

# Friedman3

July 27, 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.scrap['Stats Model MAE'].data,nb.scrap['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.scrap['GAN_1 Metrics'].data
    for i in range(1000):
        gan_mse.append(metrics[0][i])
    nbList = [nb.scrap['GAN Model MSE'].data,
              nb.scrap['GAN Model MAE'].data,
              nb.scrap['GAN Model Euclidean distance'].data,
              nb.scrap['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.scrap['ABC_GAN_1 Metrics'].data)
    metrics3 = np.array(nb.scrap['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.scrap['Skip Connection Weight'].data)
prior_model[i].append(nb.scrap['Prior Model MSE'].data)
abc_pre_generator[i].append(nb.scrap['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  \
0           1   0.1           0.33982           0.99085           0.73196
1           1   0.1           0.36078           0.96710           0.42287
2           1   0.1           0.35341           1.20779           0.08241
3           1   0.1           0.29915           1.06911           0.08746
4           1   0.1           0.53808           1.13153           0.15200
5           1   0.1           0.52993           1.21257           0.52067
6           1   0.1           0.23190           0.91021           0.72811
7           1   0.1           0.46407           0.79147           0.06695
8           1   0.1           0.40931           0.97473           0.08642
9           1   0.1           0.25540           0.86825           0.07913

```

```

      ABC GAN MAE  ABC_GAN MAE (skip connection)
0         0.35385                0.31337
1         0.39859                0.37761
2         0.36900                0.36547
3         0.30682                0.30456
4         0.58616                0.53587
5         0.50569                0.48261
6         0.23282                0.22546
7         0.42181                0.47998
8         0.37943                0.39480
9         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  \
0      0.1    0.1      0.48521          0.49516          0.42236
1      0.1    0.1      0.42198          0.44762          0.17766
2      0.1    0.1      0.37103          0.40611          0.11748
3      0.1    0.1      0.28395          0.34739          0.46384
4      0.1    0.1      0.31840          0.31547          0.15693
5      0.1    0.1      0.25629          0.25924          0.11373
6      0.1    0.1      0.31856          0.32447          0.12191
7      0.1    0.1      0.43340          0.51264          0.07154
8      0.1    0.1      0.18438          0.18535          0.10086
9      0.1    0.1      0.44524          0.46988          0.14702

```

```

      ABC GAN MAE  ABC_GAN MAE (skip connection)
0      0.47018          0.49758
1      0.42187          0.43543
2      0.39183          0.35301
3      0.33538          0.30777
4      0.35089          0.31495
5      0.26756          0.26324
6      0.30586          0.28880
7      0.43847          0.46338
8      0.19990          0.20868
9      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.scrapes['ABC_GAN_1 Metrics'].data)
    metrics3 = np.array(nb.scrapes['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.scrapes['Skip Connection Weight'].data)
            prior_model[i].append(nb.scrapes['Prior Model MSE'].data)
            abc_pre_generator[i].append(nb.scrapes['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	0.45321	1.37373	0.98985
1	1	1	0.46372	1.50672	0.97564
2	1	1	0.58514	1.16563	0.99841
3	1	1	0.52032	1.42406	1.00000
4	1	1	0.66686	1.11099	0.99498
5	1	1	0.59179	1.56344	0.99157
6	1	1	0.49935	1.69111	1.00000
7	1	1	0.44243	1.40947	0.98950
8	1	1	0.49656	1.25013	1.00000
9	1	1	0.55986	1.11980	0.99020

	ABC GAN MAE	ABC_GAN MAE (skip connection)
0	0.46898	0.40212
1	0.40372	0.29641
2	0.44245	0.42443
3	0.68059	0.77544
4	0.51811	0.51083
5	0.97788	0.71474
6	0.46297	0.32696
7	0.34726	0.28979
8	0.61839	0.49452
9	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
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

---

	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