        0.28806
4      0.28736                        0.30219
5      0.34961                        0.36539
6      0.26998                        0.26230
7      0.33829                        0.33017
8      0.23111                        0.24712
9      0.35149                        0.32421

Variance                          0.010000
Bias                              0.010000
Prior Model MAE                   0.293463
ABC pre-generator MAE             0.299790
Skip Node weight                  0.027141
ABC GAN MAE                       0.278670
ABC_GAN MAE (skip connection)     0.295124
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   0.15019          1.20444  0.17147  0.16662
1      1.00  0.10   0.15019          1.06700  0.19253  0.23753
2      1.00  0.01   0.15019          0.94564  0.29223  0.30183
3      0.10  1.00   0.15019          0.75765  0.16472  0.14768
4      0.10  0.10   0.15019          0.34143  0.25225  0.24970
5      0.10  0.01   0.15019          0.33574  0.26668  0.31049
```

```
6      0.01  1.00   0.15019          0.91162  0.19762  0.17594
7      0.01  0.10   0.15019          0.30255  0.24146  0.23115
8      0.01  0.01   0.15019          0.29979  0.27867  0.29512
```

```
   Skip Node weight
0           0.28836
1           0.08485
2           0.08088
3           0.23734
4           0.13910
5           0.04239
6           0.43750
7           0.22231
8           0.02714
```

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	0.40908	1.10139	0.85934	
1	1	1	0.41042	1.32019	0.99024	
2	1	1	0.34189	1.38493	0.99243	
3	1	1	0.34599	1.28583	0.88857	
4	1	1	0.40760	1.46145	0.98863	
5	1	1	0.26292	1.16470	0.91238	
6	1	1	0.41536	1.17383	0.90924	
7	1	1	0.46712	1.32771	0.97800	
8	1	1	0.40423	1.32115	0.98528	
9	1	1	0.40066	1.14204	1.00000	

	ABC GAN MAE	ABC_GAN MAE (skip connection)
0	0.20651	0.16391
1	0.27560	0.22850
2	0.28316	0.17152
3	0.29835	0.15427
4	0.31588	0.23272
5	0.26853	0.18664
6	0.33878	0.15214
7	0.48451	0.22742
8	0.30436	0.26602
9	0.25613	0.17187

```
Variance                        1.000000
Bias                            1.000000
Prior Model MAE                 0.405913
ABC pre-generator MAE           1.303008
Skip Node weight                0.981644
ABC GAN MAE                     0.290755
ABC_GAN MAE (skip connection)   0.179254
dtype: float64
------------------------------------------------------------
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight	\
0	0.1	1	0.52136	0.81170	0.93736	

```
1       0.1     1          0.42667               0.88454           0.88077
2       0.1     1          0.40904               0.83525           0.94681
3       0.1     1          0.49473               1.10486           0.88486
4       0.1     1          0.35824               0.81270           0.97526
5       0.1     1          0.39750               1.12945           0.98278
6       0.1     1          0.31279               1.09576           0.99090
7       0.1     1          0.39661               0.83775           1.00000
8       0.1     1          0.49191               1.02374           0.89998
9       0.1     1          0.46810               0.72521           0.99496

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.29945                        0.19836
1      0.26522                        0.20568
2      0.40484                        0.20381
3      0.23727                        0.19190
4      0.21981                        0.15826
5      0.24304                        0.20855
6      0.23434                        0.23928
7      0.22590                        0.19992
8      0.32193                        0.22931
9      0.25526                        0.16161

Variance                        0.100000
Bias                            1.000000
Prior Model MAE                 0.417857
ABC pre-generator MAE           0.861147
Skip Node weight                0.961035
ABC GAN MAE                     0.249152
ABC_GAN MAE (skip connection)   0.201866
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0      0.01     1          0.34208                1.06281           0.96790
1      0.01     1          0.34047                0.82213           0.98897
2      0.01     1          0.33042                1.05162           0.91036
3      0.01     1          0.30579                0.91307           0.99857
4      0.01     1          0.38413                0.92709           0.96132
5      0.01     1          0.52283                1.05918           0.99273
6      0.01     1          0.43137                0.95676           0.90589
7      0.01     1          0.46726                0.76921           0.99332
8      0.01     1          0.31540                0.71590           0.99084
9      0.01     1          0.48232                0.82943           0.96845

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.19264                        0.16789
1      0.29801                        0.23198
2      0.21778                        0.10698
3      0.16342                        0.21422
```

```
4      0.27958                          0.20624
5      0.25753                          0.27060
6      0.31383                          0.16247
7      0.28664                          0.33421
8      0.18193                          0.12482
9      0.23853                          0.22870

Variance                          0.010000
Bias                              1.000000
Prior Model MAE                   0.363103
ABC pre-generator MAE             0.920077
Skip Node weight                  0.978710
ABC GAN MAE                       0.248027
ABC_GAN MAE (skip connection)     0.210228
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0         1   0.1          0.41851                1.01245           0.35368
1         1   0.1          0.48086                0.95670           0.51525
2         1   0.1          0.30167                0.96823           0.35935
3         1   0.1          0.43685                0.78992           0.32479
4         1   0.1          0.31179                1.00748           0.49948
5         1   0.1          0.33188                0.84119           0.38857
6         1   0.1          0.39450                0.90665           0.61461
7         1   0.1          0.41520                0.98818           0.37720
8         1   0.1          0.51948                1.04058           0.35903
9         1   0.1          0.44897                0.94149           0.50185

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.42575                         0.16567
1      0.37939                         0.31790
2      0.25954                         0.11411
3      0.30088                         0.15081
4      0.21589                         0.17043
5      0.14090                         0.14349
6      0.29032                         0.21962
7      0.27953                         0.18203
8      0.39642                         0.21998
9      0.45190                         0.34947

Variance                          1.000000
Bias                              0.100000
Prior Model MAE                   0.416853
ABC pre-generator MAE             0.962467
Skip Node weight                  0.382882
ABC GAN MAE                       0.295597
ABC_GAN MAE (skip connection)     0.176232
dtype: float64
```

```
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0       0.1   0.1          0.43423                0.45724           0.15629
1       0.1   0.1          0.50253                0.46381           0.24143
2       0.1   0.1          0.51497                0.53788           0.18495
3       0.1   0.1          0.47118                0.43746           0.00000
4       0.1   0.1          0.36451                0.35276           0.09599
5       0.1   0.1          0.27936                0.29534           0.11499
6       0.1   0.1          0.32146                0.37104           0.29069
7       0.1   0.1          0.24287                0.29760           0.13815
8       0.1   0.1          0.43877                0.41488           0.15837
9       0.1   0.1          0.28585                0.30276           0.27808

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.30113                        0.22782
1      0.29863                        0.24915
2      0.29364                        0.20181
3      0.37236                        0.48143
4      0.29239                        0.25563
5      0.23424                        0.14706
6      0.18260                        0.18074
7      0.22370                      218.79657
8      0.31888                      513.07599
9      0.25451                        0.16765

Variance                        0.100000
Bias                            0.100000
Prior Model MAE                 0.399370
ABC pre-generator MAE           0.392960
Skip Node weight                0.157326
ABC GAN MAE                     0.293015
ABC_GAN MAE (skip connection)   0.238486
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0      0.01   0.1          0.36735                0.36667           0.19494
1      0.01   0.1          0.37911                0.39458           0.22404
2      0.01   0.1          0.43064                0.42726           0.16373
3      0.01   0.1          0.49663                0.54428           0.19106
4      0.01   0.1          0.43983                0.42607           0.18299
5      0.01   0.1          0.43317                0.41482           0.21746
6      0.01   0.1          0.46812                0.45703           0.16406
7      0.01   0.1          0.44445                0.46915           0.11033
8      0.01   0.1          0.35391                0.37790           0.23042
9      0.01   0.1          0.50761                0.51222           0.19713

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

```
0      0.23420                        0.12064
1      0.44180                        0.33420
2      0.29303                        0.18955
3      0.28195                        0.13315
4      0.32287                        0.14806
5      0.21996                        0.12568
6      0.35202                     3616.72852
7      0.22980                      194.26148
8      0.32378                        0.14427
9      0.29584                        0.20807

Variance                         0.010000
Bias                             0.100000
Prior Model MAE                  0.436503
ABC pre-generator MAE            0.426667
Skip Node weight                 0.193001
ABC GAN MAE                      0.294432
ABC_GAN MAE (skip connection)    0.168803
dtype: float64
------------------------------------------------------------

   Variance  Bias  Prior Model MAE  ABC pre-generator MAE  Skip Node weight  \
0         1  0.01          0.38594                0.91551           0.31936
1         1  0.01          0.40179                0.97093           0.32509
2         1  0.01          0.34979                1.04081           0.32387
3         1  0.01          0.36355                0.94634           0.31516
4         1  0.01          0.40848                0.74974           0.31455
5         1  0.01          0.41688                0.94606           0.26291
6         1  0.01          0.33452                0.98946           0.32876
7         1  0.01          0.42811                1.06129           0.45677
8         1  0.01          0.31316                1.00148           0.28414
9         1  0.01          0.20127                0.99918           0.27269

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.29981                        0.23299
1      0.32281                        0.25213
2      0.27013                        0.21707
3      0.23940                        0.23337
4      0.28690                        0.28454
5      0.28772                        0.16874
6      0.32990                        0.21805
7      0.27334                        0.27846
8      0.31166                        0.24690
9      0.27704                        0.15225

Variance                         1.000000
Bias                             0.010000
Prior Model MAE                  0.374747
ABC pre-generator MAE            0.980198
```

```
Skip Node weight                 0.317261
ABC GAN MAE                      0.287311
ABC_GAN MAE (skip connection)    0.233179
dtype: float64
------------------------------------------------------------
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight	\
0	0.1	0.01	0.49230	0.51399	0.12942	
1	0.1	0.01	0.29982	0.31046	0.27293	
2	0.1	0.01	0.41310	0.40431	0.07710	
3	0.1	0.01	0.28925	0.32271	0.16547	
4	0.1	0.01	0.45239	0.40022	0.20453	
5	0.1	0.01	0.35190	0.35466	0.09987	
6	0.1	0.01	0.37064	0.38155	0.13743	
7	0.1	0.01	0.29918	0.31110	0.07976	
8	0.1	0.01	0.35718	0.34842	0.09866	
9	0.1	0.01	0.45058	0.45452	0.10034	

	ABC GAN MAE	ABC_GAN MAE (skip connection)
0	0.38151	28.27809
1	0.29066	62.90161
2	0.30654	226.53303
3	0.23204	0.24526
4	0.33694	64.43114
5	0.23345	0.23204
6	0.48735	0.32087
7	0.37793	19.46445
8	0.20500	33.84229
9	0.27653	0.18642

```
Variance                         0.100000
Bias                             0.010000
Prior Model MAE                  0.363909
ABC pre-generator MAE            0.368106
Skip Node weight                 0.114881
ABC GAN MAE                      0.298600
ABC_GAN MAE (skip connection)    23.871272
dtype: float64
------------------------------------------------------------
```

	Variance	Bias	Prior Model MAE	ABC pre-generator MAE	Skip Node weight	\
0	0.01	0.01	0.45341	0.45326	0.14017	
1	0.01	0.01	0.34609	0.34193	0.10421	
2	0.01	0.01	0.40232	0.39803	0.18738	
3	0.01	0.01	0.32400	0.32628	0.14579	
4	0.01	0.01	0.36699	0.36494	0.16711	
5	0.01	0.01	0.39431	0.39236	0.22245	
6	0.01	0.01	0.44717	0.44629	0.11131	
7	0.01	0.01	0.34248	0.34579	0.09757	

```
8      0.01  0.01          0.47569                0.47295           0.15139
9      0.01  0.01          0.46516                0.46412           0.13947

   ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.35608                        0.23465
1      0.22331                        0.20010
2      0.42377                        0.36342
3      0.34244                      105.98985
4      0.20662                        0.28224
5      0.40595                        0.22446
6      0.37020                        0.28247
7      0.38565                       10.01225
8      0.31280                      645.21505
9      0.37827                        0.38524

Variance                         0.010000
Bias                             0.010000
Prior Model MAE                  0.398316
ABC pre-generator MAE            0.395198
Skip Node weight                 0.142977
ABC GAN MAE                      0.363143
ABC_GAN MAE (skip connection)    0.322945
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  0.37376          1.30301  0.29076   0.17925
1      0.10  1.00  0.37376          0.86115  0.24915   0.20187
2      0.01  1.00  0.37376          0.92008  0.24803   0.21023
3      1.00  0.10  0.37376          0.96247  0.29560   0.17623
4      0.10  0.10  0.37376          0.39296  0.29301   0.23849
5      0.01  0.10  0.37376          0.42667  0.29443   0.16880
6      1.00  0.01  0.37376          0.98020  0.28731   0.23318
7      0.10  0.01  0.37376          0.36811  0.29860  23.87127
8      0.01  0.01  0.37376          0.39520  0.36314   0.32295

   Skip Node weight
0           0.98164
```

1	0.96103
2	0.97871
3	0.38288
4	0.15733
5	0.19300
6	0.31726
7	0.11488
8	0.14298