```
pip install pandas
```

```
Defaulting to user installation because normal site-packages is not
writeable
Requirement already satisfied: pandas in c:\users\lenovo\appdata\
roaming\python\python311\site-packages (2.0.3)
Requirement already satisfied: python-dateutil>=2.8.2 in c:\users\
lenovo\appdata\roaming\python\python311\site-packages (from pandas)
(2.8.2)
Requirement already satisfied: pytz>=2020.1 in c:\users\lenovo\
appdata\roaming\python\python311\site-packages (from pandas) (2023.3)
Requirement already satisfied: tzdata>=2022.1 in c:\users\lenovo\
appdata\roaming\python\python311\site-packages (from pandas) (2023.3)
Requirement already satisfied: numpy>=1.21.0 in c:\users\lenovo\
appdata\roaming\python\python311\site-packages (from pandas) (1.25.2)
Requirement already satisfied: six>=1.5 in c:\users\lenovo\appdata\
roaming\python\python311\site-packages (from python-dateutil>=2.8.2-
>pandas) (1.16.0)
Note: you may need to restart the kernel to use updated packages.
```

```
import pandas as pd
print(pd.__version__)
```

```
2.0.3
```

```
import pandas as pd
df = pd.read_csv('Bias_correction_ucl.csv')
print(df)
```

```
      station        Date  Present_Tmax  Present_Tmin  LDAPS_RHmin  \
0         1.0  2013-06-30          28.7          21.4    58.255688
1         2.0  2013-06-30          31.9          21.6    52.263397
2         3.0  2013-06-30          31.6          23.3    48.690479
3         4.0  2013-06-30          32.0          23.4    58.239788
4         5.0  2013-06-30          31.4          21.9    56.174095
...       ...         ...           ...           ...          ...
7747     23.0  2017-08-30          23.3          17.1    26.741310
7748     24.0  2017-08-30          23.3          17.7    24.040634
7749     25.0  2017-08-30          23.2          17.4    22.933014
7750      NaN         NaN          20.0          11.3    19.794666
7751      NaN         NaN          37.6          29.9    98.524734

      LDAPS_RHmax  LDAPS_Tmax_lapse  LDAPS_Tmin_lapse   LDAPS_WS
LDAPS_LH  \
0       91.116364         28.074101         23.006936   6.818887
69.451805
1       90.604721         29.850689         24.035009   5.691890
51.937448
2       83.973587         30.091292         24.565633   6.138224
20.573050
```

```
3       96.483688         29.704629         23.326177   5.650050
65.727144
4       90.155128         29.113934         23.486480   5.735004
107.965535
...           ...               ...               ...        ...
...
7747    78.869858         26.352081         18.775678   6.148918
72.058294
7748    77.294975         27.010193         18.733519   6.542819
47.241457
7749    77.243744         27.939516         18.522965   7.289264
9.090034
7750    58.936283         17.624954         14.272646   2.882580  -
13.603212
7751   100.000153         38.542255         29.619342  21.857621
213.414006

      ...  LDAPS_PPT2  LDAPS_PPT3  LDAPS_PPT4      lat      lon
DEM  \
0     ...    0.000000    0.000000    0.000000  37.6046  126.991
212.3350
1     ...    0.000000    0.000000    0.000000  37.6046  127.032
44.7624
2     ...    0.000000    0.000000    0.000000  37.5776  127.058
33.3068
3     ...    0.000000    0.000000    0.000000  37.6450  127.022
45.7160
4     ...    0.000000    0.000000    0.000000  37.5507  127.135
35.0380
...   ...         ...         ...         ...      ...      ...
...
7747  ...    0.000000    0.000000    0.000000  37.5372  126.891
15.5876
7748  ...    0.000000    0.000000    0.000000  37.5237  126.909
17.2956
7749  ...    0.000000    0.000000    0.000000  37.5237  126.970
19.5844
7750  ...    0.000000    0.000000    0.000000  37.4562  126.826
12.3700
7751  ...   21.621661   15.841235   16.655469  37.6450  127.135
212.3350

         Slope  Solar radiation  Next_Tmax  Next_Tmin
0     2.785000      5992.895996       29.1       21.2
1     0.514100      5869.312500       30.5       22.5
2     0.266100      5863.555664       31.1       23.9
3     2.534800      5856.964844       31.7       24.3
4     0.505500      5859.552246       31.2       22.5
...        ...              ...        ...        ...
```

```
7747  0.155400      4443.313965       28.3       18.1
7748  0.222300      4438.373535       28.6       18.8
7749  0.271300      4451.345215       27.8       17.4
7750  0.098475      4329.520508       17.4       11.3
7751  5.178230      5992.895996       38.9       29.8

[7752 rows x 25 columns]
```

```
main_data = pd.read_csv('Bias_correction_ucl.csv')
main_data.sample(10)
```

```
      station        Date  Present_Tmax  Present_Tmin  LDAPS_RHmin  \
355       6.0  2013-07-14          26.5          23.5    65.549965
6638     14.0  2017-07-17          28.8          26.0    59.148586
2163     14.0  2014-07-24          24.5          19.0    65.626198
2452      3.0  2014-08-05          28.7          24.7    70.530167
6971     22.0  2017-07-30          32.0          24.8    54.827930
1648     24.0  2014-07-03          25.3          21.4    42.039574
2854      5.0  2014-08-21          23.6          21.5    59.711246
4414     15.0  2015-08-21          28.4          22.8    38.611950
7625      1.0  2017-08-26          25.2          18.1    51.869904
1171     22.0  2013-08-15          33.2          26.2    52.092922

      LDAPS_RHmax  LDAPS_Tmax_lapse  LDAPS_Tmin_lapse  LDAPS_WS
LDAPS_LH  \
355     94.181763         30.221667         23.520221  6.908038
30.766633
6638    84.882111         31.165211         24.218230  6.149441
15.734958
2163    92.932800         31.979214         23.568098  7.939121
95.618308
2452    83.589104         27.932137         24.713666  4.674527
18.714207
6971    85.143456         31.572832         25.398230  5.324597
71.478461
1648    81.534416         30.991366         21.675931  5.641842
38.721476
2854    97.181526         27.664566         21.538094  5.832161
80.912008
4414    90.911377         30.469613         24.351966  6.436514
38.701617
7625    79.798698         23.725956         17.760520  5.794455
75.291540
1171    88.561287         32.642831         27.109044  6.804489
81.000755

      ...  LDAPS_PPT2  LDAPS_PPT3  LDAPS_PPT4      lat      lon
DEM  \
355   ...    0.462615    0.000000    0.000000  37.5102  127.042
54.6384
```

```
6638  ...    0.000000    0.000000    0.000000  37.4967  126.927
30.9680
2163  ...    0.000000    2.549734    1.291113  37.4967  126.927
30.9680
2452  ...    0.004749    0.089129    0.003611  37.5776  127.058
33.3068
6971  ...    0.000000    0.000000    0.025517  37.5102  127.086
21.9668
1648  ...    0.000000    0.011717    0.000000  37.5237  126.909
17.2956
2854  ...    0.048612    0.168615    0.000000  37.5507  127.135
35.0380
4414  ...    0.207468    0.000000    0.000000  37.5507  126.937
30.0464
7625  ...    0.000000    0.000000    0.000000  37.6046  126.991
212.3350
1171  ...    0.000000    0.000000    0.000000  37.5102  127.086
21.9668

       Slope  Solar radiation  Next_Tmax  Next_Tmin
355   0.1457      5744.228027       29.8       23.9
6638  0.6180      5685.721191       30.4       23.5
2163  0.6180      5564.984375       35.0       22.2
2452  0.2661      5296.954590       26.4       22.4
6971  0.1332      5432.503418       28.3       24.3
1648  0.2223      5832.412109       33.1       22.8
2854  0.5055      4786.577637       29.0       19.5
4414  0.8552      4808.338379       30.0       22.9
7625  2.7850      4769.281738       23.5       17.2
1171  0.1332      4987.023438       33.7       26.6

[10 rows x 25 columns]
```

```
main_data= main_data.drop(columns= ['station','Next_Tmin',
'Date','LDAPS_PPT2', 'LDAPS_PPT3', 'LDAPS_PPT4', 'lat',     'lon',
     'LDAPS_CC2','LDAPS_CC3','LDAPS_CC4','LDAPS_PPT1', 'Next_Tmax'])
main_data
```

```
      Present_Tmax  Present_Tmin  LDAPS_RHmin  LDAPS_RHmax
LDAPS_Tmax_lapse  \
0             28.7          21.4    58.255688    91.116364
28.074101
1             31.9          21.6    52.263397    90.604721
29.850689
2             31.6          23.3    48.690479    83.973587
30.091292
3             32.0          23.4    58.239788    96.483688
29.704629
4             31.4          21.9    56.174095    90.155128
29.113934
```

```
...            ...           ...          ...          ...
...
7747          23.3          17.1    26.741310    78.869858
26.352081
7748          23.3          17.7    24.040634    77.294975
27.010193
7749          23.2          17.4    22.933014    77.243744
27.939516
7750          20.0          11.3    19.794666    58.936283
17.624954
7751          37.6          29.9    98.524734   100.000153
38.542255

      LDAPS_Tmin_lapse   LDAPS_WS    LDAPS_LH  LDAPS_CC1       DEM
Slope  \
0            23.006936   6.818887   69.451805   0.233947  212.3350
2.785000
1            24.035009   5.691890   51.937448   0.225508   44.7624
0.514100
2            24.565633   6.138224   20.573050   0.209344   33.3068
0.266100
3            23.326177   5.650050   65.727144   0.216372   45.7160
2.534800
4            23.486480   5.735004  107.965535   0.151407   35.0380
0.505500
...                ...        ...         ...        ...        ...
...
7747         18.775678   6.148918   72.058294   0.030034   15.5876
0.155400
7748         18.733519   6.542819   47.241457   0.035874   17.2956
0.222300
7749         18.522965   7.289264    9.090034   0.048954   19.5844
0.271300
7750         14.272646   2.882580  -13.603212   0.000000   12.3700
0.098475
7751         29.619342  21.857621  213.414006   0.967277  212.3350
5.178230

      Solar radiation
0         5992.895996
1         5869.312500
2         5863.555664
3         5856.964844
4         5859.552246
...               ...
7747      4443.313965
7748      4438.373535
7749      4451.345215
7750      4329.520508
```

```
7751      5992.895996

[7752 rows x 12 columns]
```

```
Y= main_data['LDAPS_Tmin_lapse']
Y
```

```
0       23.006936
1       24.035009
2       24.565633
3       23.326177
4       23.486480
          ...
7747    18.775678
7748    18.733519
7749    18.522965
7750    14.272646
7751    29.619342
Name: LDAPS_Tmin_lapse, Length: 7752, dtype: float64
```

```
main_data.rename(columns = {'Present_Tmax': 'prMax',
                    'Present_Tmin': 'prMin',
                     'LDAPS_RHmin': 'minRelativeH',
                     'LDAPS_RHmax': 'maxRelativeH',
                     'LDAPS_Tmax_lapse': 'maxLapseR',
                    'LDAPS_Tmin_lapse': 'minLapseR',
                     'LDAPS_WS': 'avgWS',
                     'LDAPS_LH': 'avgLHF',
                     'LDAPS_CC1': 'CC'}, inplace=True)
```

```
main_data.columns
```

```
Index(['prMax', 'prMin', 'minRelativeH', 'maxRelativeH', 'maxLapseR',
       'minLapseR', 'avgWS', 'avgLHF', 'CC', 'DEM', 'Slope',
       'Solar radiation'],
      dtype='object')
```

```
main_data.info
```

```
<bound method DataFrame.info of       prMax  prMin  minRelativeH
maxRelativeH  maxLapseR  minLapseR  \
0      28.7   21.4     58.255688     91.116364  28.074101  23.006936

1      31.9   21.6     52.263397     90.604721  29.850689  24.035009

2      31.6   23.3     48.690479     83.973587  30.091292  24.565633

3      32.0   23.4     58.239788     96.483688  29.704629  23.326177

4      31.4   21.9     56.174095     90.155128  29.113934  23.486480
```

```
...     ...    ...           ...           ...        ...        ...

7747   23.3   17.1     26.741310     78.869858  26.352081  18.775678

7748   23.3   17.7     24.040634     77.294975  27.010193  18.733519

7749   23.2   17.4     22.933014     77.243744  27.939516  18.522965

7750   20.0   11.3     19.794666     58.936283  17.624954  14.272646

7751   37.6   29.9     98.524734    100.000153  38.542255  29.619342


          avgWS      avgLHF        CC       DEM     Slope  Solar
radiation
0      6.818887   69.451805  0.233947  212.3350  2.785000
5992.895996
1      5.691890   51.937448  0.225508   44.7624  0.514100
5869.312500
2      6.138224   20.573050  0.209344   33.3068  0.266100
5863.555664
3      5.650050   65.727144  0.216372   45.7160  2.534800
5856.964844
4      5.735004  107.965535  0.151407   35.0380  0.505500
5859.552246
...         ...         ...       ...       ...       ...
...
7747   6.148918   72.058294  0.030034   15.5876  0.155400
4443.313965
7748   6.542819   47.241457  0.035874   17.2956  0.222300
4438.373535
7749   7.289264    9.090034  0.048954   19.5844  0.271300
4451.345215
7750   2.882580  -13.603212  0.000000   12.3700  0.098475
4329.520508
7751  21.857621  213.414006  0.967277  212.3350  5.178230
5992.895996

[7752 rows x 12 columns]>
```

```
inputList = ['prMax', 'prMin', 'minRelativeH',
'maxRelativeH','maxLapseR', 'minLapseR', 'avgWS', 'avgLHF', 'CC',
'DEM', 'Slope', 'Solar radiation']
input = main_data[inputList]

input.isnull().sum()
```

```
prMax              70
prMin              70
minRelativeH       75
maxRelativeH       75
```

```
maxLapseR          75
minLapseR          75
avgWS              75
avgLHF             75
CC                 75
DEM                 0
Slope               0
Solar radiation     0
dtype: int64
```

```
output = main_data[['minRelativeH']]
```

```
output = output.fillna(output.median())
output.shape
output.duplicated().sum()
```

```
80
```

```
main_data.isnull()
main_data = main_data.fillna(main_data.median())
main_data
```

```
      prMax  prMin  minRelativeH  maxRelativeH  maxLapseR
minLapseR  \
0      28.7   21.4     58.255688     91.116364  28.074101  23.006936

1      31.9   21.6     52.263397     90.604721  29.850689  24.035009

2      31.6   23.3     48.690479     83.973587  30.091292  24.565633

3      32.0   23.4     58.239788     96.483688  29.704629  23.326177

4      31.4   21.9     56.174095     90.155128  29.113934  23.486480

...     ...    ...           ...           ...        ...        ...

7747   23.3   17.1     26.741310     78.869858  26.352081  18.775678

7748   23.3   17.7     24.040634     77.294975  27.010193  18.733519

7749   23.2   17.4     22.933014     77.243744  27.939516  18.522965

7750   20.0   11.3     19.794666     58.936283  17.624954  14.272646

7751   37.6   29.9     98.524734    100.000153  38.542255  29.619342


          avgWS      avgLHF        CC       DEM     Slope  Solar
radiation
0      6.818887   69.451805  0.233947  212.3350  2.785000
5992.895996
```

```
1      5.691890   51.937448  0.225508   44.7624  0.514100
5869.312500
2      6.138224   20.573050  0.209344   33.3068  0.266100
5863.555664
3      5.650050   65.727144  0.216372   45.7160  2.534800
5856.964844
4      5.735004  107.965535  0.151407   35.0380  0.505500
5859.552246
...         ...         ...       ...       ...       ...
...
7747   6.148918   72.058294  0.030034   15.5876  0.155400
4443.313965
7748   6.542819   47.241457  0.035874   17.2956  0.222300
4438.373535
7749   7.289264    9.090034  0.048954   19.5844  0.271300
4451.345215
7750   2.882580  -13.603212  0.000000   12.3700  0.098475
4329.520508
7751  21.857621  213.414006  0.967277  212.3350  5.178230
5992.895996

[7752 rows x 12 columns]
```

```
main_data.isnull().sum()
```

```
prMax              0
prMin              0
minRelativeH       0
maxRelativeH       0
maxLapseR          0
minLapseR          0
avgWS              0
avgLHF             0
CC                 0
DEM                0
Slope              0
Solar radiation    0
dtype: int64
```

```
pip install -U scikit-learn
```

```
Defaulting to user installation because normal site-packages is not
writeable
Collecting scikit-learn
  Obtaining dependency information for scikit-learn from
https://files.pythonhosted.org/packages/77/85/bff3a1e818ec6aa3dd466ff4
f4b0a727db9fdb41f2e849747ad902ddbe95/scikit_learn-1.3.0-cp311-cp311-
win_amd64.whl.metadata
  Downloading scikit_learn-1.3.0-cp311-cp311-win_amd64.whl.metadata
(11 kB)
```

```
Requirement already satisfied: numpy>=1.17.3 in c:\users\lenovo\
appdata\roaming\python\python311\site-packages (from scikit-learn)
(1.25.2)
Collecting scipy>=1.5.0 (from scikit-learn)
  Obtaining dependency information for scipy>=1.5.0 from
https://files.pythonhosted.org/packages/06/15/e73734f9170b66c6a84a0bd7
e03586e87e77404e2eb8e34749fc49fa43f7/scipy-1.11.2-cp311-cp311-
win_amd64.whl.metadata
  Downloading scipy-1.11.2-cp311-cp311-win_amd64.whl.metadata (59 kB)
     ---------------------------------------- 0.0/59.1 kB ? eta
-:--:--
     ---------------------------------------- 59.1/59.1 kB 3.1 MB/s
eta 0:00:00
Collecting joblib>=1.1.1 (from scikit-learn)
  Obtaining dependency information for joblib>=1.1.1 from
https://files.pythonhosted.org/packages/10/40/d551139c85db202f1f384ba8
bcf96aca2f329440a844f924c8a0040b6d02/joblib-1.3.2-py3-none-
any.whl.metadata
  Downloading joblib-1.3.2-py3-none-any.whl.metadata (5.4 kB)
Collecting threadpoolctl>=2.0.0 (from scikit-learn)
  Obtaining dependency information for threadpoolctl>=2.0.0 from
https://files.pythonhosted.org/packages/81/12/fd4dea011af9d69e1cad05c7
5f3f7202cdcbeac9b712eea58ca779a72865/threadpoolctl-3.2.0-py3-none-
any.whl.metadata
  Downloading threadpoolctl-3.2.0-py3-none-any.whl.metadata (10.0 kB)
Downloading scikit_learn-1.3.0-cp311-cp311-win_amd64.whl (9.2 MB)
   ---------------------------------------- 0.0/9.2 MB ? eta -:--:--
   -- ------------------------------------- 0.6/9.2 MB 11.8 MB/s eta
0:00:01
   --- ------------------------------------ 0.7/9.2 MB 7.7 MB/s eta
0:00:02
   ---- ----------------------------------- 0.9/9.2 MB 6.5 MB/s eta
0:00:02
   ---- ----------------------------------- 1.1/9.2 MB 5.9 MB/s eta
0:00:02
   ----- ---------------------------------- 1.3/9.2 MB 5.5 MB/s eta
0:00:02
   ------ --------------------------------- 1.5/9.2 MB 5.2 MB/s eta
0:00:02
   ------- -------------------------------- 1.6/9.2 MB 5.0 MB/s eta
0:00:02
   ------- -------------------------------- 1.8/9.2 MB 4.9 MB/s eta
0:00:02
   -------- ------------------------------- 2.0/9.2 MB 4.7 MB/s eta
0:00:02
   --------- ------------------------------ 2.2/9.2 MB 4.7 MB/s eta
0:00:02
   ---------- ----------------------------- 2.4/9.2 MB 4.6 MB/s eta
0:00:02
```

```
   ----------- ---------------------------- 2.5/9.2 MB 4.5 MB/s eta
0:00:02
   ----------- ---------------------------- 2.7/9.2 MB 4.4 MB/s eta
0:00:02
   ------------ ---------------------------- 2.9/9.2 MB 4.4 MB/s eta
0:00:02
   ------------- ------------------------- 3.1/9.2 MB 4.5 MB/s eta
0:00:02
   -------------- ------------------------- 3.3/9.2 MB 4.3 MB/s eta
0:00:02
   -------------- ------------------------- 3.4/9.2 MB 4.4 MB/s eta
0:00:02
   ---------------- ----------------------- 3.6/9.2 MB 4.3 MB/s eta
0:00:02
   ---------------- ----------------------- 3.8/9.2 MB 4.2 MB/s eta
0:00:02
   ----------------- ---------------------- 4.0/9.2 MB 4.3 MB/s eta
0:00:02
   ------------------ --------------------- 4.2/9.2 MB 4.3 MB/s eta
0:00:02
   ------------------ --------------------- 4.3/9.2 MB 4.3 MB/s eta
0:00:02
   ------------------- -------------------- 4.5/9.2 MB 4.2 MB/s eta
0:00:02
   -------------------- ------------------- 4.7/9.2 MB 4.2 MB/s eta
0:00:02
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0:00:01
   ---------------------------------------- 44.0/44.0 MB 3.7 MB/s eta
0:00:00
Downloading threadpoolctl-3.2.0-py3-none-any.whl (15 kB)
Installing collected packages: threadpoolctl, scipy, joblib, scikit-
learn
Successfully installed joblib-1.3.2 scikit-learn-1.3.0 scipy-1.11.2
threadpoolctl-3.2.0
Note: you may need to restart the kernel to use updated packages.
```

```
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression

x_train, x_test, y_train, y_test= train_test_split(input,output,
test_size=0.3, random_state=0)

x_train
```

```
      prMax  prMin  minRelativeH  maxRelativeH  maxLapseR
minLapseR  \
6962   32.4   25.1     48.446579     81.101311  33.173575  24.865377

1031   29.5   26.8           NaN           NaN        NaN        NaN

249    26.8   23.9     59.100754     94.579933  30.486747  24.378562

2784   23.6   20.1     77.475189     96.958069  23.874927  19.629710

3485   33.4   23.2     40.344585     65.746956  29.156051  21.340140

...     ...    ...           ...           ...        ...        ...

4931   33.4   25.1     75.379791     95.942955  26.683718  23.402165

3264   32.3   20.3     40.637978     64.212646  29.657513  23.249294

1653   31.6   21.6     49.419498     84.043106  30.552425  21.785842

2607   27.4   19.6     51.147076     92.764832  29.557037  22.451301

2732   29.2   21.2     60.048485     93.021439  26.661457  21.062700
```

```
          avgWS      avgLHF        CC       DEM   Slope  Solar
radiation
6962   5.352939   62.747479  0.181988   59.8324  2.6865
5434.702148
1031        NaN         NaN       NaN   12.3700  0.0985
5140.230957
249    8.567573   29.681216  0.913904   19.5844  0.2713
5785.897949
2784   5.856270   41.131574  0.872410  208.5070  5.1782
4843.271973
3485  11.224095   94.299025  0.132574   28.7000  0.6233
5723.078613
...         ...         ...       ...       ...     ...               .
..
4931   3.774118   90.345341  0.745746   12.3700  0.0985
5745.854980
3264   5.500212   25.083205  0.285534   30.0464  0.8552
5826.164063
1653   7.407677  101.544119  0.014348   45.7160  2.5348
5832.032227
2607   5.994706   47.468430  0.237105   52.5180  1.5629
5115.180664
2732   4.254807   36.080332  0.407012   52.5180  1.5629
4955.319824

[5426 rows x 12 columns]

y_train

      minRelativeH
6962     48.446579
1031     55.039024
249      59.100754
2784     77.475189
3485     40.344585
...            ...
4931     75.379791
3264     40.637978
1653     49.419498
2607     51.147076
2732     60.048485

[5426 rows x 1 columns]

x_test

      prMax  prMin  minRelativeH  maxRelativeH  maxLapseR
minLapseR  \
4271   32.1   24.5     63.083488     83.169289  27.043221  24.184606
```

```
971    32.7   24.9     57.288948     89.839920  33.530312  27.405979
7541   31.7   21.3     81.746681     90.070435  29.039634  23.828240
4806   26.4   20.5     68.170364     93.259880  25.199747  20.782339
2048   30.0   25.0     56.149647     91.013557  30.304948  24.716520
...     ...    ...           ...           ...        ...        ...
4162   30.4   25.1     31.287195     85.990143  33.564047  22.406384
5833   34.3   25.3     47.203590     90.999664  32.038195  24.848857
3814   30.8   24.1     73.752441     95.392082  28.257011  25.764625
3170   28.4   20.5     28.859676     78.474220  28.612619  20.291360
7401   27.6   20.5     60.326942     84.649559  28.402225  23.484118

         avgWS      avgLHF        CC      DEM   Slope  Solar radiation
4271  4.613474   69.023742  0.319488  21.9668  0.1332      4987.023438
971   8.275806   72.596921  0.299611  21.9668  0.1332      5228.346680
7541  6.686319   38.842143  0.324799  53.4712  0.6970      4765.267578
4806  3.917524   63.849919  0.567421  12.3700  0.0985      5799.268066
2048  6.070194   43.157278  0.139779  17.2956  0.2223      5646.496582
...        ...         ...       ...      ...     ...              ...
4162  6.618729   36.813558  0.047379  59.8324  2.6865      5111.087891
5833  4.771669  121.051648  0.000064  50.9312  0.4125      4949.122559
3814  7.631200   36.153160  0.530044  30.0464  0.8552      5496.536133
3170  8.263220   14.614233  0.008417  26.2980  0.5721      5848.048828
7401  4.162334   42.427461  0.288030  44.7624  0.5141      4941.636230

[2326 rows x 12 columns]
y_test
```

```
      minRelativeH
4271     63.083488
971      57.288948
7541     81.746681
4806     68.170364
2048     56.149647
...            ...
4162     31.287195
5833     47.203590
3814     73.752441
3170     28.859676
7401     60.326942

[2326 rows x 1 columns]
```

```
model= LinearRegression()
```

```
import numpy as np

median_value_y = np.nanmedian(y_train)
y_train_filled = np.nan_to_num(y_train, nan=median_value_y)

median_value_x = np.nanmedian(x_train)
x_train_filled = np.nan_to_num(x_train, nan=median_value_x)

x_train_filled = np.array(x_train_filled)
y_train_filled = np.array(y_train_filled)

model.fit(x_train_filled, y_train_filled)
```

```
LinearRegression()
```

```
x=model.intercept_

x
```

```
array([0.29051409])
```

```
y=model.coef_
y
```

```
array([[ 2.15968222e-02, -1.66186976e-02,  9.96584189e-01,
        -7.49305604e-03,  2.52175238e-02, -2.02276710e-02,
        -7.62730126e-03,  6.16989769e-04,  9.49759517e-01,
         2.62210633e-04,  1.42237822e-02, -6.21608689e-05]])
```

```
y_pred_train = model.predict(x_train_filled)
y_pred_train
```

```
array([[48.46691242],
       [54.8268393 ],
       [59.40827682],
```

```
       ...,
       [49.27003592],
       [51.05182706],
       [60.06581354]])
```

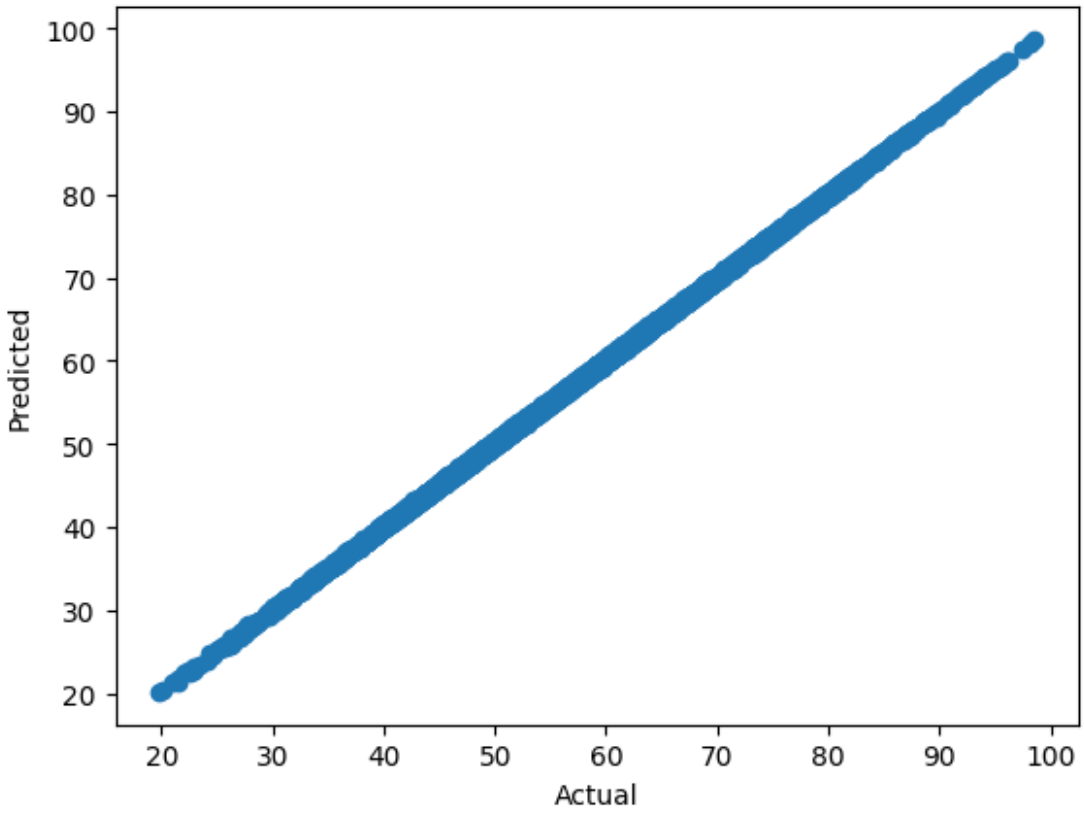
```
pip install matplotlib
```

```
Defaulting to user installation because normal site-packages is not
writeableNote: you may need to restart the kernel to use updated
packages.

Requirement already satisfied: matplotlib in c:\users\lenovo\appdata\
roaming\python\python311\site-packages (3.7.2)
Requirement already satisfied: contourpy>=1.0.1 in c:\users\lenovo\
appdata\roaming\python\python311\site-packages (from matplotlib)
(1.1.0)
Requirement already satisfied: cycler>=0.10 in c:\users\lenovo\
appdata\roaming\python\python311\site-packages (from matplotlib)
(0.11.0)
Requirement already satisfied: fonttools>=4.22.0 in c:\users\lenovo\
appdata\roaming\python\python311\site-packages (from matplotlib)
(4.42.0)
Requirement already satisfied: kiwisolver>=1.0.1 in c:\users\lenovo\
appdata\roaming\python\python311\site-packages (from matplotlib)
(1.4.4)
Requirement already satisfied: numpy>=1.20 in c:\users\lenovo\appdata\
roaming\python\python311\site-packages (from matplotlib) (1.25.2)
Requirement already satisfied: packaging>=20.0 in c:\users\lenovo\
appdata\roaming\python\python311\site-packages (from matplotlib)
(23.1)
Requirement already satisfied: pillow>=6.2.0 in c:\users\lenovo\
appdata\roaming\python\python311\site-packages (from matplotlib)
(10.0.0)
Requirement already satisfied: pyparsing<3.1,>=2.3.1 in c:\users\
lenovo\appdata\roaming\python\python311\site-packages (from
matplotlib) (3.0.9)
Requirement already satisfied: python-dateutil>=2.7 in c:\users\
lenovo\appdata\roaming\python\python311\site-packages (from
matplotlib) (2.8.2)
Requirement already satisfied: six>=1.5 in c:\users\lenovo\appdata\
roaming\python\python311\site-packages (from python-dateutil>=2.7-
>matplotlib) (1.16.0)
```

```
import matplotlib.pyplot as plt

plt.scatter(y_train_filled, y_pred_train)
plt.xlabel("Actual")
plt.ylabel("Predicted")
plt.show()
```




```
from sklearn.metrics import r2_score

r2_score(y_train_filled, y_pred_train)
```

```
0.999853798463216
```

```
x_test.isnull().sum()
```

```
prMax               19
prMin               19
minRelativeH        21
maxRelativeH        21
maxLapseR           21
minLapseR           21
avgWS               21
avgLHF              21
CC                  21
DEM                  0
Slope                0
Solar radiation      0
dtype: int64
```

```
x_test.isnull()
x_test = x_test.fillna(x_test.median())
x_test
```

```
      prMax  prMin  minRelativeH  maxRelativeH  maxLapseR
minLapseR  \
4271   32.1   24.5     63.083488     83.169289  27.043221  24.184606
971    32.7   24.9     57.288948     89.839920  33.530312  27.405979
7541   31.7   21.3     81.746681     90.070435  29.039634  23.828240
4806   26.4   20.5     68.170364     93.259880  25.199747  20.782339
2048   30.0   25.0     56.149647     91.013557  30.304948  24.716520
...     ...    ...           ...           ...        ...        ...
4162   30.4   25.1     31.287195     85.990143  33.564047  22.406384
5833   34.3   25.3     47.203590     90.999664  32.038195  24.848857
3814   30.8   24.1     73.752441     95.392082  28.257011  25.764625
3170   28.4   20.5     28.859676     78.474220  28.612619  20.291360
7401   27.6   20.5     60.326942     84.649559  28.402225  23.484118

         avgWS      avgLHF        CC      DEM   Slope  Solar radiation
4271  4.613474   69.023742  0.319488  21.9668  0.1332      4987.023438
971   8.275806   72.596921  0.299611  21.9668  0.1332      5228.346680
7541  6.686319   38.842143  0.324799  53.4712  0.6970      4765.267578
4806  3.917524   63.849919  0.567421  12.3700  0.0985      5799.268066
2048  6.070194   43.157278  0.139779  17.2956  0.2223      5646.496582
...        ...         ...       ...      ...     ...              ...
4162  6.618729   36.813558  0.047379  59.8324  2.6865      5111.087891
5833  4.771669  121.051648  0.000064  50.9312  0.4125      4949.122559
3814  7.631200   36.153160  0.530044  30.0464  0.8552      5496.536133
3170  8.263220   14.614233  0.008417  26.2980  0.5721      5848.048828
7401  4.162334   42.427461  0.288030  44.7624  0.5141      4941.636230
```

```
[2326 rows x 12 columns]
```

```
x_test.isnull().sum()
```

```
prMax               0
prMin               0
minRelativeH        0
maxRelativeH        0
maxLapseR           0
minLapseR           0
avgWS               0
avgLHF              0
CC                  0
DEM                 0
Slope               0
Solar radiation     0
dtype: int64
```

```
model.fit(x_train_filled, y_train_filled)
```

```
LinearRegression()
```

```
import warnings

with warnings.catch_warnings():
    # Suppress the warning
    warnings.simplefilter("ignore")
    model.fit(x_train_filled, y_train_filled)
```

```
x_test.isnull().sum()
```

```
prMax               0
prMin               0
minRelativeH        0
maxRelativeH        0
maxLapseR           0
minLapseR           0
avgWS               0
avgLHF              0
CC                  0
DEM                 0
Slope               0
Solar radiation     0
dtype: int64
```

```
x_test
```

```
      prMax  prMin  minRelativeH  maxRelativeH  maxLapseR
minLapseR  \
4271   32.1   24.5     63.083488     83.169289  27.043221  24.184606
```

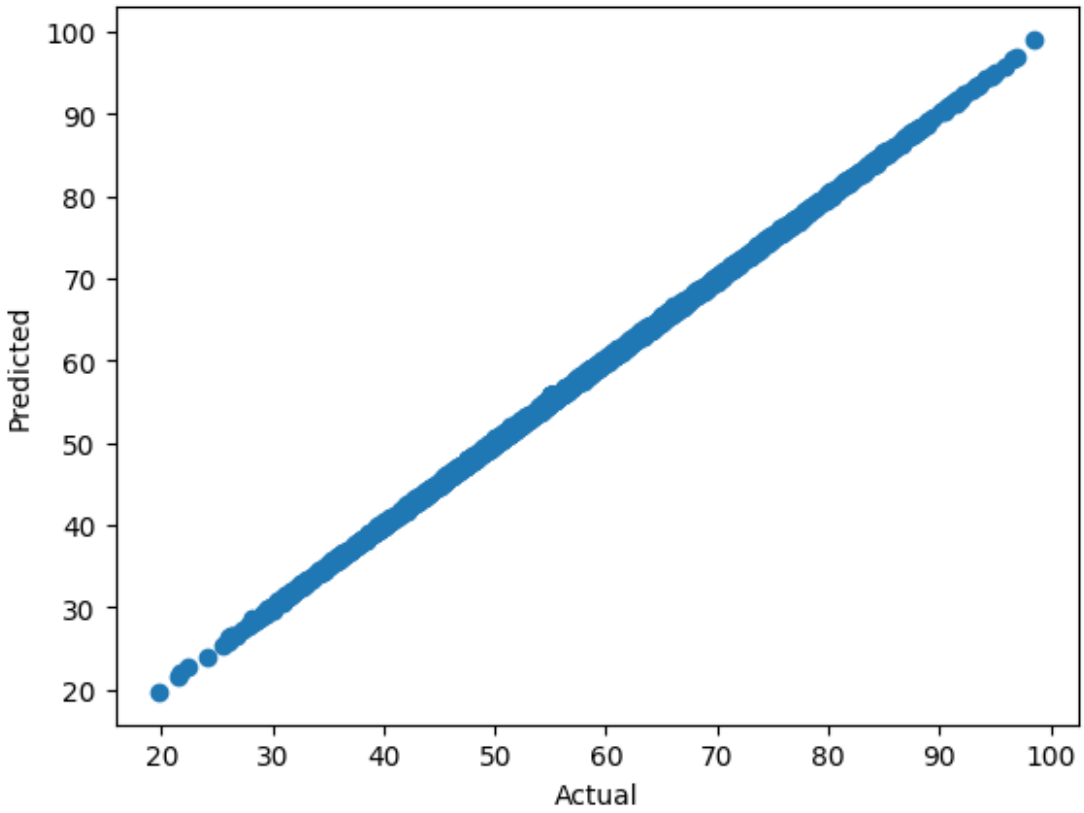
```
971    32.7   24.9     57.288948     89.839920  33.530312  27.405979
7541   31.7   21.3     81.746681     90.070435  29.039634  23.828240
4806   26.4   20.5     68.170364     93.259880  25.199747  20.782339
2048   30.0   25.0     56.149647     91.013557  30.304948  24.716520
...     ...    ...           ...           ...        ...        ...
4162   30.4   25.1     31.287195     85.990143  33.564047  22.406384
5833   34.3   25.3     47.203590     90.999664  32.038195  24.848857
3814   30.8   24.1     73.752441     95.392082  28.257011  25.764625
3170   28.4   20.5     28.859676     78.474220  28.612619  20.291360
7401   27.6   20.5     60.326942     84.649559  28.402225  23.484118

          avgWS      avgLHF        CC      DEM   Slope  Solar radiation
4271  4.613474   69.023742  0.319488  21.9668  0.1332      4987.023438
971   8.275806   72.596921  0.299611  21.9668  0.1332      5228.346680
7541  6.686319   38.842143  0.324799  53.4712  0.6970      4765.267578
4806  3.917524   63.849919  0.567421  12.3700  0.0985      5799.268066
2048  6.070194   43.157278  0.139779  17.2956  0.2223      5646.496582
...        ...         ...       ...      ...     ...              ...
4162  6.618729   36.813558  0.047379  59.8324  2.6865      5111.087891
5833  4.771669  121.051648  0.000064  50.9312  0.4125      4949.122559
3814  7.631200   36.153160  0.530044  30.0464  0.8552      5496.536133
3170  8.263220   14.614233  0.008417  26.2980  0.5721      5848.048828
7401  4.162334   42.427461  0.288030  44.7624  0.5141      4941.636230

[2326 rows x 12 columns]
```

```
import matplotlib.pyplot as plt
plt.scatter(y_test, y_pred_tes)
plt.xlabel("Actual")
```

```
plt.ylabel("Predicted")
plt.show()
```




```
median_value = np.nanmedian(y_test)
y_test_filled = np.nan_to_num(y_test, nan=median_value)

r2_score(y_test_filled, y_pred_tes)
```

```
0.9998365882695753
```