add_advanced_pitching_stats

April 29, 2020

```
[53]: import pandas as pd
      import matplotlib.pyplot as plt
```

```
[54]: df = pd.read_csv('../core/output/pitchers.csv')
      df_adv = pd.read_csv('../core/output/advanced_pitching.csv')
```

Adding Advanced Stats

```
[55]: df_adv.sort_values('retroID')
```

```
[55]:        retroID        IP   K/9  BB/9  HR/9  BABIP  LOB%   ERA   FIP   WAR
      2866  aardd001  0.062360  9.08  4.89  1.09  0.285  74.5  4.27  4.45   1.1
      841   aased001  0.205233  5.20  3.71  0.72  0.282  73.4  3.80  3.85  11.7
      3237  abadf001  0.061102  7.62  3.16  1.14  0.281  77.7  3.67  4.24   0.6
      949   abbog001  0.237967  3.39  2.46  1.13  0.278  69.3  4.39  4.46  10.2
      394   abboj001  0.309765  4.77  3.33  0.83  0.295  70.0  4.25  4.25  22.7
      ...        ...       ...   ...   ...   ...    ...   ...   ...   ...   ...
      1030  zolds101  0.171925  2.00  2.91  0.52  0.267  70.7  3.54  3.80   9.3
      1934  zubeb101  0.145445  4.39  5.36  0.40  0.283  69.0  4.28  3.96   3.3
      2098  zumaj001  0.038711  9.01  4.89  0.77  0.267  78.7  3.00  3.94   2.7
      2399  zuveg101  0.118817  3.12  2.84  0.78  0.270  73.2  3.54  3.93   1.9
      2808  zycht001  0.013360  9.91  4.21  0.37  0.293  79.1  2.72  3.22   1.1

      [8025 rows x 10 columns]
```

```
[56]: df
```

```
[56]:        retroID  BAOpp     ERA  CG  SHO  IPouts     H   ER   HR   BB  ...  WP  \
      0     aardd001  0.2574  5.1944   0    0    1011   296  160   41  183  ...  12
      1     aased001  0.2508  3.4931  22    5    3328  1085  468   89  457  ...  22
      2     abadf001  0.2447  4.0810   0    0     992   309  135   42  116  ...  10
      3     abbog001  0.2786  4.3317  37    5    3858  1405  627  162  352  ...  18
      4     abboj001  0.2804  4.4964  31    6    5022  1779  791  154  620  ...  53
      ...        ...     ...     ...  ..  ...     ...   ...  ...  ...  ...  ...  ..
      8020  zolds101  0.2700  3.6890  30    5    2788   956  366   54  301  ...   8
      8021  zubeb101  0.2717  5.3617  23    3    2358   767  374   35  468  ...  28
      8022  zumaj001  0.2286  3.4420   0    0     629   169   71   18  114  ...  16
```

```
8023  zuveg101  0.2760  4.1280   9    2    1927   660   253    56   203  ...   10
8024  zycht001  0.2183  2.8000   0    0     218    57    22     3    34  ...    2

      HBP  BK   BFP   GF    R  SH  SF  GIDP        K%
0      16   1  1475  141  169  17  11    21  0.230508
1       7   3  4730  235  503  50  34   106  0.135518
2      12   2  1399   97  143   7  12    25  0.200143
3      32   5  5508   13  707  60  39   111  0.087872
4      32  11  7211    5  880  70  47   200  0.123145
...   ...  ..   ...  ...  ...  ..  ..   ...       ...
8020    3   4  3946   78  423   0   0     0  0.052458
8021    4   1  3476   90  418   0   0     0  0.110184
8022    4   0   911   35   80   6  10    10  0.230516
8023   27   1  2746  139  296   0   0     0  0.081209
8024    8   1   309   14   24   1   3     6  0.258900

[8025 rows x 22 columns]
```

```
[57]: df = df.drop(columns=['ERA'])
```

```
[58]: df = df.merge(df_adv, on='retroID' ,how='left')
```

```
[59]: 100 * df.isnull().sum() / len(df)
```

```
[59]: retroID    0.0
      BAOpp      0.0
      CG         0.0
      SHO        0.0
      IPouts     0.0
      H          0.0
      ER         0.0
      HR         0.0
      BB         0.0
      SO         0.0
      IBB        0.0
      WP         0.0
      HBP        0.0
      BK         0.0
      BFP        0.0
      GF         0.0
      R          0.0
      SH         0.0
      SF         0.0
      GIDP       0.0
      K%         0.0
      IP         0.0
      K/9        0.0
```

```
BB/9        0.0
HR/9        0.0
BABIP       0.0
LOB%        0.0
ERA         0.0
FIP         0.0
WAR         0.0
dtype: float64
```

```
[60]: df['Pitching'] = df[['K%', 'ERA', 'FIP', 'WAR']].mean(axis=1).round(3)
```

```
[61]: df['Pitching']
```

```
[61]: 0       2.513
      1       4.871
      2       2.178
      3       4.784
      4       7.831
              ...
      8020    4.173
      8021    2.913
      8022    2.468
      8023    2.363
      8024    1.825
      Name: Pitching, Length: 8025, dtype: float64
```

Finalizing the new Pitching statistic

```
[64]: df['Pitching'].mean()
```

```
[64]: 3.627380436137072
```

```
[65]: df['Pitching'].min()
```

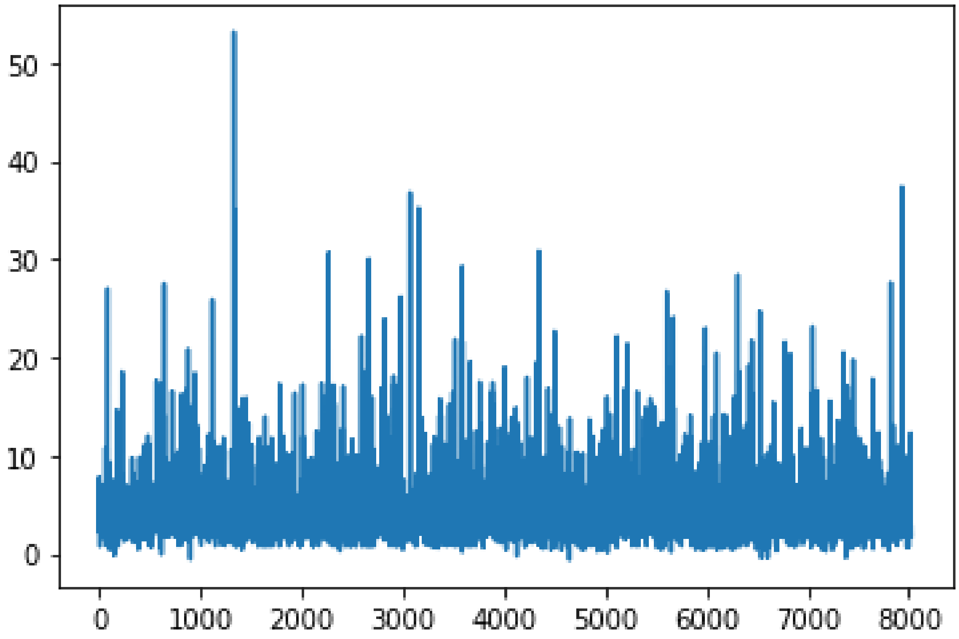
```
[65]: -0.654
```

```
[66]: df['Pitching'].max()
```

```
[66]: 53.138
```

```
[63]: plt.plot(df['Pitching'])
```

```
[63]: [<matplotlib.lines.Line2D at 0x127615250>]
```



[67]:
```
df[df['Pitching'] == df['Pitching'].max()]
```

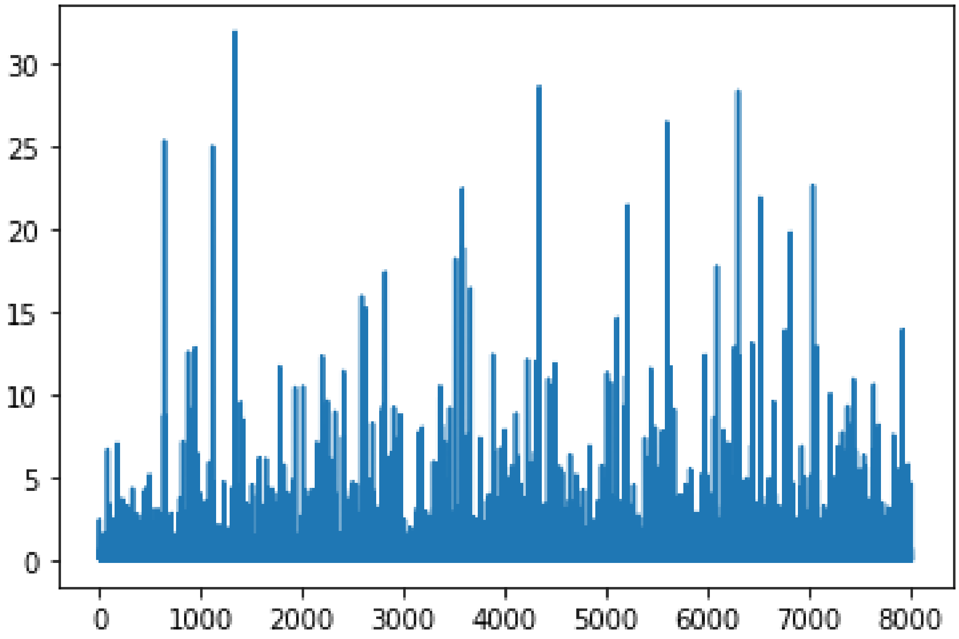
[67]:
```
       retroID  BAOpp  CG  SHO  IPouts  H  ER  HR  BB  SO  ...        IP  \
1333  cleaj101   0.83   0    0       1  5   7   0   3   1  ...  0.000019

       K/9  BB/9  HR/9  BABIP  LOB%    ERA    FIP  WAR  Pitching
1333  27.0  81.0   0.0    1.0  12.5  189.0  23.54 -0.1    53.138

[1 rows x 31 columns]
```

This immediately demonstrates an issue with our Pitching stat - a player with very few appearances, but who did well in those appearances, will be skewed too high. We need to also take innings pitched into account.

[91]:
```
df['Pitching'] = df[['K%', 'ERA', 'FIP', 'WAR']].mean(axis=1).round(3) * df['IP']
```

[92]:
```
plt.plot(df['Pitching'])
```

[92]:
```
[<matplotlib.lines.Line2D at 0x12793b850>]
```



```
[93]: df[df['Pitching'] == df['Pitching'].max()]
```

```
[93]:       retroID   BAOpp   CG  SHO  IPouts     H    ER   HR    BB    SO  ...  \
      1341  clemr001  0.2308  118   46   14750  4185  1707  363  1580  4672  ...

                  IP   K/9  BB/9  HR/9  BABIP  LOB%   ERA   FIP    WAR   Pitching
      1341  0.909717  8.55  2.89  0.66  0.284  74.6  3.12  3.09  133.7  31.871935

      [1 rows x 31 columns]
```

This looks like it worked, but let's explore deeper.

```
[94]: df['Pitching'].mean()
```

```
[94]: 0.49352977097414313
```

```
[95]: df['Pitching'].min()
```

```
[95]: -5.0887375e-05
```

```
[96]: df['Pitching'].max()
```

```
[96]: 31.871935094999998
```

```
[97]: df.sort_values('Pitching').tail(10)
```

[97]:

```
       retroID   BAOpp   CG  SHO  IPouts     H    ER   HR    BB    SO  ...  \
5219  niekp001  0.2570  245   45   16213  5044  2012  482  1809  3342  ...
6529  seavt001  0.2285  231   61   14348  3971  1521  380  1390  3640  ...
3588  johnr005  0.2252  100   37   12406  3346  1513  411  1497  4875  ...
7049  suttd001  0.2376  178   58   15847  4692  1914  472  1343  3574  ...
1121  carls001  0.2546  254   55   15652  4672  1864  414  1833  4136  ...
645   blylb001  0.2487  242   60   14910  4632  1830  430  1322  3701  ...
5607  perrg101  0.2540  303   53   16051  4938  1846  399  1379  3534  ...
6311  ryann001  0.2088  222   61   16158  3923  1911  321  2795  5714  ...
4347  maddg002  0.2553  109   35   15025  4726  1756  353   999  3371  ...
1341  clemr001  0.2308  118   46   14750  4185  1707  363  1580  4672  ...

            IP    K/9  BB/9  HR/9  BABIP  LOB%   ERA   FIP    WAR   Pitching
5219  1.000000   5.57  3.01  0.80  0.270  73.6  3.35  3.62   78.5  21.404000
6529  0.884921   6.85  2.62  0.72  0.259  76.7  2.86  3.04   92.7  21.854894
3588  0.765178  10.61  3.26  0.89  0.291  74.7  3.29  3.19  110.4  22.412829
7049  0.977406   6.09  2.29  0.80  0.261  73.6  3.26  3.24   85.9  22.618152
1121  0.965397   7.13  3.16  0.71  0.279  74.1  3.22  3.15   96.9  24.969993
645   0.919672   6.70  2.39  0.78  0.282  74.1  3.31  3.19  103.3  25.286382
5607  0.990008   5.94  2.32  0.67  0.275  73.3  3.11  3.06  100.5  26.441134
6311  0.996651   9.55  4.67  0.54  0.265  73.1  3.19  2.97  107.2  28.307878
4347  0.926722   6.06  1.80  0.63  0.281  72.3  3.16  3.26  116.7  28.562499
1341  0.909717   8.55  2.89  0.66  0.284  74.6  3.12  3.09  133.7  31.871935

[10 rows x 31 columns]
```

[98]:

```
df[df['retroID'] == 'kersc001']
```

[98]:

```
       retroID   BAOpp  CG  SHO  IPouts     H   ER   HR   BB    SO  ...  \
3761  kersc001  0.2105  25   15    6824  1715  617  173  577  2464  ...

            IP   K/9  BB/9  HR/9  BABIP  LOB%   ERA   FIP   WAR  Pitching
3761  0.420829  9.75  2.28  0.68   0.27  79.4  2.44  2.74  64.5  7.359878

[1 rows x 31 columns]
```

This looks good, but we intuitively see a problem with the Pitching stat. ERA and FIP are part of the average, but a low ERA/FIP is better than a high one. We need to subtract them rather than add. With this change, I'm going to see how the stat looks without taking IP into account.

[132]:

```
df['-ERA'] = 0 - df['ERA']
df['-FIP'] = 0 - df['FIP']
```

[133]:

```
df
```

[133]:

```
       retroID   BAOpp  CG  SHO  IPouts    H   ER  HR   BB   SO  ...  BB/9  \
0     aardd001  0.2574   0    0    1011  296  160  41  183  340  ...  4.89
```

```
1     aased001  0.2508  22    5   3328  1085  468   89  457  641  ...  3.71
2     abadf001  0.2447   0    0    992   309  135   42  116  280  ...  3.16
3     abbog001  0.2786  37    5   3858  1405  627  162  352  484  ...  2.46
4     abboj001  0.2804  31    6   5022  1779  791  154  620  888  ...  3.33
...        ...     ...  ..  ...    ...   ...  ...  ...  ...  ...  ...   ...
8020  zolds101  0.2700  30    5   2788   956  366   54  301  207  ...  2.91
8021  zubeb101  0.2717  23    3   2358   767  374   35  468  383  ...  5.36
8022  zumaj001  0.2286   0    0    629   169   71   18  114  210  ...  4.89
8023  zuveg101  0.2760   9    2   1927   660  253   56  203  223  ...  2.84
8024  zycht001  0.2183   0    0    218    57   22    3   34   80  ...  4.21

      HR/9  BABIP  LOB%   ERA   FIP   WAR  Pitching  -ERA  -FIP
0     1.09  0.285  74.5  4.27  4.45   1.1    -1.847 -4.27 -4.45
1     0.72  0.282  73.4  3.80  3.85  11.7     1.046 -3.80 -3.85
2     1.14  0.281  77.7  3.67  4.24   0.6    -1.777 -3.67 -4.24
3     1.13  0.278  69.3  4.39  4.46  10.2     0.359 -4.39 -4.46
4     0.83  0.295  70.0  4.25  4.25  22.7     3.581 -4.25 -4.25
...    ...    ...   ...   ...   ...   ...       ...   ...   ...
8020  0.52  0.267  70.7  3.54  3.80   9.3     0.503 -3.54 -3.80
8021  0.40  0.283  69.0  4.28  3.96   3.3    -1.207 -4.28 -3.96
8022  0.77  0.267  78.7  3.00  3.94   2.7    -1.002 -3.00 -3.94
8023  0.78  0.270  73.2  3.54  3.93   1.9    -1.372 -3.54 -3.93
8024  0.37  0.293  79.1  2.72  3.22   1.1    -1.145 -2.72 -3.22

[8025 rows x 33 columns]
```

[134]:

```python
df['Pitching'] = df[['K%', '-ERA', '-FIP', 'WAR']].mean(axis=1).round(3)
```

[135]:

```python
df.sort_values('Pitching').tail(10)
```

[135]:

```
       retroID   BAOpp   CG  SHO  IPouts     H    ER   HR    BB    SO  ...  \
7049  suttd001  0.2376  178   58   15847  4692  1914  472  1343  3574  ...
2824  grovl101  0.2535  298   35   11822  3849  1339  162  1187  2266  ...
6529  seavt001  0.2285  231   61   14348  3971  1521  380  1390  3640  ...
1121  carls001  0.2546  254   55   15652  4672  1864  414  1833  4136  ...
5607  perrg101  0.2540  303   53   16051  4938  1846  399  1379  3534  ...
645   blylb001  0.2487  242   60   14910  4632  1830  430  1322  3701  ...
6311  ryann001  0.2088  222   61   16158  3923  1911  321  2795  5714  ...
3588  johnr005  0.2252  100   37   12406  3346  1513  411  1497  4875  ...
4347  maddg002  0.2553  109   35   15025  4726  1756  353   999  3371  ...
1341  clemr001  0.2308  118   46   14750  4185  1707  363  1580  4672  ...

      BB/9  HR/9  BABIP  LOB%   ERA   FIP   WAR  Pitching  -ERA  -FIP
7049  2.29  0.80  0.261  73.6  3.26  3.24  85.9    19.891 -3.26 -3.24
2824  2.71  0.37  0.284  71.8  3.06  3.36  88.8    20.629 -3.06 -3.36
6529  2.62  0.72  0.259  76.7  2.86  3.04  92.7    21.747 -2.86 -3.04
1121  3.16  0.71  0.279  74.1  3.22  3.15  96.9    22.680 -3.22 -3.15
```

```
5607  2.32  0.67  0.275  73.3  3.11  3.06  100.5    23.623 -3.11 -3.06
645   2.39  0.78  0.282  74.1  3.31  3.19  103.3    24.245 -3.31 -3.19
6311  4.67  0.54  0.265  73.1  3.19  2.97  107.2    25.323 -3.19 -2.97
3588  3.26  0.89  0.291  74.7  3.29  3.19  110.4    26.051 -3.29 -3.19
4347  1.80  0.63  0.281  72.3  3.16  3.26  116.7    27.611 -3.16 -3.26
1341  2.89  0.66  0.284  74.6  3.12  3.09  133.7    31.930 -3.12 -3.09

[10 rows x 33 columns]
```

[136]:

```
df[df['retroID'] == 'kersc001']
```

[136]:

```
       retroID   BAOpp  CG  SHO  IPouts     H   ER   HR   BB    SO  ...  BB/9  \
3761  kersc001  0.2105  25   15    6824  1715  617  173  577  2464  ...  2.28

      HR/9  BABIP  LOB%   ERA   FIP   WAR  Pitching  -ERA  -FIP
3761  0.68   0.27  79.4  2.44  2.74  64.5    14.899 -2.44 -2.74

[1 rows x 33 columns]
```

[137]:

```
df[df['retroID'] == 'johnr005']
```

[137]:

```
       retroID   BAOpp   CG  SHO  IPouts     H    ER   HR    BB    SO  ...  \
3588  johnr005  0.2252  100   37   12406  3346  1513  411  1497  4875  ...

      BB/9  HR/9  BABIP  LOB%   ERA   FIP    WAR  Pitching  -ERA  -FIP
3588  3.26  0.89  0.291  74.7  3.29  3.19  110.4    26.051 -3.29 -3.19

[1 rows x 33 columns]
```

[138]:

```
df[df['retroID'] == 'bumgm001']
```

[138]:

```
      retroID   BAOpp  CG  SHO  IPouts     H   ER  HR    BB    SO  ...  BB/9  \
942  bumgm001  0.2358  15    6    5538  1622  642  192  428  1794  ...  2.09

     HR/9  BABIP  LOB%   ERA   FIP   WAR  Pitching  -ERA  -FIP
942  0.94  0.284  76.4  3.13  3.32  31.3     6.272 -3.13 -3.32

[1 rows x 33 columns]
```

[139]:

```
df[df['retroID'] == 'mahop001']
```

[139]:

```
       retroID   BAOpp  CG  SHO  IPouts    H   ER   HR    BB   SO  ...  BB/9  \
4377  mahop001  0.2751   0    0    2127  738  431  116  392  452  ...  4.98

      HR/9  BABIP  LOB%   ERA   FIP  WAR  Pitching  -ERA  -FIP
4377  1.47  0.284  69.5  5.47  5.62 -3.0     -3.487 -5.47 -5.62
```

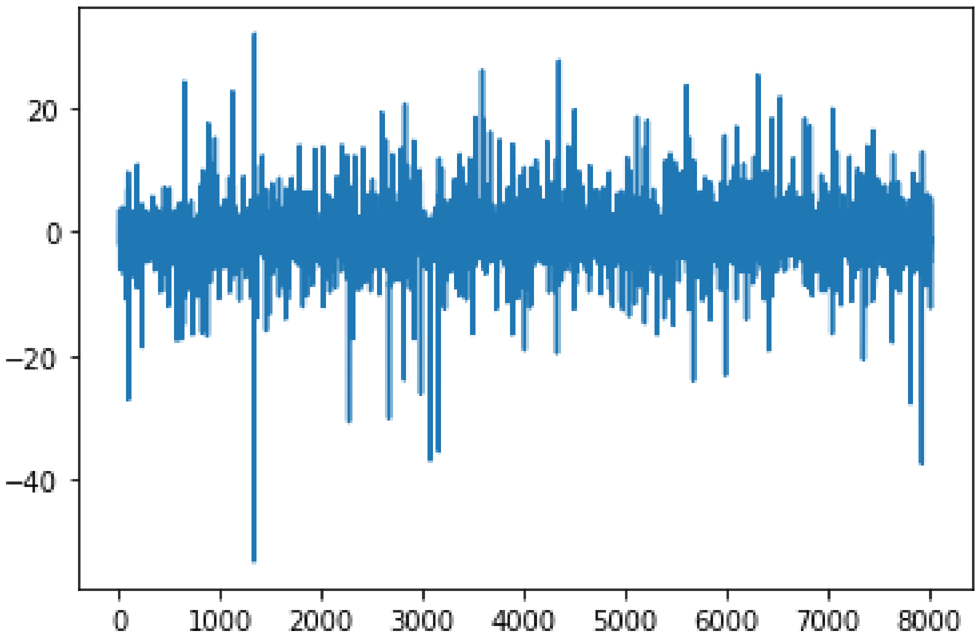
```
[1 rows x 33 columns]
```

[140]:
```
df[df['retroID'] == 'coleg001']
```

[140]:
```
       retroID   BAOpp  CG  SHO  IPouts     H   ER   HR   BB    SO  ...  BB/9  \
1383  coleg001  0.2381   2    1    3585  1034  427  115  315  1336  ...  2.37

      HR/9  BABIP  LOB%   ERA   FIP   WAR  Pitching   -ERA  -FIP
1383  0.87  0.303  75.6  3.22  3.06  28.8     5.699  -3.22 -3.06

[1 rows x 33 columns]
```

[141]:
```
plt.plot(df['Pitching'])
```

[141]:
```
[<matplotlib.lines.Line2D at 0x12a1537d0>]
```



[131]:
```
df.sort_values('Pitching').head(10)
```

[131]:
```
       retroID  BAOpp  CG  SHO  IPouts  H  ER  HR  BB  SO  ...   BB/9  HR/9  \
1333  cleaj101   0.83   0    0       1  5   7   0   3   1  ...   81.0   0.0
7932  wurmf101   0.50   0    0       1  1   4   0   5   1  ...  135.0   0.0
3074  heart001   0.75   0    0       1  3   4   0   4   0  ...  108.0   0.0
3159  herne001   0.50   0    0       1  1   3   1   2   0  ...   54.0  27.0
2272  fishf101   0.66   0    0       1  2   4   0   2   1  ...   54.0   0.0
2666  gomec002   0.00   0    0       1  0   3   0   4   0  ...  108.0   0.0
7819  wilst104   0.00   0    0       1  0   3   0   2   0  ...   54.0   0.0
```

```
88    alexm001  0.50  0   0      2  1   5   1   4   0  ...   54.0  13.5
2981  harll101  0.50  0   0      2  2   5   1   4   1  ...   54.0  13.5
5674  pickr001  0.60  0   0      2  3   6   0   4   2  ...   54.0   0.0

      BABIP  LOB%    ERA    FIP  WAR  Pitching   -ERA   -FIP
1333   1.00  12.5  189.0  23.54 -0.1   -53.132 -189.0 -23.54
7932   1.00  33.3  108.0  41.54 -0.1   -37.374 -108.0 -41.54
3074   0.75  28.6  108.0  39.21 -0.1   -36.828 -108.0 -39.21
3159   0.00   0.0   81.0  60.16 -0.3   -35.365  -81.0 -60.16
2272   1.00   0.0  108.0  14.60  0.0   -30.600 -108.0 -14.60
2666   0.00  25.0   81.0  39.16 -0.1   -30.065  -81.0 -39.16
7819   0.00   0.0   81.0  29.57 -0.1   -27.667  -81.0 -29.57
88     0.00   0.0   67.5  40.67 -0.1   -27.068  -67.5 -40.67
2981   0.50  21.7   67.5  37.08 -0.1   -26.139  -67.5 -37.08
5674   1.00  14.3   81.0  15.14  0.0   -23.979  -81.0 -15.14

[10 rows x 33 columns]
```

I'm happy with this. The new Pitching stat somewhat reflects its component parts but doesn't immediately align with WAR. We don't just want to recreate WAR so that's a good thing.

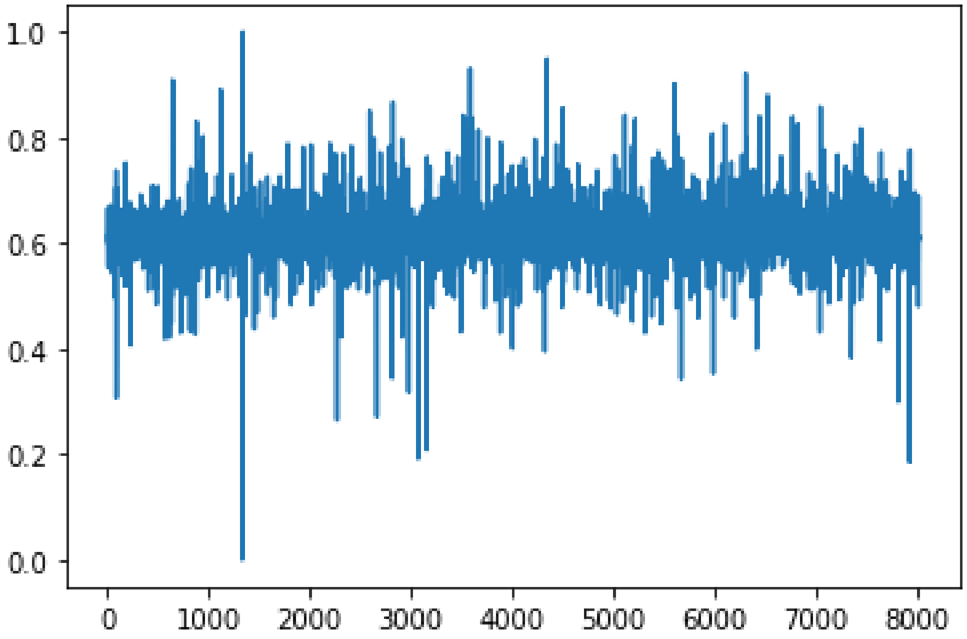
Normalization

[142]:
```python
from sklearn.preprocessing import MinMaxScaler
```

[143]:
```python
scaler = MinMaxScaler()
```

[144]:
```python
plt.plot(scaler.fit_transform(df[['Pitching']]))
```

[144]:
```
[<matplotlib.lines.Line2D at 0x1337d3f50>]
```



```
[145]: df['Pitching'] = scaler.fit_transform(df[['Pitching']])
```

```
[147]: df.sort_values('Pitching').head(10)
```

```
[147]:       retroID  BAOpp  CG  SHO  IPouts  H  ER  HR  BB  SO  ...   BB/9  HR/9  \
       1333  cleaj101   0.83   0    0       1  5   7   0   3   1  ...   81.0   0.0
       7932  wurmf101   0.50   0    0       1  1   4   0   5   1  ...  135.0   0.0
       3074  heart001   0.75   0    0       1  3   4   0   4   0  ...  108.0   0.0
       3159  herne001   0.50   0    0       1  1   3   1   2   0  ...   54.0  27.0
       2272  fishf101   0.66   0    0       1  2   4   0   2   1  ...   54.0   0.0
       2666  gomec002   0.00   0    0       1  0   3   0   4   0  ...  108.0   0.0
       7819  wilst104   0.00   0    0       1  0   3   0   2   0  ...   54.0   0.0
       88    alexm001   0.50   0    0       2  1   5   1   4   0  ...   54.0  13.5
       2981  harll101   0.50   0    0       2  2   5   1   4   1  ...   54.0  13.5
       5674  pickr001   0.60   0    0       2  3   6   0   4   2  ...   54.0   0.0

             BABIP  LOB%    ERA    FIP  WAR  Pitching    -ERA   -FIP
       1333   1.00  12.5  189.0  23.54 -0.1  0.000000 -189.0 -23.54
       7932   1.00  33.3  108.0  41.54 -0.1  0.185253 -108.0 -41.54
       3074   0.75  28.6  108.0  39.21 -0.1  0.191672 -108.0 -39.21
       3159   0.00   0.0   81.0  60.16 -0.3  0.208871  -81.0 -60.16
       2272   1.00   0.0  108.0  14.60  0.0  0.264889 -108.0 -14.60
       2666   0.00  25.0   81.0  39.16 -0.1  0.271179  -81.0 -39.16
       7819   0.00   0.0   81.0  29.57 -0.1  0.299370  -81.0 -29.57
       88     0.00   0.0   67.5  40.67 -0.1  0.306412  -67.5 -40.67
       2981   0.50  21.7   67.5  37.08 -0.1  0.317333  -67.5 -37.08
```

```
5674   1.00  14.3   81.0  15.14  0.0  0.342726  -81.0 -15.14

[10 rows x 33 columns]
```

[148]:

```
df.sort_values('Pitching').tail(10)
```

[148]:

```
       retroID   BAOpp   CG  SHO  IPouts     H    ER   HR    BB    SO  ...  \
7049  suttd001  0.2376  178   58   15847  4692  1914  472  1343  3574  ...
2824  grovl101  0.2535  298   35   11822  3849  1339  162  1187  2266  ...
6529  seavt001  0.2285  231   61   14348  3971  1521  380  1390  3640  ...
1121  carls001  0.2546  254   55   15652  4672  1864  414  1833  4136  ...
5607  perrg101  0.2540  303   53   16051  4938  1846  399  1379  3534  ...
645   blylb001  0.2487  242   60   14910  4632  1830  430  1322  3701  ...
6311  ryann001  0.2088  222   61   16158  3923  1911  321  2795  5714  ...
3588  johnr005  0.2252  100   37   12406  3346  1513  411  1497  4875  ...
4347  maddg002  0.2553  109   35   15025  4726  1756  353   999  3371  ...
1341  clemr001  0.2308  118   46   14750  4185  1707  363  1580  4672  ...

      BB/9  HR/9  BABIP  LOB%   ERA   FIP    WAR  Pitching  -ERA  -FIP
7049  2.29  0.80  0.261  73.6  3.26  3.24   85.9  0.858468 -3.26 -3.24
2824  2.71  0.37  0.284  71.8  3.06  3.36   88.8  0.867144 -3.06 -3.36
6529  2.62  0.72  0.259  76.7  2.86  3.04   92.7  0.880287 -2.86 -3.04
1121  3.16  0.71  0.279  74.1  3.22  3.15   96.9  0.891256 -3.22 -3.15
5607  2.32  0.67  0.275  73.3  3.11  3.06  100.5  0.902342 -3.11 -3.06
645   2.39  0.78  0.282  74.1  3.31  3.19  103.3  0.909654 -3.31 -3.19
6311  4.67  0.54  0.265  73.1  3.19  2.97  107.2  0.922327 -3.19 -2.97
3588  3.26  0.89  0.291  74.7  3.29  3.19  110.4  0.930886 -3.29 -3.19
4347  1.80  0.63  0.281  72.3  3.16  3.26  116.7  0.949225 -3.16 -3.26
1341  2.89  0.66  0.284  74.6  3.12  3.09  133.7  1.000000 -3.12 -3.09

[10 rows x 33 columns]
```

Finally, we should get rid of the -ERA and -FIP columns.

[149]:

```
df = df.drop(columns=['-ERA', '-FIP'])
```

[150]:

```
df
```

[150]:

```
       retroID   BAOpp  CG  SHO  IPouts     H   ER   HR   BB   SO  ...  \
0     aardd001  0.2574   0    0    1011   296  160   41  183  340  ...
1     aased001  0.2508  22    5    3328  1085  468   89  457  641  ...
2     abadf001  0.2447   0    0     992   309  135   42  116  280  ...
3     abbog001  0.2786  37    5    3858  1405  627  162  352  484  ...
4     abboj001  0.2804  31    6    5022  1779  791  154  620  888  ...
...        ...     ...  ..  ...     ...   ...  ...  ...  ...  ...  ...
8020  zolds101  0.2700  30    5    2788   956  366   54  301  207  ...
8021  zubeb101  0.2717  23    3    2358   767  374   35  468  383  ...
```

```
8022  zumaj001  0.2286   0    0     629   169   71   18  114  210  ...
8023  zuveg101  0.2760   9    2    1927   660  253   56  203  223  ...
8024  zycht001  0.2183   0    0     218    57   22    3   34   80  ...

            IP   K/9  BB/9  HR/9  BABIP  LOB%   ERA   FIP   WAR  Pitching
0     0.062360  9.08  4.89  1.09  0.285  74.5  4.27  4.45   1.1  0.602913
1     0.205233  5.20  3.71  0.72  0.282  73.4  3.80  3.85  11.7  0.636924
2     0.061102  7.62  3.16  1.14  0.281  77.7  3.67  4.24   0.6  0.603736
3     0.237967  3.39  2.46  1.13  0.278  69.3  4.39  4.46  10.2  0.628847
4     0.309765  4.77  3.33  0.83  0.295  70.0  4.25  4.25  22.7  0.666725
...        ...   ...   ...   ...    ...   ...   ...   ...   ...       ...
8020  0.171925  2.00  2.91  0.52  0.267  70.7  3.54  3.80   9.3  0.630540
8021  0.145445  4.39  5.36  0.40  0.283  69.0  4.28  3.96   3.3  0.610437
8022  0.038711  9.01  4.89  0.77  0.267  78.7  3.00  3.94   2.7  0.612847
8023  0.118817  3.12  2.84  0.78  0.270  73.2  3.54  3.93   1.9  0.608497
8024  0.013360  9.91  4.21  0.37  0.293  79.1  2.72  3.22   1.1  0.611166

[8025 rows x 31 columns]
```

[ ]: