

M07

_Xarxa_walkforard_normalitzat_multivariate2tempmin_14dies

December 21, 2019

1 Xarxa neuronal

```
In [2]: 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 [3]: daily=pd.read_csv('C:/Users/Laura/Desktop/Smart meters London/workspace R/Dades netes/1')
daily.head(5)
```

```
Out [3]:
```

	date	apparentTemperatureMax	apparentTemperatureMin	humidity	\
0	2013-05-01	16.96	3.39	0.43	
1	2013-07-14	29.30	17.96	0.45	
2	2012-03-27	21.14	4.88	0.49	
3	2012-03-26	18.26	4.77	0.53	
4	2013-07-16	30.28	17.14	0.54	
	energy_sum				
0	8.793503				

```

1      8.329979
2      9.567694
3      9.984956
4      8.023428

```

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In [4]: #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[4]:
   index      date  energy_sum  apparentTemperatureMax  \
0    809  2011-11-23    6.952692                    10.36
1    728  2011-11-24    8.536480                    12.93
2    423  2011-11-25    9.499781                    13.03
3    478  2011-11-26   10.267707                    12.96
4    212  2011-11-27   10.850805                    13.54

   apparentTemperatureMin  humidity
0                    2.18      0.93
1                    7.01      0.89
2                    4.84      0.79
3                    4.69      0.81
4                    2.94      0.72

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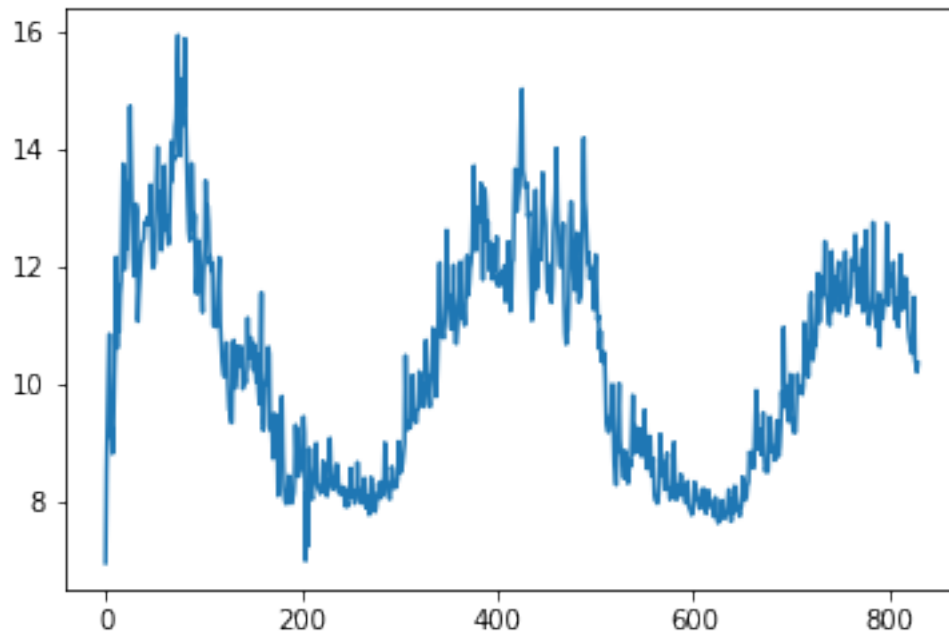
In [18]: plt.plot(daily_dia.energy_sum )

```

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

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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)

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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)

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```
daily_dia
```

```

Out [5]:

```

	index	date	energy_sum	apparentTemperatureMax	\
0	809	2011-11-23	6.952692	10.36	
1	728	2011-11-24	8.536480	12.93	
2	423	2011-11-25	9.499781	13.03	
3	478	2011-11-26	10.267707	12.96	
4	212	2011-11-27	10.850805	13.54	
5	633	2011-11-28	9.103382	12.58	
6	508	2011-11-29	9.274873	13.47	
7	382	2011-11-30	8.813513	11.87	
8	510	2011-12-01	9.227707	12.15	
9	664	2011-12-02	10.145910	5.33	
10	422	2011-12-03	10.780273	11.42	
11	499	2011-12-04	12.163127	6.66	
12	329	2011-12-05	10.609714	3.13	
13	530	2011-12-06	11.673417	3.77	
14	131	2011-12-07	10.889362	5.14	
15	466	2011-12-08	11.525150	12.89	
16	184	2011-12-09	11.759837	3.99	
17	461	2011-12-10	12.633801	3.14	
18	699	2011-12-11	13.749174	5.72	
19	570	2011-12-12	11.951958	5.94	
20	277	2011-12-13	11.957446	12.08	
21	417	2011-12-14	12.392776	2.88	
22	334	2011-12-15	12.307079	4.38	
23	695	2011-12-16	13.376080	0.99	
24	627	2011-12-17	13.511968	1.72	
25	565	2011-12-18	14.732271	1.98	
26	812	2011-12-19	13.774471	4.02	
27	471	2011-12-20	12.709106	4.98	
28	815	2011-12-21	12.148570	12.14	
29	676	2011-12-22	11.839403	12.14	
..	
800	744	2014-01-29	11.800777	2.53	
801	769	2014-01-30	11.685169	5.86	

802	768	2014-01-31	11.857957	5.27
803	311	2014-02-01	11.710582	6.86
804	213	2014-02-02	12.078164	6.48
805	419	2014-02-03	11.280011	4.59
806	278	2014-02-04	11.095584	5.63
807	333	2014-02-05	11.415105	5.86
808	504	2014-02-06	11.445403	7.34
809	411	2014-02-07	10.972318	8.44
810	341	2014-02-08	11.569300	5.67
811	100	2014-02-09	12.202967	3.91
812	572	2014-02-10	11.264175	7.07
813	307	2014-02-11	11.452649	4.06
814	276	2014-02-12	11.679099	4.73
815	130	2014-02-13	11.285737	3.42
816	465	2014-02-14	11.816914	12.02
817	146	2014-02-15	11.490470	5.79
818	306	2014-02-16	11.582159	7.88
819	546	2014-02-17	10.979566	10.67
820	671	2014-02-18	10.781898	10.13
821	666	2014-02-19	10.674624	10.13
822	581	2014-02-20	10.573835	12.50
823	207	2014-02-21	10.518126	10.15
824	185	2014-02-22	10.776242	11.63
825	316	2014-02-23	11.480411	11.94
826	261	2014-02-24	10.411403	14.23
827	383	2014-02-25	10.294997	11.43
828	238	2014-02-26	10.202945	11.29
829	252	2014-02-27	10.356350	10.31

	apparentTemperatureMin	humidity	t-1	t-2	t-3 \
0	2.18	0.93	NaN	NaN	NaN
1	7.01	0.89	6.952692	NaN	NaN
2	4.84	0.79	8.536480	6.952692	NaN
3	4.69	0.81	9.499781	8.536480	6.952692
4	2.94	0.72	10.267707	9.499781	8.536480
5	1.31	0.86	10.850805	10.267707	9.499781
6	3.39	0.82	9.103382	10.850805	10.267707
7	3.34	0.78	9.274873	9.103382	10.850805
8	5.29	0.82	8.813513	9.274873	9.103382
9	0.46	0.87	9.227707	8.813513	9.274873
10	4.71	0.79	10.145910	9.227707	8.813513
11	1.03	0.82	10.780273	10.145910	9.227707
12	-1.69	0.77	12.163127	10.780273	10.145910
13	-1.61	0.83	10.609714	12.163127	10.780273
14	0.94	0.68	11.673417	10.609714	12.163127
15	0.63	0.81	10.889362	11.673417	10.609714
16	-1.42	0.71	11.525150	10.889362	11.673417
17	-3.42	0.81	11.759837	11.525150	10.889362

18	0.11	0.88	12.633801	11.759837	11.525150
19	-0.64	0.84	13.749174	12.633801	11.759837
20	0.22	0.75	11.951958	13.749174	12.633801
21	0.78	0.79	11.957446	11.951958	13.749174
22	1.07	0.77	12.392776	11.957446	11.951958
23	-2.65	0.88	12.307079	12.392776	11.957446
24	-3.56	0.86	13.376080	12.307079	12.392776
25	-4.12	0.84	13.511968	13.376080	12.307079
26	-3.67	0.94	14.732271	13.511968	13.376080
27	1.68	0.81	13.774471	14.732271	13.511968
28	3.84	0.94	12.709106	13.774471	14.732271
29	5.37	0.87	12.148570	12.709106	13.774471
..
800	0.18	0.90	11.344805	11.753871	12.729659
801	0.61	0.91	11.800777	11.344805	11.753871
802	0.29	0.91	11.685169	11.800777	11.344805
803	1.10	0.76	11.857957	11.685169	11.800777
804	3.21	0.72	11.710582	11.857957	11.685169
805	1.96	0.79	12.078164	11.710582	11.857957
806	1.12	0.75	11.280011	12.078164	11.710582
807	1.03	0.77	11.095584	11.280011	12.078164
808	1.96	0.82	11.415105	11.095584	11.280011
809	-0.86	0.79	11.445403	11.415105	11.095584
810	2.19	0.77	10.972318	11.445403	11.415105
811	1.38	0.66	11.569300	10.972318	11.445403
812	0.89	0.84	12.202967	11.569300	10.972318
813	-0.57	0.76	11.264175	12.202967	11.569300
814	-1.20	0.75	11.452649	11.264175	12.202967
815	0.05	0.68	11.679099	11.452649	11.264175
816	0.45	0.81	11.285737	11.679099	11.452649
817	1.77	0.69	11.816914	11.285737	11.679099
818	-1.03	0.76	11.490470	11.816914	11.285737
819	2.84	0.83	11.582159	11.490470	11.816914
820	3.83	0.87	10.979566	11.582159	11.490470
821	2.65	0.87	10.781898	10.979566	11.582159
822	3.95	0.84	10.674624	10.781898	10.979566
823	0.19	0.72	10.573835	10.674624	10.781898
824	1.59	0.71	10.518126	10.573835	10.674624
825	5.53	0.76	10.776242	10.518126	10.573835
826	5.52	0.74	11.480411	10.776242	10.518126
827	3.89	0.78	10.411403	11.480411	10.776242
828	1.67	0.73	10.294997	10.411403	11.480411
829	1.41	0.74	10.202945	10.294997	10.411403

	t-4	...	humidity(t-5)	humidity(t-6)	humidity(t-7)	\
0	NaN	...	NaN	NaN	NaN	
1	NaN	...	NaN	NaN	NaN	
2	NaN	...	NaN	NaN	NaN	

3	NaN	...	NaN	NaN	NaN
4	6.952692	...	NaN	NaN	NaN
5	8.536480	...	0.93	NaN	NaN
6	9.499781	...	0.89	0.93	NaN
7	10.267707	...	0.79	0.89	0.93
8	10.850805	...	0.81	0.79	0.89
9	9.103382	...	0.72	0.81	0.79
10	9.274873	...	0.86	0.72	0.81
11	8.813513	...	0.82	0.86	0.72
12	9.227707	...	0.78	0.82	0.86
13	10.145910	...	0.82	0.78	0.82
14	10.780273	...	0.87	0.82	0.78
15	12.163127	...	0.79	0.87	0.82
16	10.609714	...	0.82	0.79	0.87
17	11.673417	...	0.77	0.82	0.79
18	10.889362	...	0.83	0.77	0.82
19	11.525150	...	0.68	0.83	0.77
20	11.759837	...	0.81	0.68	0.83
21	12.633801	...	0.71	0.81	0.68
22	13.749174	...	0.81	0.71	0.81
23	11.951958	...	0.88	0.81	0.71
24	11.957446	...	0.84	0.88	0.81
25	12.392776	...	0.75	0.84	0.88
26	12.307079	...	0.79	0.75	0.84
27	13.376080	...	0.77	0.79	0.75
28	13.511968	...	0.88	0.77	0.79
29	14.732271	...	0.86	0.88	0.77
..
800	11.620778	...	0.83	0.82	0.87
801	12.729659	...	0.83	0.83	0.82
802	11.753871	...	0.79	0.83	0.83
803	11.344805	...	0.79	0.79	0.83
804	11.800777	...	0.83	0.79	0.79
805	11.685169	...	0.90	0.83	0.79
806	11.857957	...	0.91	0.90	0.83
807	11.710582	...	0.91	0.91	0.90
808	12.078164	...	0.76	0.91	0.91
809	11.280011	...	0.72	0.76	0.91
810	11.095584	...	0.79	0.72	0.76
811	11.415105	...	0.75	0.79	0.72
812	11.445403	...	0.77	0.75	0.79
813	10.972318	...	0.82	0.77	0.75
814	11.569300	...	0.79	0.82	0.77
815	12.202967	...	0.77	0.79	0.82
816	11.264175	...	0.66	0.77	0.79
817	11.452649	...	0.84	0.66	0.77
818	11.679099	...	0.76	0.84	0.66
819	11.285737	...	0.75	0.76	0.84

820	11.816914	...	0.68	0.75	0.76
821	11.490470	...	0.81	0.68	0.75
822	11.582159	...	0.69	0.81	0.68
823	10.979566	...	0.76	0.69	0.81
824	10.781898	...	0.83	0.76	0.69
825	10.674624	...	0.87	0.83	0.76
826	10.573835	...	0.87	0.87	0.83
827	10.518126	...	0.84	0.87	0.87
828	10.776242	...	0.72	0.84	0.87
829	11.480411	...	0.71	0.72	0.84

	humidity(t-8)	humidity(t-9)	humidity(t-10)	humidity(t-11)	\
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	NaN	NaN	NaN	NaN	
6	NaN	NaN	NaN	NaN	
7	NaN	NaN	NaN	NaN	
8	0.93	NaN	NaN	NaN	
9	0.89	0.93	NaN	NaN	
10	0.79	0.89	0.93	NaN	
11	0.81	0.79	0.89	0.93	
12	0.72	0.81	0.79	0.89	
13	0.86	0.72	0.81	0.79	
14	0.82	0.86	0.72	0.81	
15	0.78	0.82	0.86	0.72	
16	0.82	0.78	0.82	0.86	
17	0.87	0.82	0.78	0.82	
18	0.79	0.87	0.82	0.78	
19	0.82	0.79	0.87	0.82	
20	0.77	0.82	0.79	0.87	
21	0.83	0.77	0.82	0.79	
22	0.68	0.83	0.77	0.82	
23	0.81	0.68	0.83	0.77	
24	0.71	0.81	0.68	0.83	
25	0.81	0.71	0.81	0.68	
26	0.88	0.81	0.71	0.81	
27	0.84	0.88	0.81	0.71	
28	0.75	0.84	0.88	0.81	
29	0.79	0.75	0.84	0.88	
..	
800	0.89	0.89	0.80	0.83	
801	0.87	0.89	0.89	0.80	
802	0.82	0.87	0.89	0.89	
803	0.83	0.82	0.87	0.89	
804	0.83	0.83	0.82	0.87	

805	0.79	0.83	0.83	0.82
806	0.79	0.79	0.83	0.83
807	0.83	0.79	0.79	0.83
808	0.90	0.83	0.79	0.79
809	0.91	0.90	0.83	0.79
810	0.91	0.91	0.90	0.83
811	0.76	0.91	0.91	0.90
812	0.72	0.76	0.91	0.91
813	0.79	0.72	0.76	0.91
814	0.75	0.79	0.72	0.76
815	0.77	0.75	0.79	0.72
816	0.82	0.77	0.75	0.79
817	0.79	0.82	0.77	0.75
818	0.77	0.79	0.82	0.77
819	0.66	0.77	0.79	0.82
820	0.84	0.66	0.77	0.79
821	0.76	0.84	0.66	0.77
822	0.75	0.76	0.84	0.66
823	0.68	0.75	0.76	0.84
824	0.81	0.68	0.75	0.76
825	0.69	0.81	0.68	0.75
826	0.76	0.69	0.81	0.68
827	0.83	0.76	0.69	0.81
828	0.87	0.83	0.76	0.69
829	0.87	0.87	0.83	0.76

	humidity(t-12)	humidity(t-13)	humidity(t-14)
0	NaN	NaN	NaN
1	NaN	NaN	NaN
2	NaN	NaN	NaN
3	NaN	NaN	NaN
4	NaN	NaN	NaN
5	NaN	NaN	NaN
6	NaN	NaN	NaN
7	NaN	NaN	NaN
8	NaN	NaN	NaN
9	NaN	NaN	NaN
10	NaN	NaN	NaN
11	NaN	NaN	NaN
12	0.93	NaN	NaN
13	0.89	0.93	NaN
14	0.79	0.89	0.93
15	0.81	0.79	0.89
16	0.72	0.81	0.79
17	0.86	0.72	0.81
18	0.82	0.86	0.72
19	0.78	0.82	0.86
20	0.82	0.78	0.82

21	0.87	0.82	0.78
22	0.79	0.87	0.82
23	0.82	0.79	0.87
24	0.77	0.82	0.79
25	0.83	0.77	0.82
26	0.68	0.83	0.77
27	0.81	0.68	0.83
28	0.71	0.81	0.68
29	0.81	0.71	0.81
..
800	0.87	0.83	0.90
801	0.83	0.87	0.83
802	0.80	0.83	0.87
803	0.89	0.80	0.83
804	0.89	0.89	0.80
805	0.87	0.89	0.89
806	0.82	0.87	0.89
807	0.83	0.82	0.87
808	0.83	0.83	0.82
809	0.79	0.83	0.83
810	0.79	0.79	0.83
811	0.83	0.79	0.79
812	0.90	0.83	0.79
813	0.91	0.90	0.83
814	0.91	0.91	0.90
815	0.76	0.91	0.91
816	0.72	0.76	0.91
817	0.79	0.72	0.76
818	0.75	0.79	0.72
819	0.77	0.75	0.79
820	0.82	0.77	0.75
821	0.79	0.82	0.77
822	0.77	0.79	0.82
823	0.66	0.77	0.79
824	0.84	0.66	0.77
825	0.76	0.84	0.66
826	0.75	0.76	0.84
827	0.68	0.75	0.76
828	0.81	0.68	0.75
829	0.69	0.81	0.68

[830 rows x 62 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','apparentTemperatureMax'])
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	NaN
1	8.536480	6.952692	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
2	9.499781	8.536480	6.952692	NaN	NaN	NaN	NaN	NaN	NaN	NaN
3	10.267707	9.499781	8.536480	6.952692	NaN	NaN	NaN	NaN	NaN	NaN
4	10.850805	10.267707	9.499781	8.536480	6.952692	NaN	NaN	NaN	NaN	NaN

	t-9	...	humidity(t-5)	humidity(t-6)	humidity(t-7)	humidity(t-8)	\
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	

	humidity(t-9)	humidity(t-10)	humidity(t-11)	humidity(t-12)	\
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	

	humidity(t-13)	humidity(t-14)
0	NaN	NaN
1	NaN	NaN
2	NaN	NaN
3	NaN	NaN
4	NaN	NaN

[5 rows x 57 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	...	humidity(t-5)	\
14	9.227707	8.813513	9.274873	9.103382	...	0.87	
15	10.145910	9.227707	8.813513	9.274873	...	0.79	
16	10.780273	10.145910	9.227707	8.813513	...	0.82	
17	12.163127	10.780273	10.145910	9.227707	...	0.77	
18	10.609714	12.163127	10.780273	10.145910	...	0.83	

	humidity(t-6)	humidity(t-7)	humidity(t-8)	humidity(t-9)	\
14	0.82	0.78	0.82	0.86	
15	0.87	0.82	0.78	0.82	
16	0.79	0.87	0.82	0.78	
17	0.82	0.79	0.87	0.82	
18	0.77	0.82	0.79	0.87	

	humidity(t-10)	humidity(t-11)	humidity(t-12)	humidity(t-13)	\
14	0.72	0.81	0.79	0.89	
15	0.86	0.72	0.81	0.79	
16	0.82	0.86	0.72	0.81	
17	0.78	0.82	0.86	0.72	
18	0.82	0.78	0.82	0.86	

	humidity(t-14)
14	0.93
15	0.89
16	0.79
17	0.81
18	0.72

[5 rows x 57 columns]

In [8]: `len(daily_dia)`

Out[8]: 816

In [9]: `#normalitzem`

```
scaler=preprocessing.MinMaxScaler(feature_range=(0, 1))
daily_dia_norm=scaler.fit_transform(daily_dia)
```

In [10]: `#Seleccionem dades per test i train`

```
y_daily=daily_dia_norm[:,0]
X_daily=daily_dia_norm[:,1:58]
```

```
#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], 14,4))
```

In [28]: `# definim model`

```
import tensorflow as tf
model =Sequential()
model.add(LSTM(50, activation='relu', input_shape=(14, 4)))
```

```

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 mitja
sumScores/(lenght-n_train)

```

Out [30]: 0.0339291443464245

In [31]: llista_scores

Out [31]: [0.03883781955409571,
0.04505325578059938,
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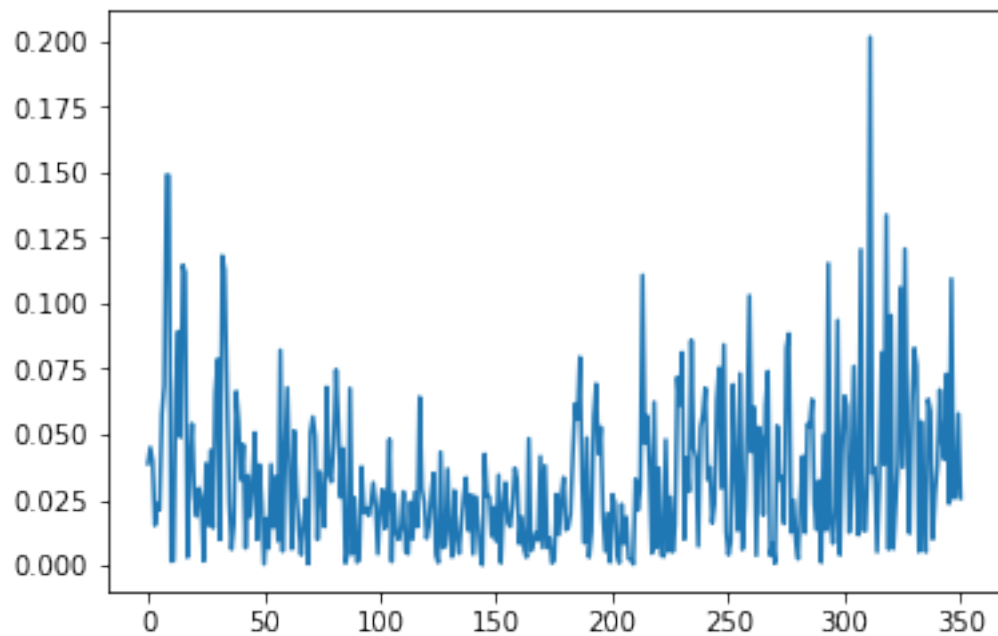
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```
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0.02628753725496802,  
0.0578585413013728,  
0.025648953657151363]
```

```
In [32]: plt.plot(llista_scores)
```

```
Out[32]: [<matplotlib.lines.Line2D at 0x235236145f8>]
```



```
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([0.5528993 , 0.5355553 , 0.58444446, 0.55460036, 0.51478428,
0.50094473, 0.56204826, 0.49901742, 0.5705961 , 0.65599465,
0.68642157, 0.66028458, 0.68151206, 0.65473479, 0.63455111,
0.65103924, 0.66404951, 0.55540788, 0.51787817, 0.53189129,
0.57763582, 0.56357855, 0.55924535, 0.48421362, 0.46749121,
0.441508 , 0.42157862, 0.42401636, 0.41321841, 0.44338632,
0.31705755, 0.33137137, 0.37837303, 0.36293936, 0.31422767,
0.22872321, 0.26855069, 0.29456532, 0.26955533, 0.21566758,
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0.19912034, 0.21672663, 0.22527121, 0.27359676, 0.21342055,
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```

```

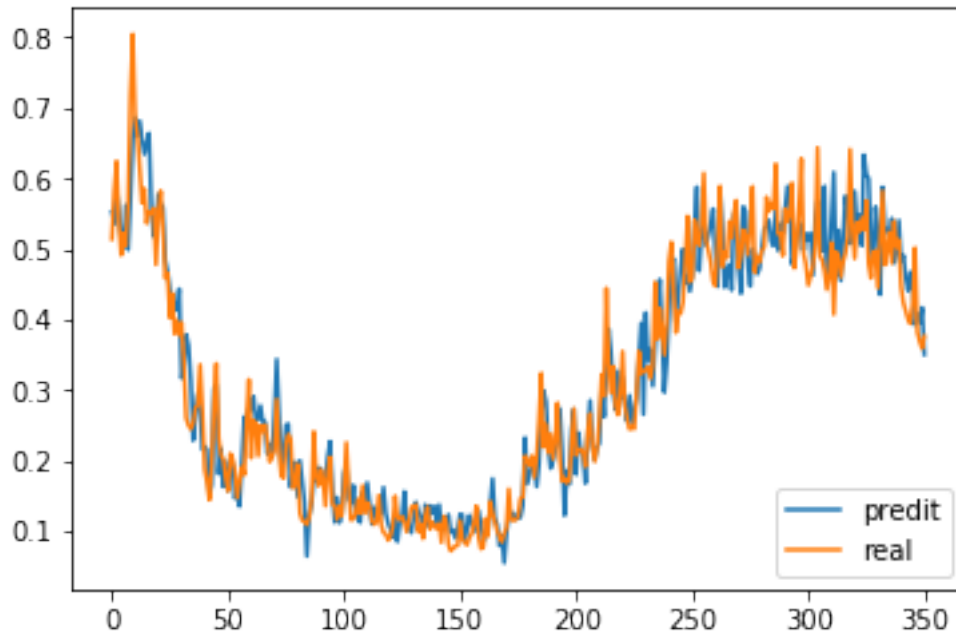
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0.58194566, 0.53112257, 0.54802209, 0.50496316, 0.63340151,
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0.52778184, 0.43547618, 0.58770442, 0.53247625, 0.52536273,
0.51872718, 0.54336655, 0.48037687, 0.49270207, 0.54064548,
0.48383224, 0.49066949, 0.45910802, 0.44079894, 0.46723109,
0.44661897, 0.39241421, 0.40796423, 0.39556754, 0.41685402,
0.3504858 ])

```

```

In [34]: ##Mostrem
plt.plot(predis, label="predict")
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'aquesta 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 aleatòries 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	0.552899	0.514061	12.119938	12.852295	13.106773	12.823073	
480	0.535555	0.580609	11.786082	12.119938	12.852295	13.106773	
481	0.584444	0.624326	11.590859	11.786082	12.119938	12.852295	
482	0.554600	0.539280	12.186487	11.590859	11.786082	12.119938	
483	0.514784	0.491355	12.577783	12.186487	11.590859	11.786082	
484	0.500945	0.522145	11.816573	12.577783	12.186487	11.590859	
485	0.562048	0.504442	11.387627	11.816573	12.577783	12.186487	
486	0.499017	0.567725	11.663214	11.387627	11.816573	12.577783	
487	0.570596	0.719460	11.504756	11.663214	11.387627	11.816573	
488	0.655995	0.804631	12.071173	11.504756	11.663214	11.387627	
489	0.686422	0.684716	13.429271	12.071173	11.504756	11.663214	
490	0.660285	0.662177	14.191591	13.429271	12.071173	11.504756	
491	0.681512	0.615194	13.118295	14.191591	13.429271	12.071173	
492	0.654735	0.565466	12.916559	13.118295	14.191591	13.429271	
493	0.634551	0.585646	12.496044	12.916559	13.118295	14.191591	
494	0.651039	0.536523	12.050954	12.496044	12.916559	13.118295	
495	0.664050	0.552256	12.231576	12.050954	12.496044	12.916559	
496	0.555408	0.552256	11.791904	12.231576	12.050954	12.496044	
497	0.517878	0.557809	11.932721	11.791904	12.231576	12.050954	
498	0.531891	0.477794	11.932721	11.932721	11.791904	12.231576	
499	0.577636	0.551195	11.982423	11.932721	11.932721	11.791904	
500	0.563579	0.582339	11.266252	11.982423	11.932721	11.932721	
501	0.559245	0.529772	11.923226	11.266252	11.982423	11.932721	
502	0.484214	0.458904	12.201972	11.923226	11.266252	11.982423	
503	0.467491	0.465733	11.731479	12.201972	11.923226	11.266252	
504	0.441508	0.402622	11.097177	11.731479	12.201972	11.923226	
505	0.421579	0.436918	11.158295	11.097177	11.731479	12.201972	
506	0.424016	0.380048	10.593420	11.158295	11.097177	11.731479	
507	0.413218	0.398860	10.900388	10.593420	11.158295	11.097177	
508	0.443386	0.377916	10.391372	10.900388	10.593420	11.158295	
...	
800	0.531123	0.537515	11.753871	12.729659	11.620778	11.409880	
801	0.548022	0.524598	11.344805	11.753871	12.729659	11.620778	
802	0.504963	0.543903	11.800777	11.344805	11.753871	12.729659	
803	0.633402	0.527438	11.685169	11.800777	11.344805	11.753871	
804	0.605957	0.568506	11.857957	11.685169	11.800777	11.344805	
805	0.600018	0.479332	11.710582	11.857957	11.685169	11.800777	
806	0.504630	0.458726	12.078164	11.710582	11.857957	11.685169	
807	0.482121	0.494425	11.280011	12.078164	11.710582	11.857957	
808	0.559785	0.497810	11.095584	11.280011	12.078164	11.710582	

809	0.527782	0.444954	11.415105	11.095584	11.280011	12.078164
810	0.435476	0.511653	11.445403	11.415105	11.095584	11.280011
811	0.587704	0.582450	10.972318	11.445403	11.415105	11.095584
812	0.532476	0.477562	11.569300	10.972318	11.445403	11.415105
813	0.525363	0.498620	12.202967	11.569300	10.972318	11.445403
814	0.518727	0.523920	11.264175	12.202967	11.569300	10.972318
815	0.543367	0.479971	11.452649	11.264175	12.202967	11.569300
816	0.480377	0.539318	11.679099	11.452649	11.264175	12.202967
817	0.492702	0.502845	11.285737	11.679099	11.452649	11.264175
818	0.540645	0.513089	11.816914	11.285737	11.679099	11.452649
819	0.483832	0.445764	11.490470	11.816914	11.285737	11.679099
820	0.490669	0.423680	11.582159	11.490470	11.816914	11.285737
821	0.459108	0.411694	10.979566	11.582159	11.490470	11.816914
822	0.440799	0.400434	10.781898	10.979566	11.582159	11.490470
823	0.467231	0.394209	10.674624	10.781898	10.979566	11.582159
824	0.446619	0.423048	10.573835	10.674624	10.781898	10.979566
825	0.392414	0.501722	10.518126	10.573835	10.674624	10.781898
826	0.407964	0.382286	10.776242	10.518126	10.573835	10.674624
827	0.395568	0.369280	11.480411	10.776242	10.518126	10.573835
828	0.416854	0.358995	10.411403	11.480411	10.776242	10.518126
829	0.350486	0.376135	10.294997	10.411403	11.480411	10.776242

	t-6	t-7	t-8	t-9	...	humidity(t-5) \
479	11.559878	10.930170	10.889469	10.675248	...	0.82
480	12.823073	11.559878	10.930170	10.889469	...	0.73
481	13.106773	12.823073	11.559878	10.930170	...	0.63
482	12.852295	13.106773	12.823073	11.559878	...	0.73
483	12.119938	12.852295	13.106773	12.823073	...	0.67
484	11.786082	12.119938	12.852295	13.106773	...	0.81
485	11.590859	11.786082	12.119938	12.852295	...	0.85
486	12.186487	11.590859	11.786082	12.119938	...	0.88
487	12.577783	12.186487	11.590859	11.786082	...	0.91
488	11.816573	12.577783	12.186487	11.590859	...	0.83
489	11.387627	11.816573	12.577783	12.186487	...	0.86
490	11.663214	11.387627	11.816573	12.577783	...	0.75
491	11.504756	11.663214	11.387627	11.816573	...	0.79
492	12.071173	11.504756	11.663214	11.387627	...	0.92
493	13.429271	12.071173	11.504756	11.663214	...	0.78
494	14.191591	13.429271	12.071173	11.504756	...	0.65
495	13.118295	14.191591	13.429271	12.071173	...	0.65
496	12.916559	13.118295	14.191591	13.429271	...	0.64
497	12.496044	12.916559	13.118295	14.191591	...	0.66
498	12.050954	12.496044	12.916559	13.118295	...	0.63
499	12.231576	12.050954	12.496044	12.916559	...	0.69
500	11.791904	12.231576	12.050954	12.496044	...	0.68
501	11.932721	11.791904	12.231576	12.050954	...	0.64
502	11.932721	11.932721	11.791904	12.231576	...	0.57
503	11.982423	11.932721	11.932721	11.791904	...	0.64

504	11.266252	11.982423	11.932721	11.932721	...	0.74
505	11.923226	11.266252	11.982423	11.932721	...	0.61
506	12.201972	11.923226	11.266252	11.982423	...	0.63
507	11.731479	12.201972	11.923226	11.266252	...	0.62
508	11.097177	11.731479	12.201972	11.923226	...	0.65
..
800	11.300414	11.109560	11.370601	11.430883	...	0.83
801	11.409880	11.300414	11.109560	11.370601	...	0.83
802	11.620778	11.409880	11.300414	11.109560	...	0.79
803	12.729659	11.620778	11.409880	11.300414	...	0.79
804	11.753871	12.729659	11.620778	11.409880	...	0.83
805	11.344805	11.753871	12.729659	11.620778	...	0.90
806	11.800777	11.344805	11.753871	12.729659	...	0.91
807	11.685169	11.800777	11.344805	11.753871	...	0.91
808	11.857957	11.685169	11.800777	11.344805	...	0.76
809	11.710582	11.857957	11.685169	11.800777	...	0.72
810	12.078164	11.710582	11.857957	11.685169	...	0.79
811	11.280011	12.078164	11.710582	11.857957	...	0.75
812	11.095584	11.280011	12.078164	11.710582	...	0.77
813	11.415105	11.095584	11.280011	12.078164	...	0.82
814	11.445403	11.415105	11.095584	11.280011	...	0.79
815	10.972318	11.445403	11.415105	11.095584	...	0.77
816	11.569300	10.972318	11.445403	11.415105	...	0.66
817	12.202967	11.569300	10.972318	11.445403	...	0.84
818	11.264175	12.202967	11.569300	10.972318	...	0.76
819	11.452649	11.264175	12.202967	11.569300	...	0.75
820	11.679099	11.452649	11.264175	12.202967	...	0.68
821	11.285737	11.679099	11.452649	11.264175	...	0.81
822	11.816914	11.285737	11.679099	11.452649	...	0.69
823	11.490470	11.816914	11.285737	11.679099	...	0.76
824	11.582159	11.490470	11.816914	11.285737	...	0.83
825	10.979566	11.582159	11.490470	11.816914	...	0.87
826	10.781898	10.979566	11.582159	11.490470	...	0.87
827	10.674624	10.781898	10.979566	11.582159	...	0.84
828	10.573835	10.674624	10.781898	10.979566	...	0.72
829	10.518126	10.573835	10.674624	10.781898	...	0.71

	humidity(t-6)	humidity(t-7)	humidity(t-8)	humidity(t-9)	\
479	0.90	0.96	0.93	0.72	
480	0.82	0.90	0.96	0.93	
481	0.73	0.82	0.90	0.96	
482	0.63	0.73	0.82	0.90	
483	0.73	0.63	0.73	0.82	
484	0.67	0.73	0.63	0.73	
485	0.81	0.67	0.73	0.63	
486	0.85	0.81	0.67	0.73	
487	0.88	0.85	0.81	0.67	
488	0.91	0.88	0.85	0.81	

489	0.83	0.91	0.88	0.85
490	0.86	0.83	0.91	0.88
491	0.75	0.86	0.83	0.91
492	0.79	0.75	0.86	0.83
493	0.92	0.79	0.75	0.86
494	0.78	0.92	0.79	0.75
495	0.65	0.78	0.92	0.79
496	0.65	0.65	0.78	0.92
497	0.64	0.65	0.65	0.78
498	0.66	0.64	0.65	0.65
499	0.63	0.66	0.64	0.65
500	0.69	0.63	0.66	0.64
501	0.68	0.69	0.63	0.66
502	0.64	0.68	0.69	0.63
503	0.57	0.64	0.68	0.69
504	0.64	0.57	0.64	0.68
505	0.74	0.64	0.57	0.64
506	0.61	0.74	0.64	0.57
507	0.63	0.61	0.74	0.64
508	0.62	0.63	0.61	0.74
..
800	0.82	0.87	0.89	0.89
801	0.83	0.82	0.87	0.89
802	0.83	0.83	0.82	0.87
803	0.79	0.83	0.83	0.82
804	0.79	0.79	0.83	0.83
805	0.83	0.79	0.79	0.83
806	0.90	0.83	0.79	0.79
807	0.91	0.90	0.83	0.79
808	0.91	0.91	0.90	0.83
809	0.76	0.91	0.91	0.90
810	0.72	0.76	0.91	0.91
811	0.79	0.72	0.76	0.91
812	0.75	0.79	0.72	0.76
813	0.77	0.75	0.79	0.72
814	0.82	0.77	0.75	0.79
815	0.79	0.82	0.77	0.75
816	0.77	0.79	0.82	0.77
817	0.66	0.77	0.79	0.82
818	0.84	0.66	0.77	0.79
819	0.76	0.84	0.66	0.77
820	0.75	0.76	0.84	0.66
821	0.68	0.75	0.76	0.84
822	0.81	0.68	0.75	0.76
823	0.69	0.81	0.68	0.75
824	0.76	0.69	0.81	0.68
825	0.83	0.76	0.69	0.81
826	0.87	0.83	0.76	0.69

827	0.87	0.87	0.83	0.76
828	0.84	0.87	0.87	0.83
829	0.72	0.84	0.87	0.87

	humidity(t-10)	humidity(t-11)	humidity(t-12)	humidity(t-13)	\
479	0.74	0.78	0.80	0.72	
480	0.72	0.74	0.78	0.80	
481	0.93	0.72	0.74	0.78	
482	0.96	0.93	0.72	0.74	
483	0.90	0.96	0.93	0.72	
484	0.82	0.90	0.96	0.93	
485	0.73	0.82	0.90	0.96	
486	0.63	0.73	0.82	0.90	
487	0.73	0.63	0.73	0.82	
488	0.67	0.73	0.63	0.73	
489	0.81	0.67	0.73	0.63	
490	0.85	0.81	0.67	0.73	
491	0.88	0.85	0.81	0.67	
492	0.91	0.88	0.85	0.81	
493	0.83	0.91	0.88	0.85	
494	0.86	0.83	0.91	0.88	
495	0.75	0.86	0.83	0.91	
496	0.79	0.75	0.86	0.83	
497	0.92	0.79	0.75	0.86	
498	0.78	0.92	0.79	0.75	
499	0.65	0.78	0.92	0.79	
500	0.65	0.65	0.78	0.92	
501	0.64	0.65	0.65	0.78	
502	0.66	0.64	0.65	0.65	
503	0.63	0.66	0.64	0.65	
504	0.69	0.63	0.66	0.64	
505	0.68	0.69	0.63	0.66	
506	0.64	0.68	0.69	0.63	
507	0.57	0.64	0.68	0.69	
508	0.64	0.57	0.64	0.68	
..	
800	0.80	0.83	0.87	0.83	
801	0.89	0.80	0.83	0.87	
802	0.89	0.89	0.80	0.83	
803	0.87	0.89	0.89	0.80	
804	0.82	0.87	0.89	0.89	
805	0.83	0.82	0.87	0.89	
806	0.83	0.83	0.82	0.87	
807	0.79	0.83	0.83	0.82	
808	0.79	0.79	0.83	0.83	
809	0.83	0.79	0.79	0.83	
810	0.90	0.83	0.79	0.79	
811	0.91	0.90	0.83	0.79	

812	0.91	0.91	0.90	0.83
813	0.76	0.91	0.91	0.90
814	0.72	0.76	0.91	0.91
815	0.79	0.72	0.76	0.91
816	0.75	0.79	0.72	0.76
817	0.77	0.75	0.79	0.72
818	0.82	0.77	0.75	0.79
819	0.79	0.82	0.77	0.75
820	0.77	0.79	0.82	0.77
821	0.66	0.77	0.79	0.82
822	0.84	0.66	0.77	0.79
823	0.76	0.84	0.66	0.77
824	0.75	0.76	0.84	0.66
825	0.68	0.75	0.76	0.84
826	0.81	0.68	0.75	0.76
827	0.69	0.81	0.68	0.75
828	0.76	0.69	0.81	0.68
829	0.83	0.76	0.69	0.81

	humidity(t-14)
479	0.78
480	0.72
481	0.80
482	0.78
483	0.74
484	0.72
485	0.93
486	0.96
487	0.90
488	0.82
489	0.73
490	0.63
491	0.73
492	0.67
493	0.81
494	0.85
495	0.88
496	0.91
497	0.83
498	0.86
499	0.75
500	0.79
501	0.92
502	0.78
503	0.65
504	0.65
505	0.64
506	0.66

507	0.63
508	0.69
..	...
800	0.90
801	0.83
802	0.87
803	0.83
804	0.80
805	0.89
806	0.89
807	0.87
808	0.82
809	0.83
810	0.83
811	0.79
812	0.79
813	0.83
814	0.90
815	0.91
816	0.91
817	0.76
818	0.72
819	0.79
820	0.75
821	0.77
822	0.82
823	0.79
824	0.77
825	0.66
826	0.84
827	0.76
828	0.75
829	0.68

[351 rows x 57 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 15 i 16 són predicció i y respectivament

```

[[ 11.93847598  11.59085917 115.46893021 ...  0.87      0.826
   0.859      ]
 [ 11.78323901  12.18648691 112.48075791 ...  0.859      0.87

```

```

    0.826      ]
[ 12.22082006 12.57778255 110.7334244 ... 0.837      0.859
    0.87      ]
...
[ 10.53028246 10.2949966 109.74485905 ... 0.804      0.8425
    0.848      ]
[ 10.72080656 10.20294532 100.17673598 ... 0.8755     0.804
    0.8425     ]
[ 10.12677966 10.3563499 99.13484299 ... 0.8095     0.8755
    0.804      ]]
11.938475978988809
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,
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13.4292708131623,
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11.9327208888355,
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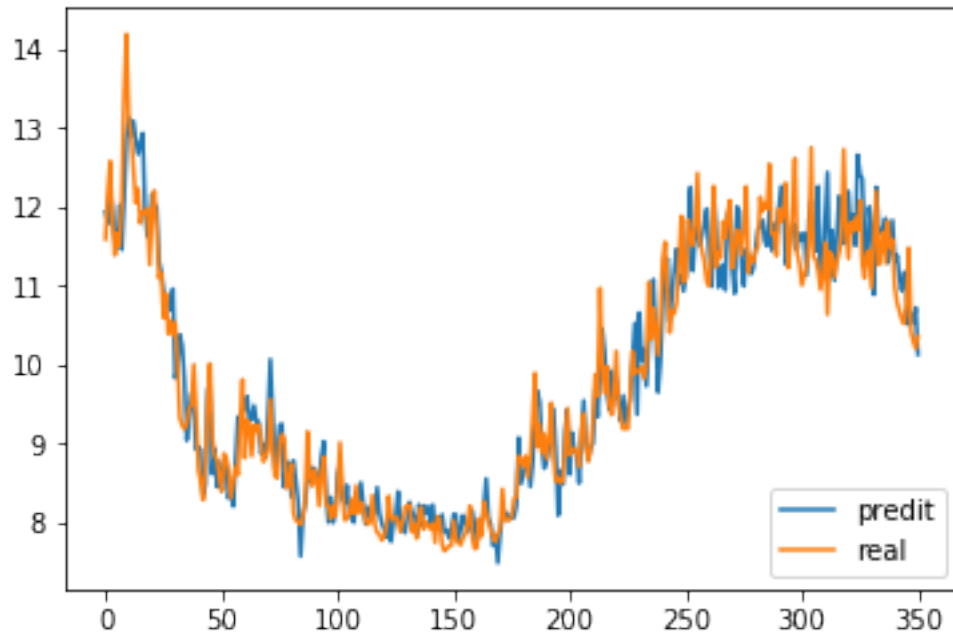
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```
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10.3563498993587]
```

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

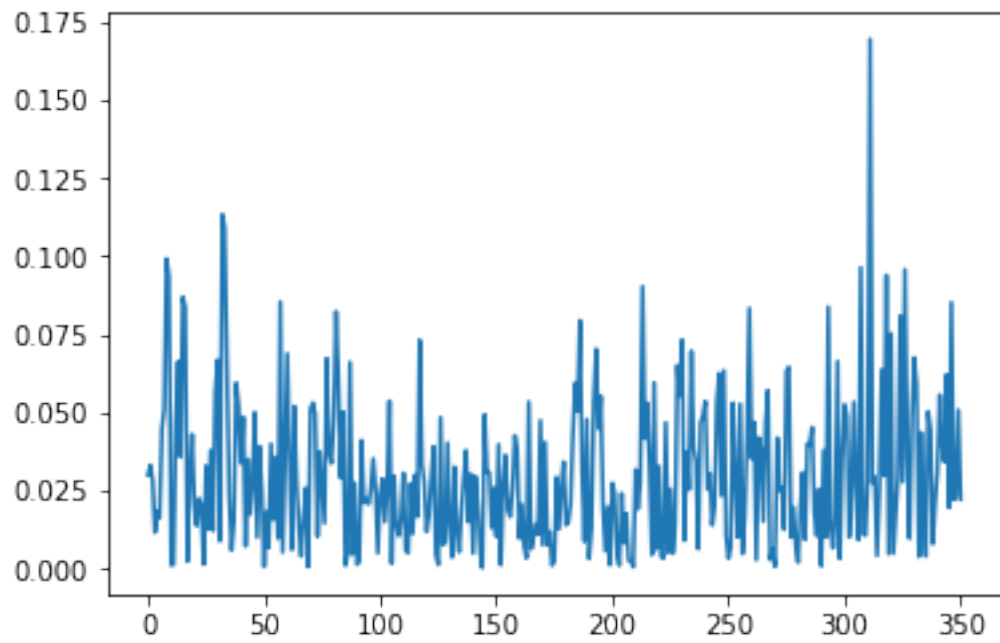


```
In [39]: llista_errors=list()
         llista_errorsabs=list()
         llista_errorsres=list()

         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)
```

```
In [40]: plt.plot(llista_errorsres)
```

```
Out[40]: [<matplotlib.lines.Line2D at 0x235236fb080>]
```

```
In [41]: sum(llista_errorsres)/(len(llista_errorsres))
```

```
Out[41]: 0.03009384692315653
```

```
In [ ]:
```