M22 _Xarxa_walkforard_normalitzat_multivariate2tempmin_posta_14dies-walkforward augment

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
```

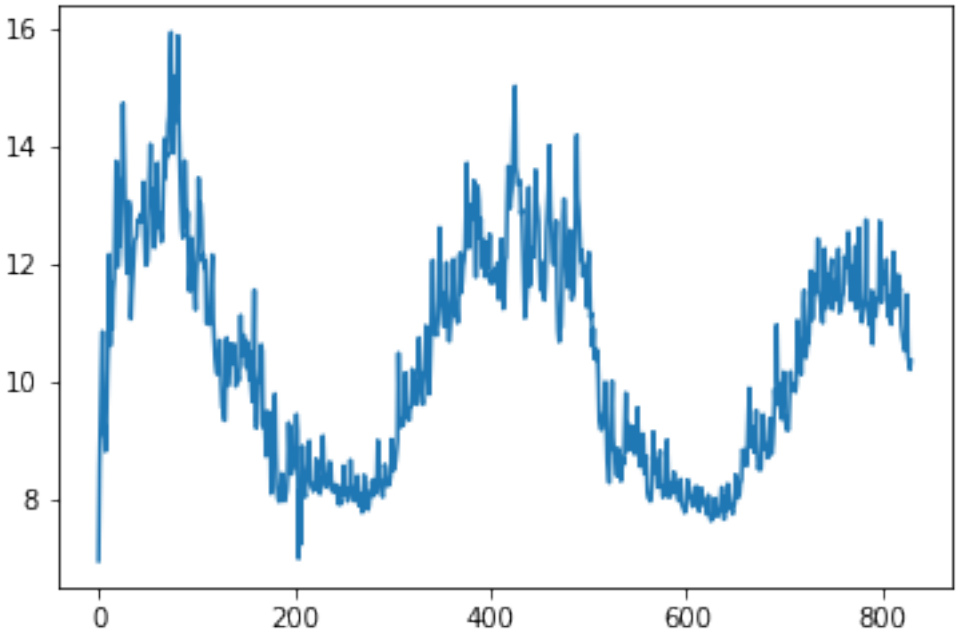
In [3]:
```
#Ens quedem amb date i energy_sum, ordenem valors per data i resetejem index
daily_dia=daily[['date','energy_sum','apparentTemperatureMax','apparentTemperatureMin'
daily_dia.head(5)
```

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  sunsetTimeHour
0                    2.18      0.93              16
1                    7.01      0.89              16
2                    4.84      0.79              16
3                    4.69      0.81              16
4                    2.94      0.72              16
```

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

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



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

```
daily_dia
```

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	
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	sunsetTimeHour	t-1	t-2	\
0	2.18	0.93	16	NaN	NaN	
1	7.01	0.89	16	6.952692	NaN	
2	4.84	0.79	16	8.536480	6.952692	
3	4.69	0.81	16	9.499781	8.536480	
4	2.94	0.72	16	10.267707	9.499781	
5	1.31	0.86	15	10.850805	10.267707	
6	3.39	0.82	15	9.103382	10.850805	
7	3.34	0.78	15	9.274873	9.103382	
8	5.29	0.82	15	8.813513	9.274873	
9	0.46	0.87	15	9.227707	8.813513	
10	4.71	0.79	15	10.145910	9.227707	
11	1.03	0.82	15	10.780273	10.145910	
12	-1.69	0.77	15	12.163127	10.780273	
13	-1.61	0.83	15	10.609714	12.163127	
14	0.94	0.68	15	11.673417	10.609714	
15	0.63	0.81	15	10.889362	11.673417	
16	-1.42	0.71	15	11.525150	10.889362	
17	-3.42	0.81	15	11.759837	11.525150	
18	0.11	0.88	15	12.633801	11.759837	
19	-0.64	0.84	15	13.749174	12.633801	
20	0.22	0.75	15	11.951958	13.749174	
21	0.78	0.79	15	11.957446	11.951958	
22	1.07	0.77	15	12.392776	11.957446	
23	-2.65	0.88	15	12.307079	12.392776	
24	-3.56	0.86	15	13.376080	12.307079	
25	-4.12	0.84	15	13.511968	13.376080	
26	-3.67	0.94	15	14.732271	13.511968	
27	1.68	0.81	15	13.774471	14.732271	

28	3.84	0.94	15	12.709106	13.774471
29	5.37	0.87	15	12.148570	12.709106
..	...	...	...	...	...
800	0.18	0.90	16	11.344805	11.753871
801	0.61	0.91	16	11.800777	11.344805
802	0.29	0.91	16	11.685169	11.800777
803	1.10	0.76	16	11.857957	11.685169
804	3.21	0.72	16	11.710582	11.857957
805	1.96	0.79	16	12.078164	11.710582
806	1.12	0.75	16	11.280011	12.078164
807	1.03	0.77	16	11.095584	11.280011
808	1.96	0.82	16	11.415105	11.095584
809	-0.86	0.79	17	11.445403	11.415105
810	2.19	0.77	17	10.972318	11.445403
811	1.38	0.66	17	11.569300	10.972318
812	0.89	0.84	17	12.202967	11.569300
813	-0.57	0.76	17	11.264175	12.202967
814	-1.20	0.75	17	11.452649	11.264175
815	0.05	0.68	17	11.679099	11.452649
816	0.45	0.81	17	11.285737	11.679099
817	1.77	0.69	17	11.816914	11.285737
818	-1.03	0.76	17	11.490470	11.816914
819	2.84	0.83	17	11.582159	11.490470
820	3.83	0.87	17	10.979566	11.582159
821	2.65	0.87	17	10.781898	10.979566
822	3.95	0.84	17	10.674624	10.781898
823	0.19	0.72	17	10.573835	10.674624
824	1.59	0.71	17	10.518126	10.573835
825	5.53	0.76	17	10.776242	10.518126
826	5.52	0.74	17	11.480411	10.776242
827	3.89	0.78	17	10.411403	11.480411
828	1.67	0.73	17	10.294997	10.411403
829	1.41	0.74	17	10.202945	10.294997

	t-3	...	sun(t-5)	sun(t-6)	sun(t-7)	sun(t-8)	sun(t-9)	\
0	NaN	...	NaN	NaN	NaN	NaN	NaN	
1	NaN	...	NaN	NaN	NaN	NaN	NaN	
2	NaN	...	NaN	NaN	NaN	NaN	NaN	
3	6.952692	...	NaN	NaN	NaN	NaN	NaN	
4	8.536480	...	NaN	NaN	NaN	NaN	NaN	
5	9.499781	...	16.0	NaN	NaN	NaN	NaN	
6	10.267707	...	16.0	16.0	NaN	NaN	NaN	
7	10.850805	...	16.0	16.0	16.0	NaN	NaN	
8	9.103382	...	16.0	16.0	16.0	16.0	NaN	
9	9.274873	...	16.0	16.0	16.0	16.0	16.0	
10	8.813513	...	15.0	16.0	16.0	16.0	16.0	
11	9.227707	...	15.0	15.0	16.0	16.0	16.0	
12	10.145910	...	15.0	15.0	15.0	16.0	16.0	

13	10.780273	...	15.0	15.0	15.0	15.0	16.0
14	12.163127	...	15.0	15.0	15.0	15.0	15.0
15	10.609714	...	15.0	15.0	15.0	15.0	15.0
16	11.673417	...	15.0	15.0	15.0	15.0	15.0
17	10.889362	...	15.0	15.0	15.0	15.0	15.0
18	11.525150	...	15.0	15.0	15.0	15.0	15.0
19	11.759837	...	15.0	15.0	15.0	15.0	15.0
20	12.633801	...	15.0	15.0	15.0	15.0	15.0
21	13.749174	...	15.0	15.0	15.0	15.0	15.0
22	11.951958	...	15.0	15.0	15.0	15.0	15.0
23	11.957446	...	15.0	15.0	15.0	15.0	15.0
24	12.392776	...	15.0	15.0	15.0	15.0	15.0
25	12.307079	...	15.0	15.0	15.0	15.0	15.0
26	13.376080	...	15.0	15.0	15.0	15.0	15.0
27	13.511968	...	15.0	15.0	15.0	15.0	15.0
28	14.732271	...	15.0	15.0	15.0	15.0	15.0
29	13.774471	...	15.0	15.0	15.0	15.0	15.0
..	...	...	...	...	...	...	...
800	12.729659	...	16.0	16.0	16.0	16.0	16.0
801	11.753871	...	16.0	16.0	16.0	16.0	16.0
802	11.344805	...	16.0	16.0	16.0	16.0	16.0
803	11.800777	...	16.0	16.0	16.0	16.0	16.0
804	11.685169	...	16.0	16.0	16.0	16.0	16.0
805	11.857957	...	16.0	16.0	16.0	16.0	16.0
806	11.710582	...	16.0	16.0	16.0	16.0	16.0
807	12.078164	...	16.0	16.0	16.0	16.0	16.0
808	11.280011	...	16.0	16.0	16.0	16.0	16.0
809	11.095584	...	16.0	16.0	16.0	16.0	16.0
810	11.415105	...	16.0	16.0	16.0	16.0	16.0
811	11.445403	...	16.0	16.0	16.0	16.0	16.0
812	10.972318	...	16.0	16.0	16.0	16.0	16.0
813	11.569300	...	16.0	16.0	16.0	16.0	16.0
814	12.202967	...	17.0	16.0	16.0	16.0	16.0
815	11.264175	...	17.0	17.0	16.0	16.0	16.0
816	11.452649	...	17.0	17.0	17.0	16.0	16.0
817	11.679099	...	17.0	17.0	17.0	17.0	16.0
818	11.285737	...	17.0	17.0	17.0	17.0	17.0
819	11.816914	...	17.0	17.0	17.0	17.0	17.0
820	11.490470	...	17.0	17.0	17.0	17.0	17.0
821	11.582159	...	17.0	17.0	17.0	17.0	17.0
822	10.979566	...	17.0	17.0	17.0	17.0	17.0
823	10.781898	...	17.0	17.0	17.0	17.0	17.0
824	10.674624	...	17.0	17.0	17.0	17.0	17.0
825	10.573835	...	17.0	17.0	17.0	17.0	17.0
826	10.518126	...	17.0	17.0	17.0	17.0	17.0
827	10.776242	...	17.0	17.0	17.0	17.0	17.0
828	11.480411	...	17.0	17.0	17.0	17.0	17.0
829	10.411403	...	17.0	17.0	17.0	17.0	17.0

	sun(t-10)	sun(t-11)	sun(t-12)	sun(t-13)	sun(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	16.0	NaN	NaN	NaN	NaN
11	16.0	16.0	NaN	NaN	NaN
12	16.0	16.0	16.0	NaN	NaN
13	16.0	16.0	16.0	16.0	NaN
14	16.0	16.0	16.0	16.0	16.0
15	15.0	16.0	16.0	16.0	16.0
16	15.0	15.0	16.0	16.0	16.0
17	15.0	15.0	15.0	16.0	16.0
18	15.0	15.0	15.0	15.0	16.0
19	15.0	15.0	15.0	15.0	15.0
20	15.0	15.0	15.0	15.0	15.0
21	15.0	15.0	15.0	15.0	15.0
22	15.0	15.0	15.0	15.0	15.0
23	15.0	15.0	15.0	15.0	15.0
24	15.0	15.0	15.0	15.0	15.0
25	15.0	15.0	15.0	15.0	15.0
26	15.0	15.0	15.0	15.0	15.0
27	15.0	15.0	15.0	15.0	15.0
28	15.0	15.0	15.0	15.0	15.0
29	15.0	15.0	15.0	15.0	15.0
..	...	...	...	...	...
800	16.0	16.0	16.0	16.0	16.0
801	16.0	16.0	16.0	16.0	16.0
802	16.0	16.0	16.0	16.0	16.0
803	16.0	16.0	16.0	16.0	16.0
804	16.0	16.0	16.0	16.0	16.0
805	16.0	16.0	16.0	16.0	16.0
806	16.0	16.0	16.0	16.0	16.0
807	16.0	16.0	16.0	16.0	16.0
808	16.0	16.0	16.0	16.0	16.0
809	16.0	16.0	16.0	16.0	16.0
810	16.0	16.0	16.0	16.0	16.0
811	16.0	16.0	16.0	16.0	16.0
812	16.0	16.0	16.0	16.0	16.0
813	16.0	16.0	16.0	16.0	16.0
814	16.0	16.0	16.0	16.0	16.0

```
815       16.0       16.0       16.0       16.0       16.0
816       16.0       16.0       16.0       16.0       16.0
817       16.0       16.0       16.0       16.0       16.0
818       16.0       16.0       16.0       16.0       16.0
819       17.0       16.0       16.0       16.0       16.0
820       17.0       17.0       16.0       16.0       16.0
821       17.0       17.0       17.0       16.0       16.0
822       17.0       17.0       17.0       17.0       16.0
823       17.0       17.0       17.0       17.0       17.0
824       17.0       17.0       17.0       17.0       17.0
825       17.0       17.0       17.0       17.0       17.0
826       17.0       17.0       17.0       17.0       17.0
827       17.0       17.0       17.0       17.0       17.0
828       17.0       17.0       17.0       17.0       17.0
829       17.0       17.0       17.0       17.0       17.0

[830 rows x 77 columns]
```

In [5]:
```
#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','apparentTemperatureM
daily_dia.head(5)
```

Out[5]:
```
   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  ...  sun(t-5)  sun(t-6)  sun(t-7)  sun(t-8)  sun(t-9)  sun(t-10)  \
0  NaN  ...       NaN       NaN       NaN       NaN       NaN        NaN
1  NaN  ...       NaN       NaN       NaN       NaN       NaN        NaN
2  NaN  ...       NaN       NaN       NaN       NaN       NaN        NaN
3  NaN  ...       NaN       NaN       NaN       NaN       NaN        NaN
4  NaN  ...       NaN       NaN       NaN       NaN       NaN        NaN

   sun(t-11)  sun(t-12)  sun(t-13)  sun(t-14)
0        NaN        NaN        NaN        NaN
1        NaN        NaN        NaN        NaN
2        NaN        NaN        NaN        NaN
3        NaN        NaN        NaN        NaN
4        NaN        NaN        NaN        NaN

[5 rows x 71 columns]
```

In [6]:
```
#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[6]:

	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	...	sun(t-5)	sun(t-6)	\
14	9.227707	8.813513	9.274873	9.103382	...	15.0	15.0	
15	10.145910	9.227707	8.813513	9.274873	...	15.0	15.0	
16	10.780273	10.145910	9.227707	8.813513	...	15.0	15.0	
17	12.163127	10.780273	10.145910	9.227707	...	15.0	15.0	
18	10.609714	12.163127	10.780273	10.145910	...	15.0	15.0	

	sun(t-7)	sun(t-8)	sun(t-9)	sun(t-10)	sun(t-11)	sun(t-12)	sun(t-13)	\
14	15.0	15.0	15.0	16.0	16.0	16.0	16.0	
15	15.0	15.0	15.0	15.0	16.0	16.0	16.0	
16	15.0	15.0	15.0	15.0	15.0	16.0	16.0	
17	15.0	15.0	15.0	15.0	15.0	15.0	16.0	
18	15.0	15.0	15.0	15.0	15.0	15.0	15.0	

	sun(t-14)
14	16.0
15	16.0
16	16.0
17	16.0
18	16.0

[5 rows x 71 columns]

In [8]:
```
len(daily_dia)
```

Out[8]: 816

In [7]:
```
#normalitzem
scaler=preprocessing.MinMaxScaler(feature_range=(0, 1))
daily_dia_norm=scaler.fit_transform(daily_dia)
```

In [8]:
```
#Seleccionem dades per test i train
y_daily=daily_dia_norm[:,0]
X_daily=daily_dia_norm[:,1:72]

#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], 14,5))
```

In [28]:
```
        # definim model
        import tensorflow as tf
        model =Sequential()
        model.add(LSTM(50, activation='relu', input_shape=(14, 5)))
        model.add(Dense(1))
        model.compile(optimizer='adam', loss='mse', metrics=['accuracy'])
```

In [29]:
```
        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
```

In [30]:
```
#Dividim la suma de scores de test entre el nombre de prediccions per obtenir la mitj
sumScores/(lenght-n_train)
```

Out[30]: 0.03299686799625552

In [31]:
```
llista_scores
```

Out[31]:
```
[0.041467695690875495,
 0.07280583403911378,
 0.028689056866647356,
 0.13027029429044412,
 0.04281942112296466,
 6.740717803910279e-05,
 0.009737453756714975,
 0.044918323529727466,
 0.05363589935789381,
 0.07861609697978134,
 0.06545835974574032,
 0.07546305546329957,
 0.002864296610680217,
 0.07207423895603715,
 0.023945568559904595,
 0.10793951054498518,
 0.10767934509570276,
 0.03597774318402136,
 0.09032472402702396,
 0.008379882058516364,
 0.036494219702677855,
 0.06559680119716194,
 0.024989778803260032,
 0.04791916932694695,
 0.01712290955063822,
 0.06552588714845298,
 0.012365094539102284,
 0.018380426199689825,
 0.04005388915611441,
 0.054351170049974806,
 0.022532093889545468,
 0.01647587476821677,
 0.07101111712834451,
 0.07081754675715723,
```

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0.02506416189866756,
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```
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0.022836271062044333,
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```

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0.09039118303503058,
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```
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 0.014661986582481079,
 0.08809086345268402,
 0.06648191784848856,
 0.006577473320641847,
 0.006759420343753542,
 0.024406907815932133]
```
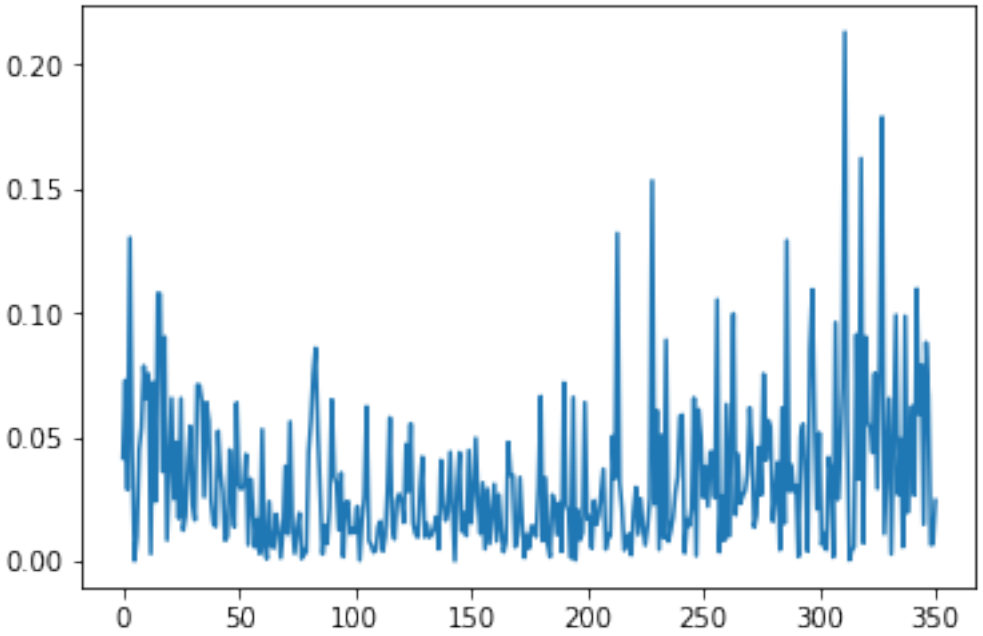

In [40]:
```
#plt.figure(figsize=(9,8))
plt.plot(llista_scores)
```

Out[40]:
```
[<matplotlib.lines.Line2D at 0x1b5f9e110f0>]
```



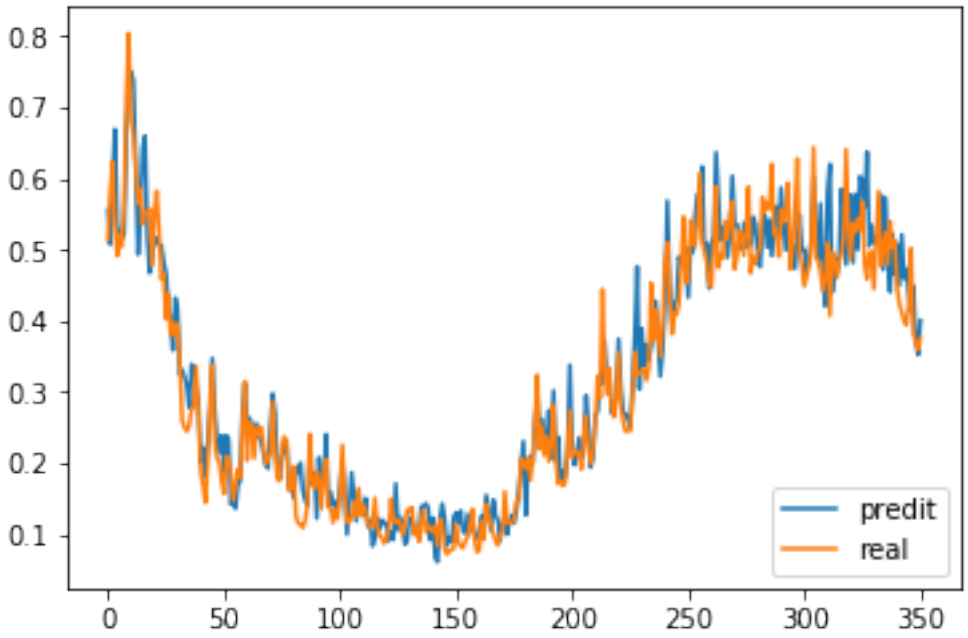
In [33]:
```
predis=list()

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

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

predis
```

Out[33]:
```
array([0.55552918, 0.50780272, 0.59563738, 0.66954982, 0.53417456,
       0.5222128 , 0.51417899, 0.52280664, 0.66582388, 0.72601467,
       0.75017405, 0.73763967, 0.61232984, 0.49339181, 0.56170058,
       0.64446288, 0.65993565, 0.51627856, 0.46748459, 0.48617429,
       0.51470125, 0.51674187, 0.50478262, 0.50682354, 0.48285577,
       0.46814758, 0.42455283, 0.39842805, 0.35880601, 0.43226719,
       0.41824877, 0.32478994, 0.33132231, 0.321096  , 0.30911395,
       0.27835453, 0.33867565, 0.33522141, 0.31175822, 0.28549844,
       0.20100644, 0.22179413, 0.1806729 , 0.22777155, 0.27510372,
       0.34720477, 0.2764551 , 0.23226839, 0.21516761, 0.23888791,
       0.18722945, 0.23878087, 0.23330279, 0.14195779, 0.15360969,
       0.13608241, 0.16918793, 0.17450503, 0.272237  , 0.31199878,
       0.25678468, 0.2631408 , 0.25405335, 0.23048644, 0.25587702,
       0.23624676, 0.2318542 , 0.21360594, 0.19707826, 0.19270247,
       0.25196218, 0.29778868, 0.27140641, 0.19216764, 0.17807373,
       0.21057536, 0.21787277, 0.22935   , 0.16595507, 0.16930625,
```

```
0.15137981, 0.18213513, 0.19029205, 0.20003743, 0.16097236,
0.14745528, 0.1402584 , 0.22658819, 0.17028728, 0.18538669,
0.12239508, 0.20775419, 0.16664265, 0.17326224, 0.24064867,
0.13958913, 0.15937933, 0.1405368 , 0.14615531, 0.1351486 ,
0.17037641, 0.2035505 , 0.15952334, 0.0997244 , 0.14319403,
0.18668014, 0.15346178, 0.11856221, 0.16105944, 0.13032404,
0.12658322, 0.15060443, 0.11053212, 0.11935807, 0.08352388,
0.09308711, 0.12309344, 0.10660358, 0.12018649, 0.11424606,
0.11563373, 0.09100929, 0.1026837 , 0.09236053, 0.17084697,
0.10564706, 0.12388103, 0.10858985, 0.08556977, 0.09255531,
0.12322341, 0.12272242, 0.10891561, 0.09916668, 0.10301276,
0.13878579, 0.13913512, 0.14312464, 0.13677289, 0.0920888 ,
0.12288664, 0.06707057, 0.06111303, 0.12101495, 0.14293939,
0.12462725, 0.08382767, 0.09493594, 0.08880143, 0.12431958,
0.13012272, 0.1152914 , 0.13288161, 0.10385941, 0.10154454,
0.12827596, 0.10892799, 0.10646972, 0.09847675, 0.09446061,
0.10812706, 0.12571108, 0.11951287, 0.15485272, 0.12962471,
0.10549749, 0.14838929, 0.12639293, 0.1192041 , 0.09107646,
0.11475833, 0.12604982, 0.09974626, 0.11660163, 0.12693539,
0.11568494, 0.13250488, 0.16177794, 0.1969796 , 0.23059136,
0.1267634 , 0.19859654, 0.2095952 , 0.19894153, 0.25882834,
0.29739788, 0.24201596, 0.26218107, 0.23447675, 0.23388536,
0.27411279, 0.20714013, 0.30181754, 0.20310949, 0.23668292,
0.17560796, 0.18855537, 0.18013605, 0.2126393 , 0.33778328,
0.22436045, 0.19749667, 0.21168409, 0.23562175, 0.20610456,
0.22323106, 0.29491603, 0.25591224, 0.19405285, 0.20719117,
0.26730341, 0.27195153, 0.32452768, 0.31232214, 0.37130663,
0.31772357, 0.32898518, 0.27062303, 0.2757208 , 0.29159436,
0.37451947, 0.30705598, 0.27007028, 0.26959488, 0.26141724,
0.25125235, 0.30718234, 0.38014317, 0.47635913, 0.30392951,
0.38921896, 0.33761379, 0.36711904, 0.34316719, 0.36390772,
0.38019547, 0.42784199, 0.37233067, 0.32198274, 0.36176533,
0.42399547, 0.56880993, 0.45206785, 0.39834186, 0.42527387,
0.42982012, 0.49010396, 0.48316124, 0.48549646, 0.50318187,
0.43309021, 0.50301546, 0.49695837, 0.54889655, 0.57806301,
0.5821296 , 0.61680543, 0.50115871, 0.50786668, 0.44581246,
0.51082933, 0.51710284, 0.63694721, 0.57440108, 0.512797  ,
0.53086436, 0.51593965, 0.48944277, 0.5231536 , 0.60377735,
0.53484768, 0.53592086, 0.5135535 , 0.50118655, 0.53773808,
0.50378919, 0.51311606, 0.50762874, 0.54605913, 0.53541434,
0.48176455, 0.47615737, 0.53386235, 0.54885   , 0.50321203,
0.5426147 , 0.49123406, 0.54933465, 0.560709  , 0.51837569,
0.58725089, 0.54065037, 0.49954754, 0.53842151, 0.50623399,
0.50650489, 0.47371197, 0.51867485, 0.54854441, 0.49886015,
0.50041276, 0.46798015, 0.48694748, 0.51280487, 0.60204184,
0.52507645, 0.48685834, 0.56484854, 0.46724939, 0.42098081,
0.57907498, 0.62049246, 0.44029385, 0.489822  , 0.46467322,
0.48718244, 0.58510065, 0.55037236, 0.47902203, 0.5394417 ,
```

```
       0.57696199, 0.4818469 , 0.57851589, 0.50034708, 0.60318226,
       0.59767276, 0.56095052, 0.63770401, 0.50534749, 0.53466111,
       0.51045048, 0.50893277, 0.52864993, 0.57663512, 0.47185344,
       0.57315934, 0.48565185, 0.44061971, 0.52232355, 0.4648447 ,
       0.50815147, 0.45012015, 0.52140099, 0.45957214, 0.47314453,
       0.4377096 , 0.41363066, 0.44876754, 0.37585747, 0.35223606,
       0.40054166])
```

In [34]:
```
##Mostrem
plt.plot(predis, label="predit")
plt.plot(y_daily[n_train:lenght], label="real")
plt.legend(loc="lower right")
plt.show()
```



In [35]:
```
#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[35]:

	predi	y	t-2	t-3	t-4	t-5	\
479	0.555529	0.514061	12.119938	12.852295	13.106773	12.823073	
480	0.507803	0.580609	11.786082	12.119938	12.852295	13.106773	
481	0.595637	0.624326	11.590859	11.786082	12.119938	12.852295	
482	0.669550	0.539280	12.186487	11.590859	11.786082	12.119938	
483	0.534175	0.491355	12.577783	12.186487	11.590859	11.786082	
484	0.522213	0.522145	11.816573	12.577783	12.186487	11.590859	
485	0.514179	0.504442	11.387627	11.816573	12.577783	12.186487	
486	0.522807	0.567725	11.663214	11.387627	11.816573	12.577783	
487	0.665824	0.719460	11.504756	11.663214	11.387627	11.816573	
488	0.726015	0.804631	12.071173	11.504756	11.663214	11.387627	
489	0.750174	0.684716	13.429271	12.071173	11.504756	11.663214	
490	0.737640	0.662177	14.191591	13.429271	12.071173	11.504756	
491	0.612330	0.615194	13.118295	14.191591	13.429271	12.071173	
492	0.493392	0.565466	12.916559	13.118295	14.191591	13.429271	
493	0.561701	0.585646	12.496044	12.916559	13.118295	14.191591	
494	0.644463	0.536523	12.050954	12.496044	12.916559	13.118295	
495	0.659936	0.552256	12.231576	12.050954	12.496044	12.916559	
496	0.516279	0.552256	11.791904	12.231576	12.050954	12.496044	
497	0.467485	0.557809	11.932721	11.791904	12.231576	12.050954	
498	0.486174	0.477794	11.932721	11.932721	11.791904	12.231576	
499	0.514701	0.551195	11.982423	11.932721	11.932721	11.791904	
500	0.516742	0.582339	11.266252	11.982423	11.932721	11.932721	
501	0.504783	0.529772	11.923226	11.266252	11.982423	11.932721	
502	0.506824	0.458904	12.201972	11.923226	11.266252	11.982423	
503	0.482856	0.465733	11.731479	12.201972	11.923226	11.266252	
504	0.468148	0.402622	11.097177	11.731479	12.201972	11.923226	

```
505  0.424553  0.436918  11.158295  11.097177  11.731479  12.201972
506  0.398428  0.380048  10.593420  11.158295  11.097177  11.731479
507  0.358806  0.398860  10.900388  10.593420  11.158295  11.097177
508  0.432267  0.377916  10.391372  10.900388  10.593420  11.158295
..        ...       ...        ...        ...        ...        ...
800  0.481847  0.537515  11.753871  12.729659  11.620778  11.409880
801  0.578516  0.524598  11.344805  11.753871  12.729659  11.620778
802  0.500347  0.543903  11.800777  11.344805  11.753871  12.729659
803  0.603182  0.527438  11.685169  11.800777  11.344805  11.753871
804  0.597673  0.568506  11.857957  11.685169  11.800777  11.344805
805  0.560951  0.479332  11.710582  11.857957  11.685169  11.800777
806  0.637704  0.458726  12.078164  11.710582  11.857957  11.685169
807  0.505347  0.494425  11.280011  12.078164  11.710582  11.857957
808  0.534661  0.497810  11.095584  11.280011  12.078164  11.710582
809  0.510450  0.444954  11.415105  11.095584  11.280011  12.078164
810  0.508933  0.511653  11.445403  11.415105  11.095584  11.280011
811  0.528650  0.582450  10.972318  11.445403  11.415105  11.095584
812  0.576635  0.477562  11.569300  10.972318  11.445403  11.415105
813  0.471853  0.498620  12.202967  11.569300  10.972318  11.445403
814  0.573159  0.523920  11.264175  12.202967  11.569300  10.972318
815  0.485652  0.479971  11.452649  11.264175  12.202967  11.569300
816  0.440620  0.539318  11.679099  11.452649  11.264175  12.202967
817  0.522324  0.502845  11.285737  11.679099  11.452649  11.264175
818  0.464845  0.513089  11.816914  11.285737  11.679099  11.452649
819  0.508151  0.445764  11.490470  11.816914  11.285737  11.679099
820  0.450120  0.423680  11.582159  11.490470  11.816914  11.285737
821  0.521401  0.411694  10.979566  11.582159  11.490470  11.816914
822  0.459572  0.400434  10.781898  10.979566  11.582159  11.490470
823  0.473145  0.394209  10.674624  10.781898  10.979566  11.582159
824  0.437710  0.423048  10.573835  10.674624  10.781898  10.979566
825  0.413631  0.501722  10.518126  10.573835  10.674624  10.781898
826  0.448768  0.382286  10.776242  10.518126  10.573835  10.674624
827  0.375857  0.369280  11.480411  10.776242  10.518126  10.573835
828  0.352236  0.358995  10.411403  11.480411  10.776242  10.518126
829  0.400542  0.376135  10.294997  10.411403  11.480411  10.776242

           t-6        t-7        t-8        t-9  ...  sun(t-5)  sun(t-6)  \
479  11.559878  10.930170  10.889469  10.675248  ...      17.0      17.0
480  12.823073  11.559878  10.930170  10.889469  ...      17.0      17.0
481  13.106773  12.823073  11.559878  10.930170  ...      18.0      17.0
482  12.852295  13.106773  12.823073  11.559878  ...      18.0      18.0
483  12.119938  12.852295  13.106773  12.823073  ...      18.0      18.0
484  11.786082  12.119938  12.852295  13.106773  ...      18.0      18.0
485  11.590859  11.786082  12.119938  12.852295  ...      18.0      18.0
486  12.186487  11.590859  11.786082  12.119938  ...      18.0      18.0
487  12.577783  12.186487  11.590859  11.786082  ...      18.0      18.0
488  11.816573  12.577783  12.186487  11.590859  ...      18.0      18.0
489  11.387627  11.816573  12.577783  12.186487  ...      18.0      18.0
```

490	11.663214	11.387627	11.816573	12.577783	...	18.0	18.0
491	11.504756	11.663214	11.387627	11.816573	...	18.0	18.0
492	12.071173	11.504756	11.663214	11.387627	...	18.0	18.0
493	13.429271	12.071173	11.504756	11.663214	...	18.0	18.0
494	14.191591	13.429271	12.071173	11.504756	...	18.0	18.0
495	13.118295	14.191591	13.429271	12.071173	...	18.0	18.0
496	12.916559	13.118295	14.191591	13.429271	...	18.0	18.0
497	12.496044	12.916559	13.118295	14.191591	...	18.0	18.0
498	12.050954	12.496044	12.916559	13.118295	...	18.0	18.0
499	12.231576	12.050954	12.496044	12.916559	...	18.0	18.0
500	11.791904	12.231576	12.050954	12.496044	...	18.0	18.0
501	11.932721	11.791904	12.231576	12.050954	...	18.0	18.0
502	11.932721	11.932721	11.791904	12.231576	...	18.0	18.0
503	11.982423	11.932721	11.932721	11.791904	...	18.0	18.0
504	11.266252	11.982423	11.932721	11.932721	...	18.0	18.0
505	11.923226	11.266252	11.982423	11.932721	...	18.0	18.0
506	12.201972	11.923226	11.266252	11.982423	...	18.0	18.0
507	11.731479	12.201972	11.923226	11.266252	...	18.0	18.0
508	11.097177	11.731479	12.201972	11.923226	...	18.0	18.0
..	...	...	...	...	...	...	...
800	11.300414	11.109560	11.370601	11.430883	...	16.0	16.0
801	11.409880	11.300414	11.109560	11.370601	...	16.0	16.0
802	11.620778	11.409880	11.300414	11.109560	...	16.0	16.0
803	12.729659	11.620778	11.409880	11.300414	...	16.0	16.0
804	11.753871	12.729659	11.620778	11.409880	...	16.0	16.0
805	11.344805	11.753871	12.729659	11.620778	...	16.0	16.0
806	11.800777	11.344805	11.753871	12.729659	...	16.0	16.0
807	11.685169	11.800777	11.344805	11.753871	...	16.0	16.0
808	11.857957	11.685169	11.800777	11.344805	...	16.0	16.0
809	11.710582	11.857957	11.685169	11.800777	...	16.0	16.0
810	12.078164	11.710582	11.857957	11.685169	...	16.0	16.0
811	11.280011	12.078164	11.710582	11.857957	...	16.0	16.0
812	11.095584	11.280011	12.078164	11.710582	...	16.0	16.0
813	11.415105	11.095584	11.280011	12.078164	...	16.0	16.0
814	11.445403	11.415105	11.095584	11.280011	...	17.0	16.0
815	10.972318	11.445403	11.415105	11.095584	...	17.0	17.0
816	11.569300	10.972318	11.445403	11.415105	...	17.0	17.0
817	12.202967	11.569300	10.972318	11.445403	...	17.0	17.0
818	11.264175	12.202967	11.569300	10.972318	...	17.0	17.0
819	11.452649	11.264175	12.202967	11.569300	...	17.0	17.0
820	11.679099	11.452649	11.264175	12.202967	...	17.0	17.0
821	11.285737	11.679099	11.452649	11.264175	...	17.0	17.0
822	11.816914	11.285737	11.679099	11.452649	...	17.0	17.0
823	11.490470	11.816914	11.285737	11.679099	...	17.0	17.0
824	11.582159	11.490470	11.816914	11.285737	...	17.0	17.0
825	10.979566	11.582159	11.490470	11.816914	...	17.0	17.0
826	10.781898	10.979566	11.582159	11.490470	...	17.0	17.0
827	10.674624	10.781898	10.979566	11.582159	...	17.0	17.0

```
828  10.573835  10.674624  10.781898  10.979566  ...      17.0      17.0
829  10.518126  10.573835  10.674624  10.781898  ...      17.0      17.0

     sun(t-7)  sun(t-8)  sun(t-9)  sun(t-10)  sun(t-11)  sun(t-12)  sun(t-13)  \
479      17.0      17.0      17.0       17.0       17.0       17.0       17.0
480      17.0      17.0      17.0       17.0       17.0       17.0       17.0
481      17.0      17.0      17.0       17.0       17.0       17.0       17.0
482      17.0      17.0      17.0       17.0       17.0       17.0       17.0
483      18.0      17.0      17.0       17.0       17.0       17.0       17.0
484      18.0      18.0      17.0       17.0       17.0       17.0       17.0
485      18.0      18.0      18.0       17.0       17.0       17.0       17.0
486      18.0      18.0      18.0       18.0       17.0       17.0       17.0
487      18.0      18.0      18.0       18.0       18.0       17.0       17.0
488      18.0      18.0      18.0       18.0       18.0       18.0       17.0
489      18.0      18.0      18.0       18.0       18.0       18.0       18.0
490      18.0      18.0      18.0       18.0       18.0       18.0       18.0
491      18.0      18.0      18.0       18.0       18.0       18.0       18.0
492      18.0      18.0      18.0       18.0       18.0       18.0       18.0
493      18.0      18.0      18.0       18.0       18.0       18.0       18.0
494      18.0      18.0      18.0       18.0       18.0       18.0       18.0
495      18.0      18.0      18.0       18.0       18.0       18.0       18.0
496      18.0      18.0      18.0       18.0       18.0       18.0       18.0
497      18.0      18.0      18.0       18.0       18.0       18.0       18.0
498      18.0      18.0      18.0       18.0       18.0       18.0       18.0
499      18.0      18.0      18.0       18.0       18.0       18.0       18.0
500      18.0      18.0      18.0       18.0       18.0       18.0       18.0
501      18.0      18.0      18.0       18.0       18.0       18.0       18.0
502      18.0      18.0      18.0       18.0       18.0       18.0       18.0
503      18.0      18.0      18.0       18.0       18.0       18.0       18.0
504      18.0      18.0      18.0       18.0       18.0       18.0       18.0
505      18.0      18.0      18.0       18.0       18.0       18.0       18.0
506      18.0      18.0      18.0       18.0       18.0       18.0       18.0
507      18.0      18.0      18.0       18.0       18.0       18.0       18.0
508      18.0      18.0      18.0       18.0       18.0       18.0       18.0
..        ...       ...       ...        ...        ...        ...        ...
800      16.0      16.0      16.0       16.0       16.0       16.0       16.0
801      16.0      16.0      16.0       16.0       16.0       16.0       16.0
802      16.0      16.0      16.0       16.0       16.0       16.0       16.0
803      16.0      16.0      16.0       16.0       16.0       16.0       16.0
804      16.0      16.0      16.0       16.0       16.0       16.0       16.0
805      16.0      16.0      16.0       16.0       16.0       16.0       16.0
806      16.0      16.0      16.0       16.0       16.0       16.0       16.0
807      16.0      16.0      16.0       16.0       16.0       16.0       16.0
808      16.0      16.0      16.0       16.0       16.0       16.0       16.0
809      16.0      16.0      16.0       16.0       16.0       16.0       16.0
810      16.0      16.0      16.0       16.0       16.0       16.0       16.0
811      16.0      16.0      16.0       16.0       16.0       16.0       16.0
812      16.0      16.0      16.0       16.0       16.0       16.0       16.0
```

813	16.0	16.0	16.0	16.0	16.0	16.0	16.0
814	16.0	16.0	16.0	16.0	16.0	16.0	16.0
815	16.0	16.0	16.0	16.0	16.0	16.0	16.0
816	17.0	16.0	16.0	16.0	16.0	16.0	16.0
817	17.0	17.0	16.0	16.0	16.0	16.0	16.0
818	17.0	17.0	17.0	16.0	16.0	16.0	16.0
819	17.0	17.0	17.0	17.0	16.0	16.0	16.0
820	17.0	17.0	17.0	17.0	17.0	16.0	16.0
821	17.0	17.0	17.0	17.0	17.0	17.0	16.0
822	17.0	17.0	17.0	17.0	17.0	17.0	17.0
823	17.0	17.0	17.0	17.0	17.0	17.0	17.0
824	17.0	17.0	17.0	17.0	17.0	17.0	17.0
825	17.0	17.0	17.0	17.0	17.0	17.0	17.0
826	17.0	17.0	17.0	17.0	17.0	17.0	17.0
827	17.0	17.0	17.0	17.0	17.0	17.0	17.0
828	17.0	17.0	17.0	17.0	17.0	17.0	17.0
829	17.0	17.0	17.0	17.0	17.0	17.0	17.0

	sun(t-14)
479	17.0
480	17.0
481	17.0
482	17.0
483	17.0
484	17.0
485	17.0
486	17.0
487	17.0
488	17.0
489	17.0
490	18.0
491	18.0
492	18.0
493	18.0
494	18.0
495	18.0
496	18.0
497	18.0
498	18.0
499	18.0
500	18.0
501	18.0
502	18.0
503	18.0
504	18.0
505	18.0
506	18.0
507	18.0

```
508       18.0
..         ...
800       16.0
801       16.0
802       16.0
803       16.0
804       16.0
805       16.0
806       16.0
807       16.0
808       16.0
809       16.0
810       16.0
811       16.0
812       16.0
813       16.0
814       16.0
815       16.0
816       16.0
817       16.0
818       16.0
819       16.0
820       16.0
821       16.0
822       16.0
823       17.0
824       17.0
825       17.0
826       17.0
827       17.0
828       17.0
829       17.0

[351 rows x 71 columns]
```

In [36]:
```
# 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
```

```
[[ 11.96201461  11.59085917 115.46893021 ... 100.         100.
  100.        ]
 [ 11.53484035  12.18648691 112.48075791 ... 100.         100.
  100.        ]
```

```
 [ 12.32100196  12.57778255 110.7334244  ... 100.         100.
  100.        ]
 ...
 [ 10.35386809  10.2949966  109.74485905 ... 100.         100.
  100.        ]
 [ 10.14244532  10.20294532 100.17673598 ... 100.         100.
  100.        ]
 [ 10.57480324  10.3563499   99.13484299 ... 100.         100.
  100.        ]]
11.962014611160562
11.590859170709699
```

In [37]:
```
#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[37]:
```
[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,
```

```
11.097177003906697,
11.158295184648098,
10.593420449120199,
10.900387923175302,
10.391371941845799,
10.5597506942169,
10.3722930491566,
10.531617352131999,
10.0442564420545,
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9.22987664514932,
9.17927174876646,
9.25026850964928,
9.44901226100687,
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9.99667631842984,
9.411523304475391,
8.66526337323551,
8.506098960360191,
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10.009824197825699,
9.06303884040141,
8.84434200802974,
8.79350297401487,
8.55738646036824,
8.3922208376186,
8.86870556311186,
8.80253695803389,
8.645489666170171,
8.30699609093616,
8.50373096231614,
8.7022052143203,
8.60023035333333,
9.27623966536313,
9.80834829610728,
8.81359064611515,
9.290409387781711,
9.256266530545721,
8.838438955880711,
9.22621335199552,
9.15104978517621,
9.23372603556509,
9.019062861238579,
8.76439910578143,
8.82453115537314,
8.90278416695295,
```

```
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8.73745320429666,
8.11301942072829,
8.01897889462084,
8.0122647113768,
7.96687892296338,
8.05955094284913,
8.26964678339566,
9.14705667833895,
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8.666901835294121,
8.54384331740921,
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```

```
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9.88995758458158,
8.95260099350277,
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11.9950962923514,
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11.408516368829599,
11.2682336777691,
11.0061509800784,
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11.3336020446172,
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11.5465703025207,

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 10.635412507516302,
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 10.7762421096284,
 11.480410763265299,
 10.411403084521401,
 10.294996596876901,
 10.202945322371301,
 10.3563498993587]
```
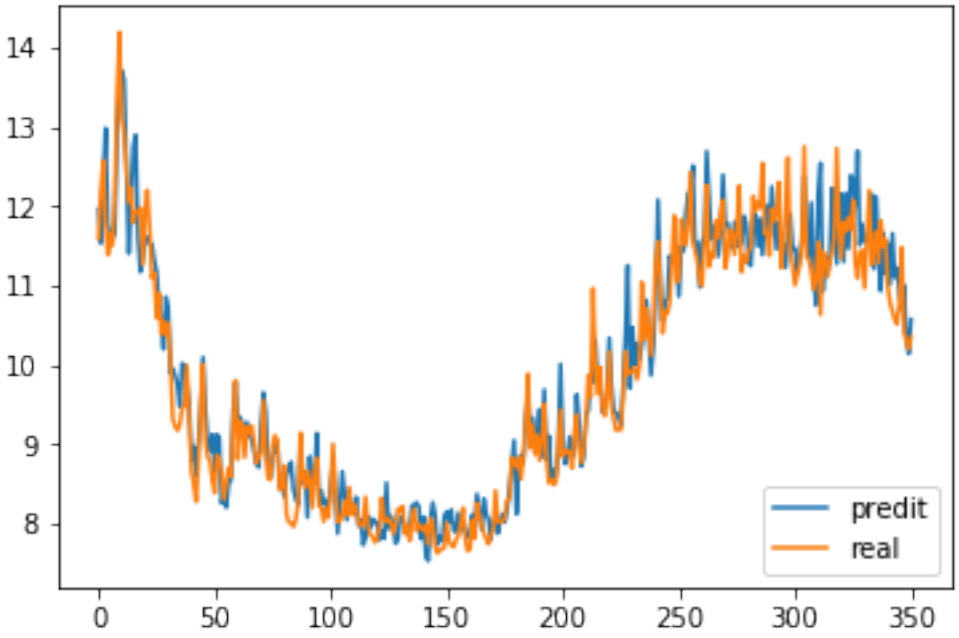
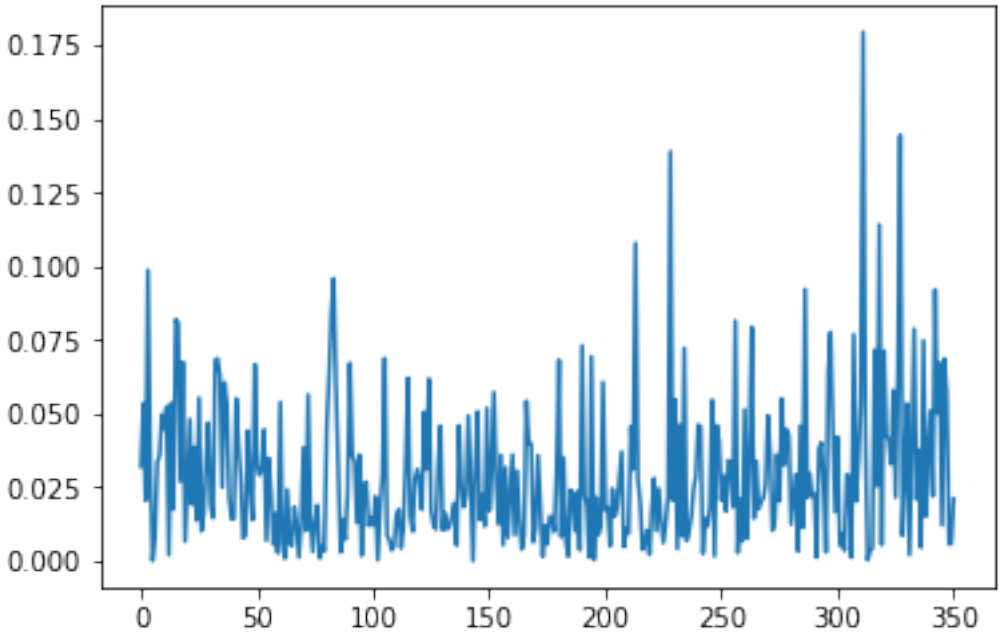

In [38]:
```
##Mostrem
plt.plot(listpredi, label="predit")
plt.plot(listy, label="real")
plt.legend(loc="lower right")
plt.show()
```




```
In [39]: 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 2.92087931552539 %
```


0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
0
50
100
150
200
250
300
350

In [ ]: