M26 _Xarxa_walkforard_normalitzat_multivariate2tempmin_weekdayseaso walkforwardaugment

December 21, 2019

1 Xarxa neuronal

```
In [1]: import pandas as pd
        import numpy as np
        from pandas import datetime
        from matplotlib import pyplot as plt

        import keras
        from keras.models import Sequential
        from keras.layers import Dense
        from keras.layers import LSTM

        from keras.optimizers import SGD
        from sklearn.model_selection import StratifiedKFold
        from scipy.stats import uniform as sp_rand
        from scipy.stats import randint
        from time import time
        from sklearn import preprocessing
```

```
Using TensorFlow backend.
```

1.1 Consum diari total multivariate one-step

```
In [2]: daily=pd.read_csv('C:/Users/Laura/Desktop/Smart meters London/workspace R/Dades netes/
        daily.head(5)
```

```
Out[2]:          date  apparentTemperatureMax  apparentTemperatureMin  sunsetTimeHour  \
        0  2014-02-08                    5.67                    2.19              17
        1  2013-12-24                   11.93                    2.68              15
        2  2012-11-01                   11.46                    0.85              16
        3  2014-02-05                    5.86                    1.03              16
        4  2012-04-17                   10.01                    2.76              19
```

```
   weekday  season  cloudCover  humidity  visibility  month  dewPoint  \
0        6  winter        0.47      0.77       11.20      2      3.99
1        2  winter        0.40      0.81       10.86     12      5.42
2        4  autumn        0.44      0.85       12.54     11      5.06
3        3  winter        0.73      0.77       10.91      2      4.06
4        2  spring        0.60      0.87       11.86      4      5.74

   pressure  energy_sum
0    979.25   11.569300
1    979.52   11.981672
2    979.63   10.781689
3    982.20   11.415105
4    982.22   10.617443
```

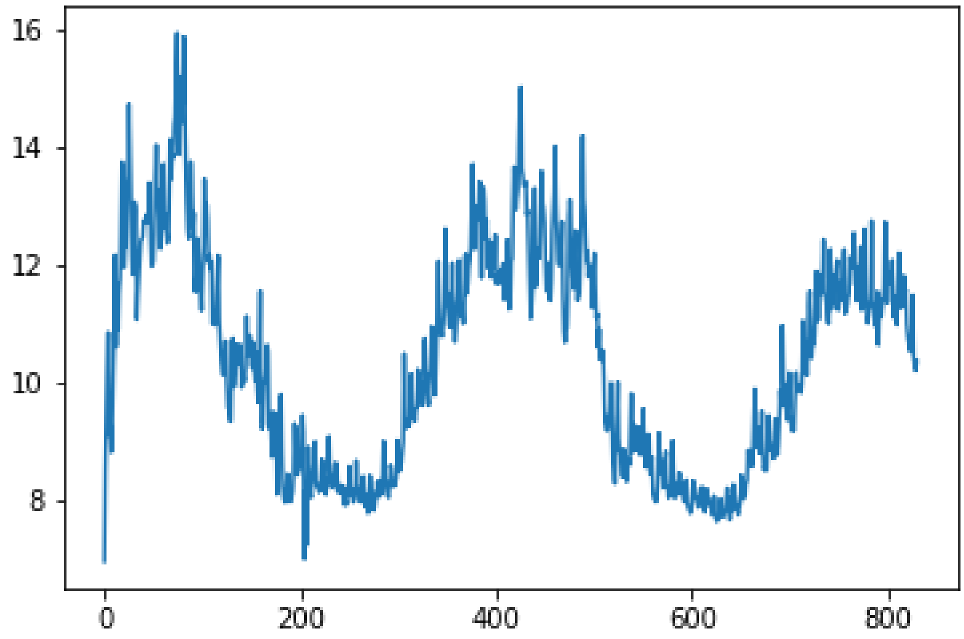
```
In [3]: #Ens quedem amb date i energy_sum, ordenem valors per data i resetejem index
        daily_dia=daily[['date','energy_sum','apparentTemperatureMax','apparentTemperatureMin'
        daily_dia.head(5)
```

```
Out[3]:    index        date  energy_sum  apparentTemperatureMax  \
        0    735  2011-11-23    6.952692                   10.36
        1    736  2011-11-24    8.536480                   12.93
        2    682  2011-11-25    9.499781                   13.03
        3    713  2011-11-26   10.267707                   12.96
        4    609  2011-11-27   10.850805                   13.54

           apparentTemperatureMin  humidity  weekday  season
        0                    2.18      0.93        3  autumn
        1                    7.01      0.89        4  autumn
        2                    4.84      0.79        5  autumn
        3                    4.69      0.81        6  autumn
        4                    2.94      0.72        7  autumn
```

```
In [18]: plt.plot(daily_dia.energy_sum )
```

```
Out[18]: [<matplotlib.lines.Line2D at 0x1d48d92d710>]
```



```
In [4]: daily_dia.season[daily_dia.season=='summer']=1
        daily_dia.season[daily_dia.season=='spring']=2
        daily_dia.season[daily_dia.season=='autumn']=3
        daily_dia.season[daily_dia.season=='winter']=4

        daily_dia.head(5)
```

```
c:\users\laura\appdata\local\programs\python\python37\lib\site-packages\ipykernel_launcher.py:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html
  """Entry point for launching an IPython kernel.
c:\users\laura\appdata\local\programs\python\python37\lib\site-packages\ipykernel_launcher.py:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html

c:\users\laura\appdata\local\programs\python\python37\lib\site-packages\ipykernel_launcher.py:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html
  This is separate from the ipykernel package so we can avoid doing imports until
c:\users\laura\appdata\local\programs\python\python37\lib\site-packages\ipykernel_launcher.py:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html
```

```
  after removing the cwd from sys.path.
```

```
Out[4]:    index        date  energy_sum  apparentTemperatureMax  \
        0    735  2011-11-23    6.952692                   10.36
        1    736  2011-11-24    8.536480                   12.93
        2    682  2011-11-25    9.499781                   13.03
        3    713  2011-11-26   10.267707                   12.96
        4    609  2011-11-27   10.850805                   13.54

           apparentTemperatureMin  humidity  weekday season
        0                    2.18      0.93        3      3
        1                    7.01      0.89        4      3
        2                    4.84      0.79        5      3
        3                    4.69      0.81        6      3
        4                    2.94      0.72        7      3
```

```
In [5]: daily_dia['t-1']=daily_dia['energy_sum'].shift(1)
        daily_dia['t-2']=daily_dia['energy_sum'].shift(2)
        daily_dia['t-3']=daily_dia['energy_sum'].shift(3)
        daily_dia['t-4']=daily_dia['energy_sum'].shift(4)
        daily_dia['t-5']=daily_dia['energy_sum'].shift(5)
        daily_dia['t-6']=daily_dia['energy_sum'].shift(6)
        daily_dia['t-7']=daily_dia['energy_sum'].shift(7)
        daily_dia['t-8']=daily_dia['energy_sum'].shift(8)
        daily_dia['t-9']=daily_dia['energy_sum'].shift(9)
        daily_dia['t-10']=daily_dia['energy_sum'].shift(10)
        daily_dia['t-11']=daily_dia['energy_sum'].shift(11)
        daily_dia['t-12']=daily_dia['energy_sum'].shift(12)
        daily_dia['t-13']=daily_dia['energy_sum'].shift(13)
        daily_dia['t-14']=daily_dia['energy_sum'].shift(14)

        daily_dia['temp(t-1)']=daily_dia['apparentTemperatureMax'].shift(1)
        daily_dia['temp(t-2)']=daily_dia['apparentTemperatureMax'].shift(2)
        daily_dia['temp(t-3)']=daily_dia['apparentTemperatureMax'].shift(3)
        daily_dia['temp(t-4)']=daily_dia['apparentTemperatureMax'].shift(4)
        daily_dia['temp(t-5)']=daily_dia['apparentTemperatureMax'].shift(5)
        daily_dia['temp(t-6)']=daily_dia['apparentTemperatureMax'].shift(6)
        daily_dia['temp(t-7)']=daily_dia['apparentTemperatureMax'].shift(7)
        daily_dia['temp(t-8)']=daily_dia['apparentTemperatureMax'].shift(8)
        daily_dia['temp(t-9)']=daily_dia['apparentTemperatureMax'].shift(9)
        daily_dia['temp(t-10)']=daily_dia['apparentTemperatureMax'].shift(10)
        daily_dia['temp(t-11)']=daily_dia['apparentTemperatureMax'].shift(11)
        daily_dia['temp(t-12)']=daily_dia['apparentTemperatureMax'].shift(12)
        daily_dia['temp(t-13)']=daily_dia['apparentTemperatureMax'].shift(13)
        daily_dia['temp(t-14)']=daily_dia['apparentTemperatureMax'].shift(14)

        daily_dia['tempmin(t-1)']=daily_dia['apparentTemperatureMin'].shift(1)
```

```
daily_dia['tempmin(t-2)']=daily_dia['apparentTemperatureMin'].shift(2)
daily_dia['tempmin(t-3)']=daily_dia['apparentTemperatureMin'].shift(3)
daily_dia['tempmin(t-4)']=daily_dia['apparentTemperatureMin'].shift(4)
daily_dia['tempmin(t-5)']=daily_dia['apparentTemperatureMin'].shift(5)
daily_dia['tempmin(t-6)']=daily_dia['apparentTemperatureMin'].shift(6)
daily_dia['tempmin(t-7)']=daily_dia['apparentTemperatureMin'].shift(7)
daily_dia['tempmin(t-8)']=daily_dia['apparentTemperatureMin'].shift(8)
daily_dia['tempmin(t-9)']=daily_dia['apparentTemperatureMin'].shift(9)
daily_dia['tempmin(t-10)']=daily_dia['apparentTemperatureMin'].shift(10)
daily_dia['tempmin(t-11)']=daily_dia['apparentTemperatureMin'].shift(11)
daily_dia['tempmin(t-12)']=daily_dia['apparentTemperatureMin'].shift(12)
daily_dia['tempmin(t-13)']=daily_dia['apparentTemperatureMin'].shift(13)
daily_dia['tempmin(t-14)']=daily_dia['apparentTemperatureMin'].shift(14)

daily_dia['humidity(t-1)']=daily_dia['humidity'].shift(1)
daily_dia['humidity(t-2)']=daily_dia['humidity'].shift(2)
daily_dia['humidity(t-3)']=daily_dia['humidity'].shift(3)
daily_dia['humidity(t-4)']=daily_dia['humidity'].shift(4)
daily_dia['humidity(t-5)']=daily_dia['humidity'].shift(5)
daily_dia['humidity(t-6)']=daily_dia['humidity'].shift(6)
daily_dia['humidity(t-7)']=daily_dia['humidity'].shift(7)
daily_dia['humidity(t-8)']=daily_dia['humidity'].shift(8)
daily_dia['humidity(t-9)']=daily_dia['humidity'].shift(9)
daily_dia['humidity(t-10)']=daily_dia['humidity'].shift(10)
daily_dia['humidity(t-11)']=daily_dia['humidity'].shift(11)
daily_dia['humidity(t-12)']=daily_dia['humidity'].shift(12)
daily_dia['humidity(t-13)']=daily_dia['humidity'].shift(13)
daily_dia['humidity(t-14)']=daily_dia['humidity'].shift(14)

daily_dia['weekday(t-1)']=daily_dia['weekday'].shift(1)
daily_dia['weekday(t-2)']=daily_dia['weekday'].shift(2)
daily_dia['weekday(t-3)']=daily_dia['weekday'].shift(3)
daily_dia['weekday(t-4)']=daily_dia['weekday'].shift(4)
daily_dia['weekday(t-5)']=daily_dia['weekday'].shift(5)
daily_dia['weekday(t-6)']=daily_dia['weekday'].shift(6)
daily_dia['weekday(t-7)']=daily_dia['weekday'].shift(7)
daily_dia['weekday(t-8)']=daily_dia['weekday'].shift(8)
daily_dia['weekday(t-9)']=daily_dia['weekday'].shift(9)
daily_dia['weekday(t-10)']=daily_dia['weekday'].shift(10)
daily_dia['weekday(t-11)']=daily_dia['weekday'].shift(11)
daily_dia['weekday(t-12)']=daily_dia['weekday'].shift(12)
daily_dia['weekday(t-13)']=daily_dia['weekday'].shift(13)
daily_dia['weekday(t-14)']=daily_dia['weekday'].shift(14)


daily_dia['season(t-1)']=daily_dia['season'].shift(1)
daily_dia['season(t-2)']=daily_dia['season'].shift(2)
daily_dia['season(t-3)']=daily_dia['season'].shift(3)
```

```
daily_dia['season(t-4)']=daily_dia['season'].shift(4)
daily_dia['season(t-5)']=daily_dia['season'].shift(5)
daily_dia['season(t-6)']=daily_dia['season'].shift(6)
daily_dia['season(t-7)']=daily_dia['season'].shift(7)
daily_dia['season(t-8)']=daily_dia['season'].shift(8)
daily_dia['season(t-9)']=daily_dia['season'].shift(9)
daily_dia['season(t-10)']=daily_dia['season'].shift(10)
daily_dia['season(t-11)']=daily_dia['season'].shift(11)
daily_dia['season(t-12)']=daily_dia['season'].shift(12)
daily_dia['season(t-13)']=daily_dia['season'].shift(13)
daily_dia['season(t-14)']=daily_dia['season'].shift(14)


daily_dia
```

```
Out[5]:      index        date  energy_sum  apparentTemperatureMax  \
        0      735  2011-11-23    6.952692                   10.36
        1      736  2011-11-24    8.536480                   12.93
        2      682  2011-11-25    9.499781                   13.03
        3      713  2011-11-26   10.267707                   12.96
        4      609  2011-11-27   10.850805                   13.54
        5      641  2011-11-28    9.103382                   12.58
        6      265  2011-11-29    9.274873                   13.47
        7      571  2011-11-30    8.813513                   11.87
        8      199  2011-12-01    9.227707                   12.15
        9      338  2011-12-02   10.145910                    5.33
        10     131  2011-12-03   10.780273                   11.42
        11     100  2011-12-04   12.163127                    6.66
        12     176  2011-12-05   10.609714                    3.13
        13     203  2011-12-06   11.673417                    3.77
        14     240  2011-12-07   10.889362                    5.14
        15     299  2011-12-08   11.525150                   12.89
        16     294  2011-12-09   11.759837                    3.99
        17     455  2011-12-10   12.633801                    3.14
        18     215  2011-12-11   13.749174                    5.72
        19     115  2011-12-12   11.951958                    5.94
        20      22  2011-12-13   11.957446                   12.08
        21      45  2011-12-14   12.392776                    2.88
        22      59  2011-12-15   12.307079                    4.38
        23      11  2011-12-16   13.376080                    0.99
        24     228  2011-12-17   13.511968                    1.72
        25     478  2011-12-18   14.732271                    1.98
        26     412  2011-12-19   13.774471                    4.02
        27     433  2011-12-20   12.709106                    4.98
        28     524  2011-12-21   12.148570                   12.14
        29     689  2011-12-22   11.839403                   12.14
        ..     ...         ...         ...                     ...
        800     41  2014-01-29   11.800777                    2.53
```

```
801    105  2014-01-30   11.685169                    5.86
802     80  2014-01-31   11.857957                    5.27
803     21  2014-02-01   11.710582                    6.86
804    163  2014-02-02   12.078164                    6.48
805    135  2014-02-03   11.280011                    4.59
806     60  2014-02-04   11.095584                    5.63
807      3  2014-02-05   11.415105                    5.86
808     18  2014-02-06   11.445403                    7.34
809     14  2014-02-07   10.972318                    8.44
810      0  2014-02-08   11.569300                    5.67
811      7  2014-02-09   12.202967                    3.91
812     35  2014-02-10   11.264175                    7.07
813     57  2014-02-11   11.452649                    4.06
814     44  2014-02-12   11.679099                    4.73
815     33  2014-02-13   11.285737                    3.42
816     23  2014-02-14   11.816914                   12.02
817     13  2014-02-15   11.490470                    5.79
818    187  2014-02-16   11.582159                    7.88
819    218  2014-02-17   10.979566                   10.67
820    235  2014-02-18   10.781898                   10.13
821    322  2014-02-19   10.674624                   10.13
822    101  2014-02-20   10.573835                   12.50
823    129  2014-02-21   10.518126                   10.15
824    248  2014-02-22   10.776242                   11.63
825    285  2014-02-23   11.480411                   11.94
826    158  2014-02-24   10.411403                   14.23
827     95  2014-02-25   10.294997                   11.43
828    360  2014-02-26   10.202945                   11.29
829    197  2014-02-27   10.356350                   10.31

     apparentTemperatureMin  humidity  weekday season        t-1        t-2  \
0                      2.18      0.93        3      3        NaN        NaN
1                      7.01      0.89        4      3   6.952692        NaN
2                      4.84      0.79        5      3   8.536480   6.952692
3                      4.69      0.81        6      3   9.499781   8.536480
4                      2.94      0.72        7      3  10.267707   9.499781
5                      1.31      0.86        1      3  10.850805  10.267707
6                      3.39      0.82        2      3   9.103382  10.850805
7                      3.34      0.78        3      3   9.274873   9.103382
8                      5.29      0.82        4      3   8.813513   9.274873
9                      0.46      0.87        5      3   9.227707   8.813513
10                     4.71      0.79        6      3  10.145910   9.227707
11                     1.03      0.82        7      3  10.780273  10.145910
12                    -1.69      0.77        1      3  12.163127  10.780273
13                    -1.61      0.83        2      3  10.609714  12.163127
14                     0.94      0.68        3      3  11.673417  10.609714
15                     0.63      0.81        4      3  10.889362  11.673417
16                    -1.42      0.71        5      3  11.525150  10.889362
```

```
17                    -3.42      0.81         6      3  11.759837  11.525150
18                     0.11      0.88         7      3  12.633801  11.759837
19                    -0.64      0.84         1      3  13.749174  12.633801
20                     0.22      0.75         2      3  11.951958  13.749174
21                     0.78      0.79         3      3  11.957446  11.951958
22                     1.07      0.77         4      3  12.392776  11.957446
23                    -2.65      0.88         5      3  12.307079  12.392776
24                    -3.56      0.86         6      3  13.376080  12.307079
25                    -4.12      0.84         7      3  13.511968  13.376080
26                    -3.67      0.94         1      3  14.732271  13.511968
27                     1.68      0.81         2      3  13.774471  14.732271
28                     3.84      0.94         3      3  12.709106  13.774471
29                     5.37      0.87         4      4  12.148570  12.709106
..                      ...       ...       ...    ...        ...        ...
800                    0.18      0.90         3      4  11.344805  11.753871
801                    0.61      0.91         4      4  11.800777  11.344805
802                    0.29      0.91         5      4  11.685169  11.800777
803                    1.10      0.76         6      4  11.857957  11.685169
804                    3.21      0.72         7      4  11.710582  11.857957
805                    1.96      0.79         1      4  12.078164  11.710582
806                    1.12      0.75         2      4  11.280011  12.078164
807                    1.03      0.77         3      4  11.095584  11.280011
808                    1.96      0.82         4      4  11.415105  11.095584
809                   -0.86      0.79         5      4  11.445403  11.415105
810                    2.19      0.77         6      4  10.972318  11.445403
811                    1.38      0.66         7      4  11.569300  10.972318
812                    0.89      0.84         1      4  12.202967  11.569300
813                   -0.57      0.76         2      4  11.264175  12.202967
814                   -1.20      0.75         3      4  11.452649  11.264175
815                    0.05      0.68         4      4  11.679099  11.452649
816                    0.45      0.81         5      4  11.285737  11.679099
817                    1.77      0.69         6      4  11.816914  11.285737
818                   -1.03      0.76         7      4  11.490470  11.816914
819                    2.84      0.83         1      4  11.582159  11.490470
820                    3.83      0.87         2      4  10.979566  11.582159
821                    2.65      0.87         3      4  10.781898  10.979566
822                    3.95      0.84         4      4  10.674624  10.781898
823                    0.19      0.72         5      4  10.573835  10.674624
824                    1.59      0.71         6      4  10.518126  10.573835
825                    5.53      0.76         7      4  10.776242  10.518126
826                    5.52      0.74         1      4  11.480411  10.776242
827                    3.89      0.78         2      4  10.411403  11.480411
828                    1.67      0.73         3      4  10.294997  10.411403
829                    1.41      0.74         4      4  10.202945  10.294997

     ...  season(t-5)  season(t-6)  season(t-7)  season(t-8)  season(t-9)  \
0    ...          NaN          NaN          NaN          NaN          NaN
1    ...          NaN          NaN          NaN          NaN          NaN
```

```
2    ...         NaN         NaN         NaN         NaN         NaN
3    ...         NaN         NaN         NaN         NaN         NaN
4    ...         NaN         NaN         NaN         NaN         NaN
5    ...           3         NaN         NaN         NaN         NaN
6    ...           3           3         NaN         NaN         NaN
7    ...           3           3           3         NaN         NaN
8    ...           3           3           3           3         NaN
9    ...           3           3           3           3           3
10   ...           3           3           3           3           3
11   ...           3           3           3           3           3
12   ...           3           3           3           3           3
13   ...           3           3           3           3           3
14   ...           3           3           3           3           3
15   ...           3           3           3           3           3
16   ...           3           3           3           3           3
17   ...           3           3           3           3           3
18   ...           3           3           3           3           3
19   ...           3           3           3           3           3
20   ...           3           3           3           3           3
21   ...           3           3           3           3           3
22   ...           3           3           3           3           3
23   ...           3           3           3           3           3
24   ...           3           3           3           3           3
25   ...           3           3           3           3           3
26   ...           3           3           3           3           3
27   ...           3           3           3           3           3
28   ...           3           3           3           3           3
29   ...           3           3           3           3           3
..   ...         ...         ...         ...         ...         ...
800  ...           4           4           4           4           4
801  ...           4           4           4           4           4
802  ...           4           4           4           4           4
803  ...           4           4           4           4           4
804  ...           4           4           4           4           4
805  ...           4           4           4           4           4
806  ...           4           4           4           4           4
807  ...           4           4           4           4           4
808  ...           4           4           4           4           4
809  ...           4           4           4           4           4
810  ...           4           4           4           4           4
811  ...           4           4           4           4           4
812  ...           4           4           4           4           4
813  ...           4           4           4           4           4
814  ...           4           4           4           4           4
815  ...           4           4           4           4           4
816  ...           4           4           4           4           4
817  ...           4           4           4           4           4
818  ...           4           4           4           4           4
```

```
819  ...            4            4            4            4            4
820  ...            4            4            4            4            4
821  ...            4            4            4            4            4
822  ...            4            4            4            4            4
823  ...            4            4            4            4            4
824  ...            4            4            4            4            4
825  ...            4            4            4            4            4
826  ...            4            4            4            4            4
827  ...            4            4            4            4            4
828  ...            4            4            4            4            4
829  ...            4            4            4            4            4

     season(t-10)  season(t-11)  season(t-12)  season(t-13)  season(t-14)
0             NaN           NaN           NaN           NaN           NaN
1             NaN           NaN           NaN           NaN           NaN
2             NaN           NaN           NaN           NaN           NaN
3             NaN           NaN           NaN           NaN           NaN
4             NaN           NaN           NaN           NaN           NaN
5             NaN           NaN           NaN           NaN           NaN
6             NaN           NaN           NaN           NaN           NaN
7             NaN           NaN           NaN           NaN           NaN
8             NaN           NaN           NaN           NaN           NaN
9             NaN           NaN           NaN           NaN           NaN
10              3           NaN           NaN           NaN           NaN
11              3             3           NaN           NaN           NaN
12              3             3             3           NaN           NaN
13              3             3             3             3           NaN
14              3             3             3             3             3
15              3             3             3             3             3
16              3             3             3             3             3
17              3             3             3             3             3
18              3             3             3             3             3
19              3             3             3             3             3
20              3             3             3             3             3
21              3             3             3             3             3
22              3             3             3             3             3
23              3             3             3             3             3
24              3             3             3             3             3
25              3             3             3             3             3
26              3             3             3             3             3
27              3             3             3             3             3
28              3             3             3             3             3
29              3             3             3             3             3
..            ...           ...           ...           ...           ...
800             4             4             4             4             4
801             4             4             4             4             4
802             4             4             4             4             4
803             4             4             4             4             4
```

```
804           4            4            4            4            4
805           4            4            4            4            4
806           4            4            4            4            4
807           4            4            4            4            4
808           4            4            4            4            4
809           4            4            4            4            4
810           4            4            4            4            4
811           4            4            4            4            4
812           4            4            4            4            4
813           4            4            4            4            4
814           4            4            4            4            4
815           4            4            4            4            4
816           4            4            4            4            4
817           4            4            4            4            4
818           4            4            4            4            4
819           4            4            4            4            4
820           4            4            4            4            4
821           4            4            4            4            4
822           4            4            4            4            4
823           4            4            4            4            4
824           4            4            4            4            4
825           4            4            4            4            4
826           4            4            4            4            4
827           4            4            4            4            4
828           4            4            4            4            4
829           4            4            4            4            4

[830 rows x 92 columns]
```

In [6]:
```
#Ens quedem amb energies i temperatures
#No agafem apparent temperature max ja que quan fem la predicció representa que no ho
daily_dia=daily_dia.drop(['index','date','apparentTemperatureMax','apparentTemperature
daily_dia.head(5)
```

Out[6]:
```
   energy_sum        t-1       t-2       t-3       t-4  t-5  t-6  t-7  t-8  \
0    6.952692        NaN       NaN       NaN       NaN  NaN  NaN  NaN  NaN
1    8.536480   6.952692       NaN       NaN       NaN  NaN  NaN  NaN  NaN
2    9.499781   8.536480  6.952692       NaN       NaN  NaN  NaN  NaN  NaN
3   10.267707   9.499781  8.536480  6.952692       NaN  NaN  NaN  NaN  NaN
4   10.850805  10.267707  9.499781  8.536480  6.952692  NaN  NaN  NaN  NaN

   t-9  ...  season(t-5)  season(t-6)  season(t-7)  season(t-8)  season(t-9)  \
0  NaN  ...          NaN          NaN          NaN          NaN          NaN
1  NaN  ...          NaN          NaN          NaN          NaN          NaN
2  NaN  ...          NaN          NaN          NaN          NaN          NaN
3  NaN  ...          NaN          NaN          NaN          NaN          NaN
4  NaN  ...          NaN          NaN          NaN          NaN          NaN
```

```
   season(t-10)  season(t-11)  season(t-12)  season(t-13)  season(t-14)
0           NaN           NaN           NaN           NaN           NaN
1           NaN           NaN           NaN           NaN           NaN
2           NaN           NaN           NaN           NaN           NaN
3           NaN           NaN           NaN           NaN           NaN
4           NaN           NaN           NaN           NaN           NaN

[5 rows x 85 columns]
```

```
In [7]: #Eliminem les 14 primeres files ja que contenen NaN (valors buits)

        daily_dia=daily_dia.drop([0,1,2,3,4,5,6,7,8,9,10,11,12,13])
        daily_dia.head(5)
```

```
Out[7]:     energy_sum        t-1        t-2        t-3        t-4        t-5  \
        14   10.889362  11.673417  10.609714  12.163127  10.780273  10.145910
        15   11.525150  10.889362  11.673417  10.609714  12.163127  10.780273
        16   11.759837  11.525150  10.889362  11.673417  10.609714  12.163127
        17   12.633801  11.759837  11.525150  10.889362  11.673417  10.609714
        18   13.749174  12.633801  11.759837  11.525150  10.889362  11.673417

                  t-6        t-7        t-8        t-9  ...  season(t-5)  season(t-6)  \
        14   9.227707   8.813513   9.274873   9.103382  ...            3            3
        15  10.145910   9.227707   8.813513   9.274873  ...            3            3
        16  10.780273  10.145910   9.227707   8.813513  ...            3            3
        17  12.163127  10.780273  10.145910   9.227707  ...            3            3
        18  10.609714  12.163127  10.780273  10.145910  ...            3            3

            season(t-7)  season(t-8)  season(t-9)  season(t-10)  season(t-11)  \
        14            3            3            3             3             3
        15            3            3            3             3             3
        16            3            3            3             3             3
        17            3            3            3             3             3
        18            3            3            3             3             3

            season(t-12)  season(t-13)  season(t-14)
        14             3             3             3
        15             3             3             3
        16             3             3             3
        17             3             3             3
        18             3             3             3

        [5 rows x 85 columns]
```

```
In [7]: len(daily_dia)
```

```
Out[7]: 816
```

```
In [8]: #normalitzem
        scaler=preprocessing.MinMaxScaler(feature_range=(0, 1))
        daily_dia_norm=scaler.fit_transform(daily_dia)
```

```
c:\users\laura\appdata\local\programs\python\python37\lib\site-packages\sklearn\preprocessing\d
  return self.partial_fit(X, y)
```

```
In [9]: #Seleccionem dades per test i train
        y_daily=daily_dia_norm[:,0]
        X_daily=daily_dia_norm[:,1:85]

        #y_daily=daily_dia['energy_sum']
        #X_daily=daily_dia.drop(['energy_sum'], axis='columns')



        #Reshape de [samples,timesteps] a [samples,timesteps,features]

        #Enlloc de 14 features en son 7 de una feature i 7 duna altre
        X_daily=np.reshape(X_daily, (X_daily.shape[0], 14,6))
```

```
In [10]: # definim model
         import tensorflow as tf
         model =Sequential()
         model.add(LSTM(50, activation='relu', input_shape=(14, 6)))
         model.add(Dense(1))
         model.compile(optimizer='adam', loss='mse', metrics=['accuracy'])
```

```
WARNING:tensorflow:From c:\users\laura\appdata\local\programs\python\python37\lib\site-packages
Instructions for updating:
Colocations handled automatically by placer.
```

```
In [11]: import math
         from sklearn.metrics import mean_squared_error

         #Walk forward per test i train
         minim=100
         n_train=465
         lenght=len(daily_dia)

         llista_evaluate=list()
         llista_prediccions=list()
         llista_preditrain=list()
         llista_scores=list()
         llista_scoretrain=list()
         sumScores=0
```

```
        for i in range(n_train,lenght):
            #minim=minim+1
            X_train,X_test= X_daily[minim:i],X_daily[i:i+1]
            y_train,y_test= y_daily[minim:i],y_daily[i:i+1]

            #fem fit al model
            model.fit(X_train, y_train, epochs=50, verbose=0)

            #mostrem score per cada model
            score=model.evaluate(X_test,y_test,verbose=0)
            llista_evaluate.append(score)

            #Predim per cadascun
            preditest=model.predict(X_test)
            llista_prediccions.append(preditest)

            preditrain=model.predict(X_train)
            llista_preditrain.append(preditrain)

            trainScore = math.sqrt(mean_squared_error(y_train, preditrain))
            llista_scoretrain.append(trainScore )


            testScore = math.sqrt(mean_squared_error(y_test, preditest))
            llista_scores.append(testScore)

            sumScores=sumScores+testScore
```

```
WARNING:tensorflow:From c:\users\laura\appdata\local\programs\python\python37\lib\site-packages
Instructions for updating:
Use tf.cast instead.
```

```
In [12]: #Dividim la suma de scores de test entre el nombre de prediccions per obtenir la mitj
         sumScores/(lenght-n_train)
```

```
Out[12]: 0.032129273523284034
```

```
In [13]: llista_scores
```

```
Out[13]: [0.028514891125445807,
          0.012696611658670642,
          0.05861392594051207,
          0.014634839635750518,
          0.0671863959535921,
          0.08288330407226607,
          0.016512475309754526,
          0.008673692716128834,
          0.11836624556074415,
          0.1232696914736473,
          0.03421395775914249,
          0.0081728707833435,
          0.10010886651721895,
          0.07800936251872481,
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          0.014033829859389613,
          0.06310761519373975,
          0.009969497126536497,
          0.08603952542506721,
          0.06191260118636399,
          0.014750346282794258,
          0.05860449386116984,
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          0.08421607315467661,
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          0.11598099938243189,
          0.15373362005045843,
          0.03870345584499346,
          0.02904879580003472,
          0.06539227955168014,
          0.027817980947353993,
          0.006622708657284093,
          0.04155934680365536,
          0.08819612439063207,
          0.023923120170529222,
          0.04629839978837946,
          0.010250207247910481,
          0.03872366108902536,
          0.004655869061718221,
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          0.002034719733007062,
          0.02627531264817562,
          0.05040585512514806,
          0.03595983108292855,
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          0.02495676060064622,
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          0.0124807216539633,
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          0.015566771851501349,
          0.0024746463361844384,
          0.0939895965246692,
          0.0885479211204736,
          0.06608757402869747,
          0.0648580096288689,
          0.005558226103340669,
          0.01699472529890067,
          0.06872089427014338,
          0.03964637079015776,
          0.07493294815668838,
          0.05975490391311322,
          0.018635939127974344,
          0.03229225607243369,
          0.06794191579457387,
          0.06097675782471845,
          0.02300149623418135,
          0.07480526560279266,
          0.01801877001753871,
          0.04420019321984592,
          0.018331963213638724,
          0.020903733011940484,
          0.025209568393007697,
          0.03450179524718133,
          0.016767613831851436,
          0.024276333031642228,
          0.03556531340584346,
          0.014200230504761824,
          0.01763897172200435,
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          0.0045581723786539685,
          0.02813697325124942,
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          0.03349872687117539,
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          0.00636431758651701,
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          0.018107613921606314,
          0.021901178858133474,
          0.008015886011335183,
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          0.017980489589137116,
          0.0019175423333888109,
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          0.0019736334158726443,
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          0.041397304792083256,
          0.013524765105297099,
          0.0019282986132979074,
          0.01833250021872279,
          0.023891423283504243,
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          0.044629404451095755,
          0.010011471782880976,
          0.0071445690604703405,
          0.08098757870133877,
          0.0811483894269256,
          0.06631327154917921,
          0.04517551911319728,
          0.07648258401042463,
          0.02578385182226106,
          0.11989794939087872,
          0.014863626358243565,
          0.030582003311311334,
          0.03791209802833362,
          0.03835832967534625,
          0.06758329765468796,
          0.04902281724785862,
          0.02762516054998332,
          0.005598650184524656,
          0.09590062358891438,
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          0.01662085438541938,
          0.06130803668539886,
          0.03759164647378088,
          0.03000579735811293,
          0.08023243045111816,
          0.007506940139997864,
          0.08626636837949442,
          0.03346590343920264,
          0.0075547841106684555,
          0.009797664623261593]
```
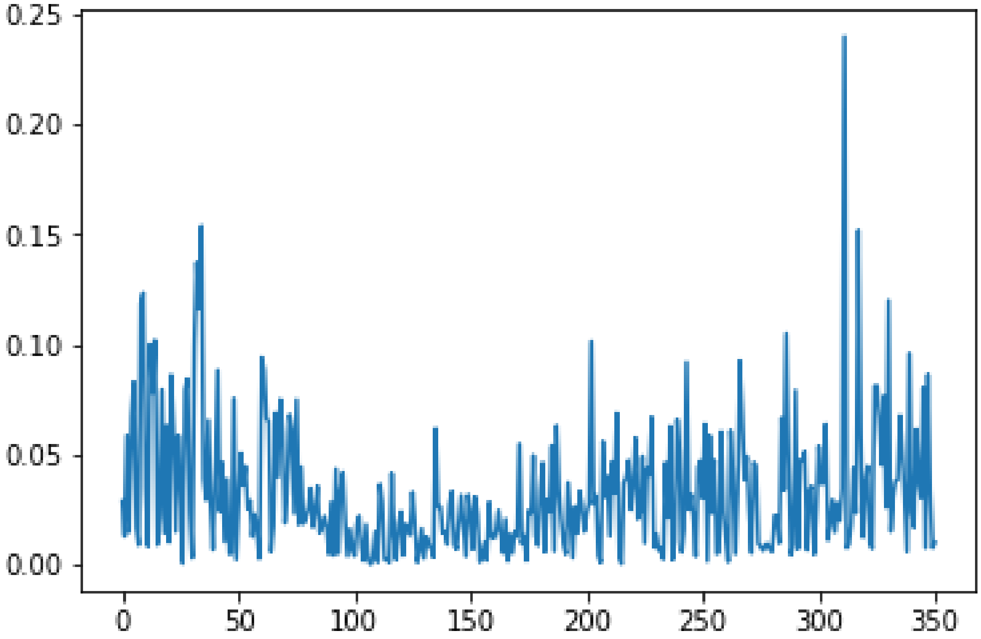

```
In [14]: plt.plot(llista_scores)
```

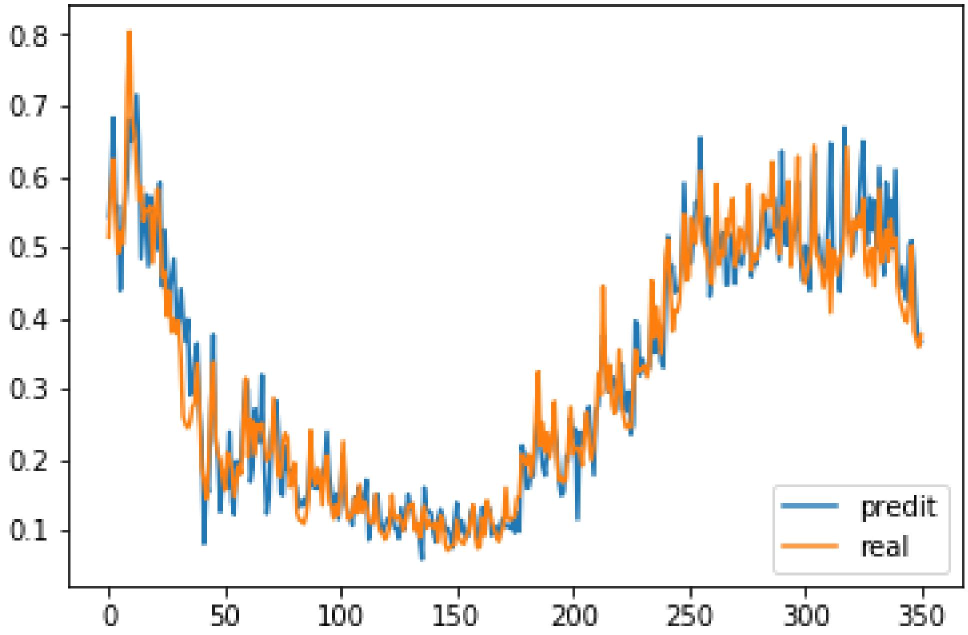
```
Out[14]: [<matplotlib.lines.Line2D at 0x25e9cefa828>]
```



```
In [15]: predis=list()

         for i in range(len(llista_prediccions)):
             predi=llista_prediccions[i].tolist()
             predis.append(predi)

         predis=np.reshape(predis, (351)  )

         predis
```

```
Out[15]: array([0.54257637, 0.59330517, 0.68294036, 0.55391437, 0.55854154,
                0.43926209, 0.52095401, 0.55905128, 0.60109353, 0.68136108,
                0.65050173, 0.65400374, 0.715303  , 0.64347541, 0.48380244,
                0.52773994, 0.57419366, 0.47293699, 0.57184315, 0.54090202,
                0.54122597, 0.49629915, 0.591685  , 0.44415402, 0.52433735,
                0.44358125, 0.4373076 , 0.45919314, 0.48307598, 0.40107539,
                0.39288366, 0.44075751, 0.39747313, 0.36625946, 0.3983582 ,
                0.29126021, 0.30381039, 0.34425285, 0.36376786, 0.27719581,
                0.22875585, 0.08121758, 0.16830662, 0.15354121, 0.27309585,
                0.3761425 , 0.22698247, 0.20225258, 0.12617597, 0.17310913,
                0.18296587, 0.15952042, 0.23849335, 0.14043434, 0.12221199,
                0.19791076, 0.17884314, 0.20257762, 0.27102518, 0.31243411,
                0.2977581 , 0.16849361, 0.18713932, 0.27140272, 0.24431095,
                0.22447672, 0.31942943, 0.18707871, 0.12333959, 0.14523594,
                0.23236968, 0.2545985 , 0.28322613, 0.23919643, 0.15206102,
                0.14928445, 0.21912813, 0.18605277, 0.17951813, 0.18694574,
                0.17005241, 0.15999831, 0.13175736, 0.13851593, 0.14473414,
                0.13372293, 0.16063483, 0.21929681, 0.16108209, 0.1595732 ,
                0.15924259, 0.16948809, 0.17894745, 0.1906375 , 0.23864052,
                0.17974733, 0.15442035, 0.12022644, 0.15125081, 0.11568493,
                0.16292545, 0.20742737, 0.13787735, 0.12392297, 0.11851424,
                0.10643858, 0.14730108, 0.12498209, 0.16105324, 0.14053775,
                0.14157246, 0.17102407, 0.08654045, 0.10741577, 0.11456469,
                0.15004869, 0.15074921, 0.11131696, 0.09773084, 0.10560804,
                0.11619595, 0.11058689, 0.1314244 , 0.10359811, 0.10217968,
                0.08830289, 0.1322829 , 0.09998479, 0.12019741, 0.15075499,
                0.13554403, 0.12516551, 0.10827863, 0.1026679 , 0.08641391,
                0.05940232, 0.16014633, 0.12865587, 0.12687007, 0.12293642,
                0.09416317, 0.08372745, 0.11701173, 0.12979114, 0.11974286,
                0.09938696, 0.10319119, 0.09358154, 0.07501916, 0.11126891,
                0.13887279, 0.09534718, 0.11408029, 0.10331215, 0.08959996,
                0.09287187, 0.12368536, 0.13377239, 0.11973106, 0.08719037,
                0.08878223, 0.13274767, 0.11727287, 0.1288389 , 0.13106072,
                0.09258614, 0.1020257 , 0.10517257, 0.08964267, 0.11154953,
                0.11691839, 0.1050852 , 0.10640768, 0.10233749, 0.11457457,
                0.09643199, 0.12332117, 0.09848701, 0.21951586, 0.20951036,
                0.15926071, 0.16049552, 0.18161137, 0.17607461, 0.23337135,
                0.27016783, 0.21342677, 0.18863176, 0.17727473, 0.21805501,
                0.21126564, 0.23428035, 0.2448445 , 0.22417924, 0.16777477,
                0.14898637, 0.15392508, 0.20488812, 0.19706444, 0.25906286,
                0.23027381, 0.243375  , 0.11549982, 0.23848774, 0.22260675,
                0.23752852, 0.26598403, 0.27476186, 0.22917092, 0.17798045,
                0.27030653, 0.27564043, 0.32360986, 0.37580383, 0.34267804,
                0.29608518, 0.29627994, 0.31654856, 0.31202698, 0.26925278,
                0.31848386, 0.33485967, 0.27987728, 0.26834643, 0.29623961,
                0.23532711, 0.24967277, 0.39555931, 0.39007187, 0.31887418,
                0.34207892, 0.3268849 , 0.32384986, 0.33158356, 0.40683481,
                0.3510904 , 0.35299349, 0.39172649, 0.33898011, 0.329795  ,
                0.43106741, 0.51536739, 0.46457016, 0.47332793, 0.43595457,
                0.44007075, 0.44514379, 0.47746861, 0.59060276, 0.49996227,
                0.48853588, 0.47746134, 0.51751626, 0.56345344, 0.55740994,
                0.65481806, 0.51622349, 0.50294882, 0.54182369, 0.42999491,
                0.45849121, 0.50615454, 0.52836609, 0.51735812, 0.48956618,
                0.52015531, 0.44649953, 0.44749737, 0.51280588, 0.51972634,
                0.44866306, 0.49543995, 0.48089921, 0.47479227, 0.50124836,
                0.52233666, 0.58233547, 0.45809335, 0.48021457, 0.47509798,
                0.49207729, 0.52487648, 0.55178994, 0.56279647, 0.49843445,
                0.52408421, 0.51557356, 0.56940997, 0.52623928, 0.48134154,
                0.63580418, 0.53197169, 0.50274324, 0.54672909, 0.52424538,
                0.509152  , 0.52566159, 0.59261483, 0.48918819, 0.45233029,
                0.50246483, 0.49800807, 0.43894613, 0.5719611 , 0.6329875 ,
                0.50710166, 0.51465213, 0.48328698, 0.47025084, 0.48330131,
                0.54333162, 0.64714611, 0.50368398, 0.48050648, 0.47846425,
                0.43780187, 0.51705533, 0.66912961, 0.58254385, 0.52010775,
                0.52339792, 0.49288529, 0.53460979, 0.5510478 , 0.6084252 ,
                0.64965451, 0.545645  , 0.50390196, 0.57090771, 0.52359414,
                0.56485236, 0.49678919, 0.61303186, 0.5154745 , 0.46026152,
                0.5915035 , 0.5289942 , 0.56694287, 0.49724671, 0.60899007,
                0.46919036, 0.44030038, 0.47300223, 0.43802518, 0.4242152 ,
                0.50328004, 0.50922847, 0.46855199, 0.4027459 , 0.36655027,
                0.36633709])
```

```
In [16]: ##Mostrem
         plt.plot(predis, label="predit")
         plt.plot(y_daily[n_train:lenght], label="real")
         plt.legend(loc="lower right")
         plt.show()
```



```
In [17]: #Creem un dataset amb format (nombre prediccions,17) per tornar les prediccions i els
         #El necessitem d'questa mida encara que només volguem passar 2 variables ja que al fe
```

```
#per fer la inversa necessitem 17 variables
#Com que només en tenim 2, les ajuntem al dataset inicial i ens quedem amb 15 variabl
#Obtenint un dataset amb 15 variables aleatories i les 2 variables que ens interessen


prova=daily_dia.iloc[n_train:lenght]
prova
#len(predis)
#lenght-n_train
prova['predi']=predis
prova['y']=y_daily[n_train:lenght]
prova=prova.drop(['energy_sum','t-1'], axis=1)
prova

prova=prova[['predi','y','t-2','t-3','t-4','t-5','t-6','t-7','t-8','t-9','t-10','t-11
prova
```

```
c:\users\laura\appdata\local\programs\python\python37\lib\site-packages\ipykernel_launcher.py:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html
  if sys.path[0] == '':
c:\users\laura\appdata\local\programs\python\python37\lib\site-packages\ipykernel_launcher.py:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html
  del sys.path[0]
```

```
Out[17]:        predi         y        t-2        t-3        t-4        t-5  \
        479  0.542576  0.514061  12.119938  12.852295  13.106773  12.823073
        480  0.593305  0.580609  11.786082  12.119938  12.852295  13.106773
        481  0.682940  0.624326  11.590859  11.786082  12.119938  12.852295
        482  0.553914  0.539280  12.186487  11.590859  11.786082  12.119938
        483  0.558542  0.491355  12.577783  12.186487  11.590859  11.786082
        484  0.439262  0.522145  11.816573  12.577783  12.186487  11.590859
        485  0.520954  0.504442  11.387627  11.816573  12.577783  12.186487
        486  0.559051  0.567725  11.663214  11.387627  11.816573  12.577783
        487  0.601094  0.719460  11.504756  11.663214  11.387627  11.816573
        488  0.681361  0.804631  12.071173  11.504756  11.663214  11.387627
        489  0.650502  0.684716  13.429271  12.071173  11.504756  11.663214
        490  0.654004  0.662177  14.191591  13.429271  12.071173  11.504756
        491  0.715303  0.615194  13.118295  14.191591  13.429271  12.071173
        492  0.643475  0.565466  12.916559  13.118295  14.191591  13.429271
        493  0.483802  0.585646  12.496044  12.916559  13.118295  14.191591
        494  0.527740  0.536523  12.050954  12.496044  12.916559  13.118295
```

```
495  0.574194  0.552256  12.231576  12.050954  12.496044  12.916559
496  0.472937  0.552256  11.791904  12.231576  12.050954  12.496044
497  0.571843  0.557809  11.932721  11.791904  12.231576  12.050954
498  0.540902  0.477794  11.932721  11.932721  11.791904  12.231576
499  0.541226  0.551195  11.982423  11.932721  11.932721  11.791904
500  0.496299  0.582339  11.266252  11.982423  11.932721  11.932721
501  0.591685  0.529772  11.923226  11.266252  11.982423  11.932721
502  0.444154  0.458904  12.201972  11.923226  11.266252  11.982423
503  0.524337  0.465733  11.731479  12.201972  11.923226  11.266252
504  0.443581  0.402622  11.097177  11.731479  12.201972  11.923226
505  0.437308  0.436918  11.158295  11.097177  11.731479  12.201972
506  0.459193  0.380048  10.593420  11.158295  11.097177  11.731479
507  0.483076  0.398860  10.900388  10.593420  11.158295  11.097177
508  0.401075  0.377916  10.391372  10.900388  10.593420  11.158295
..        ...       ...        ...        ...        ...        ...
800  0.492885  0.537515  11.753871  12.729659  11.620778  11.409880
801  0.534610  0.524598  11.344805  11.753871  12.729659  11.620778
802  0.551048  0.543903  11.800777  11.344805  11.753871  12.729659
803  0.608425  0.527438  11.685169  11.800777  11.344805  11.753871
804  0.649655  0.568506  11.857957  11.685169  11.800777  11.344805
805  0.545645  0.479332  11.710582  11.857957  11.685169  11.800777
806  0.503902  0.458726  12.078164  11.710582  11.857957  11.685169
807  0.570908  0.494425  11.280011  12.078164  11.710582  11.857957
808  0.523594  0.497810  11.095584  11.280011  12.078164  11.710582
809  0.564852  0.444954  11.415105  11.095584  11.280011  12.078164
810  0.496789  0.511653  11.445403  11.415105  11.095584  11.280011
811  0.613032  0.582450  10.972318  11.445403  11.415105  11.095584
812  0.515474  0.477562  11.569300  10.972318  11.445403  11.415105
813  0.460262  0.498620  12.202967  11.569300  10.972318  11.445403
814  0.591504  0.523920  11.264175  12.202967  11.569300  10.972318
815  0.528994  0.479971  11.452649  11.264175  12.202967  11.569300
816  0.566943  0.539318  11.679099  11.452649  11.264175  12.202967
817  0.497247  0.502845  11.285737  11.679099  11.452649  11.264175
818  0.608990  0.513089  11.816914  11.285737  11.679099  11.452649
819  0.469190  0.445764  11.490470  11.816914  11.285737  11.679099
820  0.440300  0.423680  11.582159  11.490470  11.816914  11.285737
821  0.473002  0.411694  10.979566  11.582159  11.490470  11.816914
822  0.438025  0.400434  10.781898  10.979566  11.582159  11.490470
823  0.424215  0.394209  10.674624  10.781898  10.979566  11.582159
824  0.503280  0.423048  10.573835  10.674624  10.781898  10.979566
825  0.509228  0.501722  10.518126  10.573835  10.674624  10.781898
826  0.468552  0.382286  10.776242  10.518126  10.573835  10.674624
827  0.402746  0.369280  11.480411  10.776242  10.518126  10.573835
828  0.366550  0.358995  10.411403  11.480411  10.776242  10.518126
829  0.366337  0.376135  10.294997  10.411403  11.480411  10.776242

           t-6        t-7        t-8        t-9  ...  season(t-5)  \
479  11.559878  10.930170  10.889469  10.675248  ...            4
```

```
480  12.823073  11.559878  10.930170  10.889469  ...          4
481  13.106773  12.823073  11.559878  10.930170  ...          4
482  12.852295  13.106773  12.823073  11.559878  ...          4
483  12.119938  12.852295  13.106773  12.823073  ...          4
484  11.786082  12.119938  12.852295  13.106773  ...          4
485  11.590859  11.786082  12.119938  12.852295  ...          4
486  12.186487  11.590859  11.786082  12.119938  ...          4
487  12.577783  12.186487  11.590859  11.786082  ...          4
488  11.816573  12.577783  12.186487  11.590859  ...          4
489  11.387627  11.816573  12.577783  12.186487  ...          4
490  11.663214  11.387627  11.816573  12.577783  ...          4
491  11.504756  11.663214  11.387627  11.816573  ...          2
492  12.071173  11.504756  11.663214  11.387627  ...          2
493  13.429271  12.071173  11.504756  11.663214  ...          2
494  14.191591  13.429271  12.071173  11.504756  ...          2
495  13.118295  14.191591  13.429271  12.071173  ...          2
496  12.916559  13.118295  14.191591  13.429271  ...          2
497  12.496044  12.916559  13.118295  14.191591  ...          2
498  12.050954  12.496044  12.916559  13.118295  ...          2
499  12.231576  12.050954  12.496044  12.916559  ...          2
500  11.791904  12.231576  12.050954  12.496044  ...          2
501  11.932721  11.791904  12.231576  12.050954  ...          2
502  11.932721  11.932721  11.791904  12.231576  ...          2
503  11.982423  11.932721  11.932721  11.791904  ...          2
504  11.266252  11.982423  11.932721  11.932721  ...          2
505  11.923226  11.266252  11.982423  11.932721  ...          2
506  12.201972  11.923226  11.266252  11.982423  ...          2
507  11.731479  12.201972  11.923226  11.266252  ...          2
508  11.097177  11.731479  12.201972  11.923226  ...          2
..         ...        ...        ...        ...  ...        ...
800  11.300414  11.109560  11.370601  11.430883  ...          4
801  11.409880  11.300414  11.109560  11.370601  ...          4
802  11.620778  11.409880  11.300414  11.109560  ...          4
803  12.729659  11.620778  11.409880  11.300414  ...          4
804  11.753871  12.729659  11.620778  11.409880  ...          4
805  11.344805  11.753871  12.729659  11.620778  ...          4
806  11.800777  11.344805  11.753871  12.729659  ...          4
807  11.685169  11.800777  11.344805  11.753871  ...          4
808  11.857957  11.685169  11.800777  11.344805  ...          4
809  11.710582  11.857957  11.685169  11.800777  ...          4
810  12.078164  11.710582  11.857957  11.685169  ...          4
811  11.280011  12.078164  11.710582  11.857957  ...          4
812  11.095584  11.280011  12.078164  11.710582  ...          4
813  11.415105  11.095584  11.280011  12.078164  ...          4
814  11.445403  11.415105  11.095584  11.280011  ...          4
815  10.972318  11.445403  11.415105  11.095584  ...          4
816  11.569300  10.972318  11.445403  11.415105  ...          4
817  12.202967  11.569300  10.972318  11.445403  ...          4
```

```
818  11.264175  12.202967  11.569300  10.972318  ...          4
819  11.452649  11.264175  12.202967  11.569300  ...          4
820  11.679099  11.452649  11.264175  12.202967  ...          4
821  11.285737  11.679099  11.452649  11.264175  ...          4
822  11.816914  11.285737  11.679099  11.452649  ...          4
823  11.490470  11.816914  11.285737  11.679099  ...          4
824  11.582159  11.490470  11.816914  11.285737  ...          4
825  10.979566  11.582159  11.490470  11.816914  ...          4
826  10.781898  10.979566  11.582159  11.490470  ...          4
827  10.674624  10.781898  10.979566  11.582159  ...          4
828  10.573835  10.674624  10.781898  10.979566  ...          4
829  10.518126  10.573835  10.674624  10.781898  ...          4

     season(t-6)  season(t-7)  season(t-8)  season(t-9)  season(t-10)  \
479            4            4            4            4             4
480            4            4            4            4             4
481            4            4            4            4             4
482            4            4            4            4             4
483            4            4            4            4             4
484            4            4            4            4             4
485            4            4            4            4             4
486            4            4            4            4             4
487            4            4            4            4             4
488            4            4            4            4             4
489            4            4            4            4             4
490            4            4            4            4             4
491            4            4            4            4             4
492            2            4            4            4             4
493            2            2            4            4             4
494            2            2            2            4             4
495            2            2            2            2             4
496            2            2            2            2             2
497            2            2            2            2             2
498            2            2            2            2             2
499            2            2            2            2             2
500            2            2            2            2             2
501            2            2            2            2             2
502            2            2            2            2             2
503            2            2            2            2             2
504            2            2            2            2             2
505            2            2            2            2             2
506            2            2            2            2             2
507            2            2            2            2             2
508            2            2            2            2             2
..           ...          ...          ...          ...           ...
800            4            4            4            4             4
801            4            4            4            4             4
802            4            4            4            4             4
```

```
803            4            4            4            4             4
804            4            4            4            4             4
805            4            4            4            4             4
806            4            4            4            4             4
807            4            4            4            4             4
808            4            4            4            4             4
809            4            4            4            4             4
810            4            4            4            4             4
811            4            4            4            4             4
812            4            4            4            4             4
813            4            4            4            4             4
814            4            4            4            4             4
815            4            4            4            4             4
816            4            4            4            4             4
817            4            4            4            4             4
818            4            4            4            4             4
819            4            4            4            4             4
820            4            4            4            4             4
821            4            4            4            4             4
822            4            4            4            4             4
823            4            4            4            4             4
824            4            4            4            4             4
825            4            4            4            4             4
826            4            4            4            4             4
827            4            4            4            4             4
828            4            4            4            4             4
829            4            4            4            4             4

     season(t-11)  season(t-12)  season(t-13)  season(t-14)
479             4             4             4             4
480             4             4             4             4
481             4             4             4             4
482             4             4             4             4
483             4             4             4             4
484             4             4             4             4
485             4             4             4             4
486             4             4             4             4
487             4             4             4             4
488             4             4             4             4
489             4             4             4             4
490             4             4             4             4
491             4             4             4             4
492             4             4             4             4
493             4             4             4             4
494             4             4             4             4
495             4             4             4             4
496             4             4             4             4
497             2             4             4             4
```

```
498             2             2             4             4
499             2             2             2             4
500             2             2             2             2
501             2             2             2             2
502             2             2             2             2
503             2             2             2             2
504             2             2             2             2
505             2             2             2             2
506             2             2             2             2
507             2             2             2             2
508             2             2             2             2
..            ...           ...           ...           ...
800             4             4             4             4
801             4             4             4             4
802             4             4             4             4
803             4             4             4             4
804             4             4             4             4
805             4             4             4             4
806             4             4             4             4
807             4             4             4             4
808             4             4             4             4
809             4             4             4             4
810             4             4             4             4
811             4             4             4             4
812             4             4             4             4
813             4             4             4             4
814             4             4             4             4
815             4             4             4             4
816             4             4             4             4
817             4             4             4             4
818             4             4             4             4
819             4             4             4             4
820             4             4             4             4
821             4             4             4             4
822             4             4             4             4
823             4             4             4             4
824             4             4             4             4
825             4             4             4             4
826             4             4             4             4
827             4             4             4             4
828             4             4             4             4
829             4             4             4             4

[351 rows x 85 columns]
```

```
In [18]: # Convert predictions back to normal values

         predi = scaler.inverse_transform(prova)
         print(predi)
         print(predi[0][0])
         print(predi[0][1])

         #Les variables en posició 0 i 1 són predicció i y respectivament
```

```
[[ 11.8460809   11.59085917 115.46893021 ...  13.          13.
   13.        ]
 [ 12.30012757  12.18648691 112.48075791 ...  13.          13.
   13.        ]
 [ 13.10240484  12.57778255 110.7334244  ...  13.          13.
   13.        ]
 ...
 [ 10.59453222  10.2949966  109.74485905 ...  13.          13.
   13.        ]
 [ 10.2705642   10.20294532 100.17673598 ...  13.          13.
   13.        ]
 [ 10.26865618  10.3563499   99.13484299 ...  13.          13.
   13.        ]]
11.846080899304617
11.590859170709699
```

```
In [19]: #Fem una llista amb les prediccions i una llista amb y(valor real)

         listpredi=list()
         for i in range(len(predi)):
             listpredi.append(predi[i][0])
         listpredi

         listy=list()
         for i in range(len(predi)):
             listy.append(predi[i][1])
         listy
```

```
Out[19]: [11.590859170709699,
          12.186486909458,
          12.5777825527296,
          11.816572589134799,
          11.3876267050719,
          11.6632140210701,
          11.5047561338867,
          12.071172692490801,
          13.4292708131623,
          14.1915913964734,
          13.1182948122023,
          12.916559451200099,
          12.4960441531868,
          12.050954318124699,
          12.231575736212301,
          11.7919036962847,
          11.9327208888355,
          11.9327208888355,
          11.9824229419611,
          11.266251710893302,
          11.923225859637402,
          12.2019722473821,
          11.7314792668086,
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          10.411403084521401,
          10.294996596876901,
          10.202945322371301,
          10.3563498993587]
```
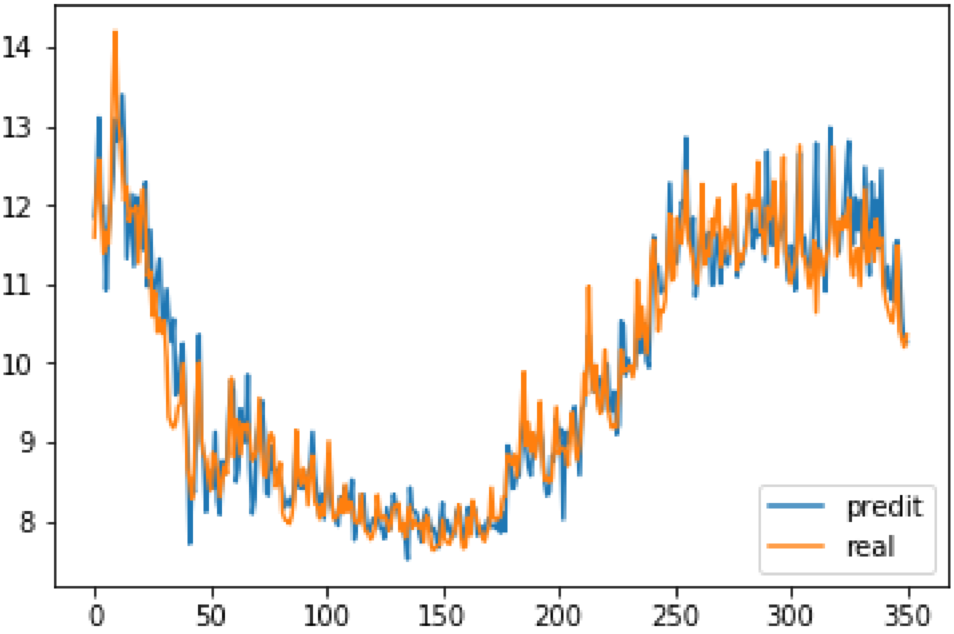
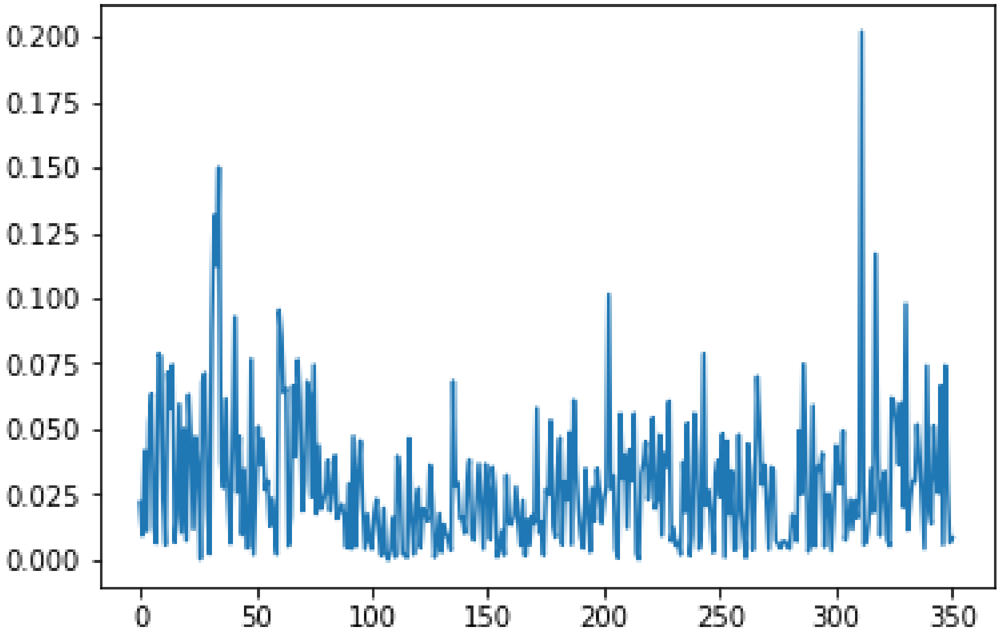

```
In [20]: ##Mostrem
         plt.plot(listpredi, label="predit")
         plt.plot(listy, label="real")
         plt.legend(loc="lower right")
         plt.show()
```



```
In [21]: llista_errors=list()
         llista_errorsabs=list()
         llista_errorsres=list()


         for i in range(len(listpredi)):
             valor=listy[i]-listpredi[i]
             valorabs=math.fabs(valor)
             valorrespecte=valorabs/listy[i]
             llista_errors.append(valor)
             llista_errorsabs.append(valorabs)
             llista_errorsres.append(valorrespecte)

         plt.plot(llista_errorsres)

         error_mitja=sum(llista_errorsres)/(len(llista_errorsres))*100
         print("L'error mitjà és de {} % " .format(error_mitja))
```

```
L'error mitjà és de 2.8676329003210257 %
```



```
In [ ]:
```