

```
In [1]: import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.preprocessing import MinMaxScaler
```

```
In [8]: df = pd.read_csv("C:/Users/Shay/Documents/Data analysis/ADC+0W_Average.csv")
```

```
In [9]: df.head()
```

	Peak Current Ratio	Number Of Adjacent Track Writes	ADC_Gain (%)	OW_Gain (dB)
0	PR0	0	-1.146400	1.011295
1	PR0	1	-1.127296	1.073638
2	PR0	5	-1.263854	1.128437
3	PR0	10	-1.213642	1.111798
4	PR0	20	-1.163398	1.133339

```
In [10]: df.dropna(how = "all")
```

	Peak Current Ratio	Number Of Adjacent Track Writes	ADC_Gain (%)	OW_Gain (dB)
0	PR0	0	-1.146400	1.011295
1	PR0	1	-1.127296	1.073638
2	PR0	5	-1.263854	1.128437
3	PR0	10	-1.213642	1.111798
4	PR0	20	-1.163398	1.133339
5	PR0	30	-1.332139	1.175964
6	PR1	0	-0.751993	0.873155
7	PR1	1	-0.574667	0.921585
8	PR1	5	-0.498499	0.903431
9	PR1	10	-0.510305	0.905759
10	PR1	20	-0.452050	0.905491
11	PR1	30	-0.578669	0.898996
12	PR2	0	-0.380356	0.659004
13	PR2	1	-0.191251	0.627746
14	PR2	5	-0.095429	0.622127
15	PR2	10	-0.037918	0.621638
16	PR2	20	-0.010030	0.572308
17	PR2	30	-0.023370	0.538929
18	PR3	0	-0.136229	0.339621
19	PR3	1	0.022276	0.316250
20	PR3	5	0.106429	0.251786
21	PR3	10	0.295077	0.171259
22	PR3	20	0.275252	0.131786
23	PR3	30	0.285489	0.115114

	Peak Current Ratio	Number Of Adjacent Track Writes	ADC_Gain (%)	OW_Gain (dB)
24	PR4	0	-0.012518	-0.041473
25	PR4	1	0.188954	-0.065000
26	PR4	5	0.304231	-0.208036
27	PR4	10	0.388367	-0.310937
28	PR4	20	0.416180	-0.398125
29	PR4	30	0.443613	-0.489442
30	PR5	0	0.165712	-0.460380
31	PR5	1	0.229913	-0.549353
32	PR5	5	0.345233	-0.722232
33	PR5	10	0.407355	-0.818147
34	PR5	20	0.434932	-0.933705
35	PR5	30	0.454442	-1.010201
36	PR6	0	0.237023	-0.963233
37	PR6	1	0.127881	-1.054196
38	PR6	5	0.349179	-1.272031
39	PR6	10	0.416095	-1.359420
40	PR6	20	0.429368	-1.533839
41	PR6	30	0.438749	-1.642679
42	PR7	0	0.162195	-1.435599
43	PR7	1	0.163914	-1.550536
44	PR7	5	0.257701	-1.810246
45	PR7	10	0.325696	-1.960603
46	PR7	20	0.321473	-2.112188
47	PR7	30	0.383129	-2.291141
48	PRD	0	0.000000	0.000000
49	PRD	1	0.372589	-0.131893
50	PRD	5	0.482410	-0.260335
51	PRD	10	0.542072	-0.395360
52	PRD	20	0.579149	-0.467212
53	PRD	30	0.475020	-0.546094

```
In [11]: Scaler = MinMaxScaler()
```

```
In [12]: norm_array = Scaler.fit_transform(df[['ADC_Gain (%)', 'OW_Gain (dB)']])
```

```
In [13]: norm_df = pd.DataFrame(norm_array)
```

```
In [14]: norm_df.head()
```

Out[14]:

	0	1
0	0.097180	0.952505

01

1	0.107175	0.970487
2	0.035727	0.986292
3	0.061998	0.981493
4	0.088287	0.987706

```
In [39]: norm_df.to_csv('C:/Users/Shay/Documents/Data Analysis/norm_df.csv', index=False)
```

```
In [42]: norm
```

Out[42]:

	Norm_ADC_Gain	Norm_OW_Gain
0	0.097180	0.952505
1	0.107175	0.970487
2	0.035727	0.986292
3	0.061998	0.981493
4	0.088287	0.987706
5	0.000000	1.000000
6	0.303537	0.912662
7	0.396315	0.926631
8	0.436167	0.921395
9	0.429990	0.922066
10	0.460469	0.921989
11	0.394221	0.920115
12	0.497980	0.850896
13	0.596921	0.841880
14	0.647056	0.840260
15	0.677146	0.840118
16	0.691737	0.825890
17	0.684758	0.816263
18	0.625709	0.758778
19	0.708640	0.752037
20	0.752669	0.733444
21	0.851372	0.710218
22	0.840999	0.698833
23	0.846355	0.694024
24	0.690436	0.648861
25	0.795847	0.642075
26	0.856161	0.600820
27	0.900182	0.571140
28	0.914734	0.545993
29	0.929087	0.519655

	Norm_ADC_Gain	Norm_OW_Gain
30	0.783687	0.528037
31	0.817278	0.502375
32	0.877614	0.452513
33	0.910116	0.424848
34	0.924545	0.391518
35	0.934753	0.369455
36	0.820997	0.383002
37	0.763894	0.356766
38	0.879678	0.293937
39	0.914689	0.268732
40	0.921633	0.218425
41	0.926542	0.187033
42	0.781847	0.246760
43	0.782746	0.213609
44	0.831816	0.138702
45	0.867392	0.095335
46	0.865182	0.051615
47	0.897441	0.000000
48	0.696985	0.660822
49	0.891926	0.622781
50	0.949386	0.585735
51	0.980601	0.546791
52	1.000000	0.526067
53	0.945519	0.503315

Calculating the geometrical mean of Norm_ADC_Gain and Norm_OW_Gain

In [48]:

```

norm['CD'] = (norm['Norm_ADC_Gain'] * norm['Norm_OW_Gain'])**.5
norm

```

Out[48]:

	Norm_ADC_Gain	Norm_OW_Gain	CD
0	0.097180	0.952505	0.304244
1	0.107175	0.970487	0.322509
2	0.035727	0.986292	0.187716
3	0.061998	0.981493	0.246680
4	0.088287	0.987706	0.295299
5	0.000000	1.000000	0.000000
6	0.303537	0.912662	0.526333
7	0.396315	0.926631	0.606001
8	0.436167	0.921395	0.633941
9	0.429990	0.922066	0.629666

	Norm_ADC_Gain	Norm_OW_Gain	CD
10	0.460469	0.921989	0.651573
11	0.394221	0.920115	0.602270
12	0.497980	0.850896	0.650945
13	0.596921	0.841880	0.708898
14	0.647056	0.840260	0.737357
15	0.677146	0.840118	0.754243
16	0.691737	0.825890	0.755843
17	0.684758	0.816263	0.747625
18	0.625709	0.758778	0.689039
19	0.708640	0.752037	0.730016
20	0.752669	0.733444	0.742994
21	0.851372	0.710218	0.777599
22	0.840999	0.698833	0.766628
23	0.846355	0.694024	0.766414
24	0.690436	0.648861	0.669325
25	0.795847	0.642075	0.714838
26	0.856161	0.600820	0.717216
27	0.900182	0.571140	0.717029
28	0.914734	0.545993	0.706710
29	0.929087	0.519655	0.694841
30	0.783687	0.528037	0.643285
31	0.817278	0.502375	0.640765
32	0.877614	0.452513	0.630184
33	0.910116	0.424848	0.621821
34	0.924545	0.391518	0.601645
35	0.934753	0.369455	0.587664
36	0.820997	0.383002	0.560753
37	0.763894	0.356766	0.522045
38	0.879678	0.293937	0.508498
39	0.914689	0.268732	0.495788
40	0.921633	0.218425	0.448673
41	0.926542	0.187033	0.416286
42	0.781847	0.246760	0.439236
43	0.782746	0.213609	0.408903
44	0.831816	0.138702	0.339669
45	0.867392	0.095335	0.287564
46	0.865182	0.051615	0.211320
47	0.897441	0.000000	0.000000
48	0.696985	0.660822	0.678663

	Norm_ADC_Gain	Norm_OW_Gain	CD
49	0.891926	0.622781	0.745302
50	0.949386	0.585735	0.745714
51	0.980601	0.546791	0.732246
52	1.000000	0.526067	0.725305
53	0.945519	0.503315	0.689851

In [50]:

norm.to_csv('C:/Users/Shay/Documents/Data Analysis/norm.csv', index=False)

In [70]:

df

Out[70]:

	Peak Current Ratio	Number Of Adjacent Track Writes	ADC_Gain (%)	OW_Gain (dB)
0	PR0	0	-1.146400	1.011295
1	PR0	1	-1.127296	1.073638
2	PR0	5	-1.263854	1.128437
3	PR0	10	-1.213642	1.111798
4	PR0	20	-1.163398	1.133339
5	PR0	30	-1.332139	1.175964
6	PR1	0	-0.751993	0.873155
7	PR1	1	-0.574667	0.921585
8	PR1	5	-0.498499	0.903431
9	PR1	10	-0.510305	0.905759
10	PR1	20	-0.452050	0.905491
11	PR1	30	-0.578669	0.898996
12	PR2	0	-0.380356	0.659004
13	PR2	1	-0.191251	0.627746
14	PR2	5	-0.095429	0.622127
15	PR2	10	-0.037918	0.621638
16	PR2	20	-0.010030	0.572308
17	PR2	30	-0.023370	0.538929
18	PR3	0	-0.136229	0.339621
19	PR3	1	0.022276	0.316250
20	PR3	5	0.106429	0.251786
21	PR3	10	0.295077	0.171259
22	PR3	20	0.275252	0.131786
23	PR3	30	0.285489	0.115114
24	PR4	0	-0.012518	-0.041473
25	PR4	1	0.188954	-0.065000
26	PR4	5	0.304231	-0.208036
27	PR4	10	0.388367	-0.310937
28	PR4	20	0.416180	-0.398125

	Peak Current Ratio	Number Of Adjacent Track Writes	ADC_Gain (%)	OW_Gain (dB)
29	PR4	30	0.443613	-0.489442
30	PR5	0	0.165712	-0.460380
31	PR5	1	0.229913	-0.549353
32	PR5	5	0.345233	-0.722232
33	PR5	10	0.407355	-0.818147
34	PR5	20	0.434932	-0.933705
35	PR5	30	0.454442	-1.010201
36	PR6	0	0.237023	-0.963233
37	PR6	1	0.127881	-1.054196
38	PR6	5	0.349179	-1.272031
39	PR6	10	0.416095	-1.359420
40	PR6	20	0.429368	-1.533839
41	PR6	30	0.438749	-1.642679
42	PR7	0	0.162195	-1.435599
43	PR7	1	0.163914	-1.550536
44	PR7	5	0.257701	-1.810246
45	PR7	10	0.325696	-1.960603
46	PR7	20	0.321473	-2.112188
47	PR7	30	0.383129	-2.291141
48	PRD	0	0.000000	0.000000
49	PRD	1	0.372589	-0.131893
50	PRD	5	0.482410	-0.260335
51	PRD	10	0.542072	-0.395360
52	PRD	20	0.579149	-0.467212
53	PRD	30	0.475020	-0.546094

```
In [75]: new_df = df.join(norm)
new_df
```

	Peak Current Ratio	Number Of Adjacent Track Writes	ADC_Gain (%)	OW_Gain (dB)	Norm_ADC_Gain	Norm_OW_Gain	CD
0	PR0	0	-1.146400	1.011295	0.097180	0.952505	0.304244
1	PR0	1	-1.127296	1.073638	0.107175	0.970487	0.322509
2	PR0	5	-1.263854	1.128437	0.035727	0.986292	0.187716
3	PR0	10	-1.213642	1.111798	0.061998	0.981493	0.246680
4	PR0	20	-1.163398	1.133339	0.088287	0.987706	0.295299
5	PR0	30	-1.332139	1.175964	0.000000	1.000000	0.000000
6	PR1	0	-0.751993	0.873155	0.303537	0.912662	0.526333
7	PR1	1	-0.574667	0.921585	0.396315	0.926631	0.606001
8	PR1	5	-0.498499	0.903431	0.436167	0.921395	0.633941
9	PR1	10	-0.510305	0.905759	0.429990	0.922066	0.629666

	Peak Current Ratio	Number Of Adjacent Track Writes	ADC_Gain (%)	OW_Gain (dB)	Norm_ADC_Gain	Norm_OW_Gain	CD
10	PR1	20	-0.452050	0.905491	0.460469	0.921989	0.651573
11	PR1	30	-0.578669	0.898996	0.394221	0.920115	0.602270
12	PR2	0	-0.380356	0.659004	0.497980	0.850896	0.650945
13	PR2	1	-0.191251	0.627746	0.596921	0.841880	0.708898
14	PR2	5	-0.095429	0.622127	0.647056	0.840260	0.737357
15	PR2	10	-0.037918	0.621638	0.677146	0.840118	0.754243
16	PR2	20	-0.010030	0.572308	0.691737	0.825890	0.755843
17	PR2	30	-0.023370	0.538929	0.684758	0.816263	0.747625
18	PR3	0	-0.136229	0.339621	0.625709	0.758778	0.689039
19	PR3	1	0.022276	0.316250	0.708640	0.752037	0.730016
20	PR3	5	0.106429	0.251786	0.752669	0.733444	0.742994
21	PR3	10	0.295077	0.171259	0.851372	0.710218	0.777599
22	PR3	20	0.275252	0.131786	0.840999	0.698833	0.766628
23	PR3	30	0.285489	0.115114	0.846355	0.694024	0.766414
24	PR4	0	-0.012518	-0.041473	0.690436	0.648861	0.669325
25	PR4	1	0.188954	-0.065000	0.795847	0.642075	0.714838
26	PR4	5	0.304231	-0.208036	0.856161	0.600820	0.717216
27	PR4	10	0.388367	-0.310937	0.900182	0.571140	0.717029
28	PR4	20	0.416180	-0.398125	0.914734	0.545993	0.706710
29	PR4	30	0.443613	-0.489442	0.929087	0.519655	0.694841
30	PR5	0	0.165712	-0.460380	0.783687	0.528037	0.643285
31	PR5	1	0.229913	-0.549353	0.817278	0.502375	0.640765
32	PR5	5	0.345233	-0.722232	0.877614	0.452513	0.630184
33	PR5	10	0.407355	-0.818147	0.910116	0.424848	0.621821
34	PR5	20	0.434932	-0.933705	0.924545	0.391518	0.601645
35	PR5	30	0.454442	-1.010201	0.934753	0.369455	0.587664
36	PR6	0	0.237023	-0.963233	0.820997	0.383002	0.560753
37	PR6	1	0.127881	-1.054196	0.763894	0.356766	0.522045
38	PR6	5	0.349179	-1.272031	0.879678	0.293937	0.508498
39	PR6	10	0.416095	-1.359420	0.914689	0.268732	0.495788
40	PR6	20	0.429368	-1.533839	0.921633	0.218425	0.448673
41	PR6	30	0.438749	-1.642679	0.926542	0.187033	0.416286
42	PR7	0	0.162195	-1.435599	0.781847	0.246760	0.439236
43	PR7	1	0.163914	-1.550536	0.782746	0.213609	0.408903
44	PR7	5	0.257701	-1.810246	0.831816	0.138702	0.339669
45	PR7	10	0.325696	-1.960603	0.867392	0.095335	0.287564
46	PR7	20	0.321473	-2.112188	0.865182	0.051615	0.211320
47	PR7	30	0.383129	-2.291141	0.897441	0.000000	0.000000
Loading [MathJax]/extensions/Safe.js		0	0.000000	0.000000	0.696985	0.660822	0.678663

	Peak Current Ratio	Number Of Adjacent Track Writes	ADC_Gain (%)	OW_Gain (dB)	Norm_ADC_Gain	Norm_OW_Gain	CD
49	PRD	1	0.372589	-0.131893	0.891926	0.622781	0.745302
50	PRD	5	0.482410	-0.260335	0.949386	0.585735	0.745714
51	PRD	10	0.542072	-0.395360	0.980601	0.546791	0.732246
52	PRD	20	0.579149	-0.467212	1.000000	0.526067	0.725305
53	PRD	30	0.475020	-0.546094	0.945519	0.503315	0.689851

```
In [77]: new_df.to_csv('C:/Users/Shay/Documents/Data Analysis/new_df.csv', index=False)

In [ ]:

In [ ]:

In [ ]:
```