MM1 _Xarxa_walkforard_normalitzat_multivariate2_MULTISTEP_tempmin_ walkforwardaugment

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 multi-step

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

```
Out[3]:          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
```

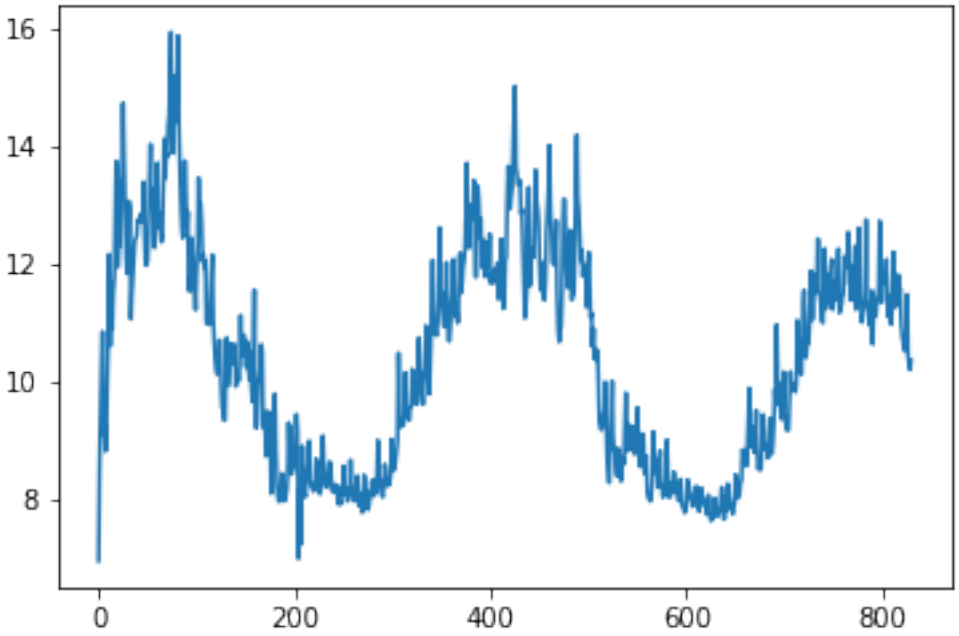
In [4]:
```
#Ens quedem amb date i energy_sum, ordenem valors per data i resetejem index
daily_dia=daily[['date','energy_sum','apparentTemperatureMax','apparentTemperatureMin'
daily_dia.head(5)
```

Out[4]:
```
   index        date  energy_sum  apparentTemperatureMax  \
0    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
0                    2.18      0.93        3
1                    7.01      0.89        4
2                    4.84      0.79        5
3                    4.69      0.81        6
4                    2.94      0.72        7
```

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

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



In [5]:
```
daily_dia['y+1']=daily_dia['energy_sum'].shift(-1)
daily_dia['y+2']=daily_dia['energy_sum'].shift(-2)
daily_dia['y+3']=daily_dia['energy_sum'].shift(-3)
daily_dia['y+4']=daily_dia['energy_sum'].shift(-4)
daily_dia['y+5']=daily_dia['energy_sum'].shift(-5)
daily_dia['y+6']=daily_dia['energy_sum'].shift(-6)
```

```
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
```

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	y+1	y+2	\
0	2.18	0.93	3	8.536480	9.499781	
1	7.01	0.89	4	9.499781	10.267707	
2	4.84	0.79	5	10.267707	10.850805	
3	4.69	0.81	6	10.850805	9.103382	
4	2.94	0.72	7	9.103382	9.274873	
5	1.31	0.86	1	9.274873	8.813513	
6	3.39	0.82	2	8.813513	9.227707	
7	3.34	0.78	3	9.227707	10.145910	
8	5.29	0.82	4	10.145910	10.780273	
9	0.46	0.87	5	10.780273	12.163127	
10	4.71	0.79	6	12.163127	10.609714	
11	1.03	0.82	7	10.609714	11.673417	
12	-1.69	0.77	1	11.673417	10.889362	
13	-1.61	0.83	2	10.889362	11.525150	
14	0.94	0.68	3	11.525150	11.759837	
15	0.63	0.81	4	11.759837	12.633801	
16	-1.42	0.71	5	12.633801	13.749174	
17	-3.42	0.81	6	13.749174	11.951958	
18	0.11	0.88	7	11.951958	11.957446	

19	-0.64	0.84	1	11.957446	12.392776
20	0.22	0.75	2	12.392776	12.307079
21	0.78	0.79	3	12.307079	13.376080
22	1.07	0.77	4	13.376080	13.511968
23	-2.65	0.88	5	13.511968	14.732271
24	-3.56	0.86	6	14.732271	13.774471
25	-4.12	0.84	7	13.774471	12.709106
26	-3.67	0.94	1	12.709106	12.148570
27	1.68	0.81	2	12.148570	11.839403
28	3.84	0.94	3	11.839403	12.254989
29	5.37	0.87	4	12.254989	13.065317
..	...	...	...	...	...
800	0.18	0.90	3	11.685169	11.857957
801	0.61	0.91	4	11.857957	11.710582
802	0.29	0.91	5	11.710582	12.078164
803	1.10	0.76	6	12.078164	11.280011
804	3.21	0.72	7	11.280011	11.095584
805	1.96	0.79	1	11.095584	11.415105
806	1.12	0.75	2	11.415105	11.445403
807	1.03	0.77	3	11.445403	10.972318
808	1.96	0.82	4	10.972318	11.569300
809	-0.86	0.79	5	11.569300	12.202967
810	2.19	0.77	6	12.202967	11.264175
811	1.38	0.66	7	11.264175	11.452649
812	0.89	0.84	1	11.452649	11.679099
813	-0.57	0.76	2	11.679099	11.285737
814	-1.20	0.75	3	11.285737	11.816914
815	0.05	0.68	4	11.816914	11.490470
816	0.45	0.81	5	11.490470	11.582159
817	1.77	0.69	6	11.582159	10.979566
818	-1.03	0.76	7	10.979566	10.781898
819	2.84	0.83	1	10.781898	10.674624
820	3.83	0.87	2	10.674624	10.573835
821	2.65	0.87	3	10.573835	10.518126
822	3.95	0.84	4	10.518126	10.776242
823	0.19	0.72	5	10.776242	11.480411
824	1.59	0.71	6	11.480411	10.411403
825	5.53	0.76	7	10.411403	10.294997
826	5.52	0.74	1	10.294997	10.202945
827	3.89	0.78	2	10.202945	10.356350
828	1.67	0.73	3	10.356350	NaN
829	1.41	0.74	4	NaN	NaN

	y+3	...	weekday(t-5)	weekday(t-6)	weekday(t-7)	weekday(t-8)	\
0	10.267707	...	NaN	NaN	NaN	NaN	
1	10.850805	...	NaN	NaN	NaN	NaN	
2	9.103382	...	NaN	NaN	NaN	NaN	
3	9.274873	...	NaN	NaN	NaN	NaN	

4	8.813513	...	NaN	NaN	NaN	NaN
5	9.227707	...	3.0	NaN	NaN	NaN
6	10.145910	...	4.0	3.0	NaN	NaN
7	10.780273	...	5.0	4.0	3.0	NaN
8	12.163127	...	6.0	5.0	4.0	3.0
9	10.609714	...	7.0	6.0	5.0	4.0
10	11.673417	...	1.0	7.0	6.0	5.0
11	10.889362	...	2.0	1.0	7.0	6.0
12	11.525150	...	3.0	2.0	1.0	7.0
13	11.759837	...	4.0	3.0	2.0	1.0
14	12.633801	...	5.0	4.0	3.0	2.0
15	13.749174	...	6.0	5.0	4.0	3.0
16	11.951958	...	7.0	6.0	5.0	4.0
17	11.957446	...	1.0	7.0	6.0	5.0
18	12.392776	...	2.0	1.0	7.0	6.0
19	12.307079	...	3.0	2.0	1.0	7.0
20	13.376080	...	4.0	3.0	2.0	1.0
21	13.511968	...	5.0	4.0	3.0	2.0
22	14.732271	...	6.0	5.0	4.0	3.0
23	13.774471	...	7.0	6.0	5.0	4.0
24	12.709106	...	1.0	7.0	6.0	5.0
25	12.148570	...	2.0	1.0	7.0	6.0
26	11.839403	...	3.0	2.0	1.0	7.0
27	12.254989	...	4.0	3.0	2.0	1.0
28	13.065317	...	5.0	4.0	3.0	2.0
29	12.949429	...	6.0	5.0	4.0	3.0
..	...	...	...	...	...	...
800	11.710582	...	5.0	4.0	3.0	2.0
801	12.078164	...	6.0	5.0	4.0	3.0
802	11.280011	...	7.0	6.0	5.0	4.0
803	11.095584	...	1.0	7.0	6.0	5.0
804	11.415105	...	2.0	1.0	7.0	6.0
805	11.445403	...	3.0	2.0	1.0	7.0
806	10.972318	...	4.0	3.0	2.0	1.0
807	11.569300	...	5.0	4.0	3.0	2.0
808	12.202967	...	6.0	5.0	4.0	3.0
809	11.264175	...	7.0	6.0	5.0	4.0
810	11.452649	...	1.0	7.0	6.0	5.0
811	11.679099	...	2.0	1.0	7.0	6.0
812	11.285737	...	3.0	2.0	1.0	7.0
813	11.816914	...	4.0	3.0	2.0	1.0
814	11.490470	...	5.0	4.0	3.0	2.0
815	11.582159	...	6.0	5.0	4.0	3.0
816	10.979566	...	7.0	6.0	5.0	4.0
817	10.781898	...	1.0	7.0	6.0	5.0
818	10.674624	...	2.0	1.0	7.0	6.0
819	10.573835	...	3.0	2.0	1.0	7.0
820	10.518126	...	4.0	3.0	2.0	1.0

```
821  10.776242  ...           5.0           4.0           3.0           2.0
822  11.480411  ...           6.0           5.0           4.0           3.0
823  10.411403  ...           7.0           6.0           5.0           4.0
824  10.294997  ...           1.0           7.0           6.0           5.0
825  10.202945  ...           2.0           1.0           7.0           6.0
826  10.356350  ...           3.0           2.0           1.0           7.0
827        NaN  ...           4.0           3.0           2.0           1.0
828        NaN  ...           5.0           4.0           3.0           2.0
829        NaN  ...           6.0           5.0           4.0           3.0

     weekday(t-9)  weekday(t-10)  weekday(t-11)  weekday(t-12)  weekday(t-13)  \
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             3.0            NaN            NaN            NaN            NaN
10            4.0            3.0            NaN            NaN            NaN
11            5.0            4.0            3.0            NaN            NaN
12            6.0            5.0            4.0            3.0            NaN
13            7.0            6.0            5.0            4.0            3.0
14            1.0            7.0            6.0            5.0            4.0
15            2.0            1.0            7.0            6.0            5.0
16            3.0            2.0            1.0            7.0            6.0
17            4.0            3.0            2.0            1.0            7.0
18            5.0            4.0            3.0            2.0            1.0
19            6.0            5.0            4.0            3.0            2.0
20            7.0            6.0            5.0            4.0            3.0
21            1.0            7.0            6.0            5.0            4.0
22            2.0            1.0            7.0            6.0            5.0
23            3.0            2.0            1.0            7.0            6.0
24            4.0            3.0            2.0            1.0            7.0
25            5.0            4.0            3.0            2.0            1.0
26            6.0            5.0            4.0            3.0            2.0
27            7.0            6.0            5.0            4.0            3.0
28            1.0            7.0            6.0            5.0            4.0
29            2.0            1.0            7.0            6.0            5.0
..            ...            ...            ...            ...            ...
800           1.0            7.0            6.0            5.0            4.0
801           2.0            1.0            7.0            6.0            5.0
802           3.0            2.0            1.0            7.0            6.0
803           4.0            3.0            2.0            1.0            7.0
804           5.0            4.0            3.0            2.0            1.0
805           6.0            5.0            4.0            3.0            2.0
```

806	7.0	6.0	5.0	4.0	3.0
807	1.0	7.0	6.0	5.0	4.0
808	2.0	1.0	7.0	6.0	5.0
809	3.0	2.0	1.0	7.0	6.0
810	4.0	3.0	2.0	1.0	7.0
811	5.0	4.0	3.0	2.0	1.0
812	6.0	5.0	4.0	3.0	2.0
813	7.0	6.0	5.0	4.0	3.0
814	1.0	7.0	6.0	5.0	4.0
815	2.0	1.0	7.0	6.0	5.0
816	3.0	2.0	1.0	7.0	6.0
817	4.0	3.0	2.0	1.0	7.0
818	5.0	4.0	3.0	2.0	1.0
819	6.0	5.0	4.0	3.0	2.0
820	7.0	6.0	5.0	4.0	3.0
821	1.0	7.0	6.0	5.0	4.0
822	2.0	1.0	7.0	6.0	5.0
823	3.0	2.0	1.0	7.0	6.0
824	4.0	3.0	2.0	1.0	7.0
825	5.0	4.0	3.0	2.0	1.0
826	6.0	5.0	4.0	3.0	2.0
827	7.0	6.0	5.0	4.0	3.0
828	1.0	7.0	6.0	5.0	4.0
829	2.0	1.0	7.0	6.0	5.0

	weekday(t-14)
0	NaN
1	NaN
2	NaN
3	NaN
4	NaN
5	NaN
6	NaN
7	NaN
8	NaN
9	NaN
10	NaN
11	NaN
12	NaN
13	NaN
14	3.0
15	4.0
16	5.0
17	6.0
18	7.0
19	1.0
20	2.0
21	3.0

```
22             4.0
23             5.0
24             6.0
25             7.0
26             1.0
27             2.0
28             3.0
29             4.0
..             ...
800            3.0
801            4.0
802            5.0
803            6.0
804            7.0
805            1.0
806            2.0
807            3.0
808            4.0
809            5.0
810            6.0
811            7.0
812            1.0
813            2.0
814            3.0
815            4.0
816            5.0
817            6.0
818            7.0
819            1.0
820            2.0
821            3.0
822            4.0
823            5.0
824            6.0
825            7.0
826            1.0
827            2.0
828            3.0
829            4.0

[830 rows x 83 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','apparentTemperatureM
daily_dia.head(5)
```

Out[6]:

	energy_sum	y+1	y+2	y+3	y+4	y+5	\
0	6.952692	8.536480	9.499781	10.267707	10.850805	9.103382	

```
1    8.536480   9.499781  10.267707  10.850805   9.103382   9.274873
2    9.499781  10.267707  10.850805   9.103382   9.274873   8.813513
3   10.267707  10.850805   9.103382   9.274873   8.813513   9.227707
4   10.850805   9.103382   9.274873   8.813513   9.227707  10.145910

         y+6        t-1       t-2       t-3  ...  weekday(t-5)  weekday(t-6)  \
0   9.274873        NaN       NaN       NaN  ...           NaN           NaN
1   8.813513   6.952692       NaN       NaN  ...           NaN           NaN
2   9.227707   8.536480  6.952692       NaN  ...           NaN           NaN
3  10.145910   9.499781  8.536480  6.952692  ...           NaN           NaN
4  10.780273  10.267707  9.499781  8.536480  ...           NaN           NaN

   weekday(t-7)  weekday(t-8)  weekday(t-9)  weekday(t-10)  weekday(t-11)  \
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

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

[5 rows x 77 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        y+1        y+2        y+3        y+4        y+5  \
14   10.889362  11.525150  11.759837  12.633801  13.749174  11.951958
15   11.525150  11.759837  12.633801  13.749174  11.951958  11.957446
16   11.759837  12.633801  13.749174  11.951958  11.957446  12.392776
17   12.633801  13.749174  11.951958  11.957446  12.392776  12.307079
18   13.749174  11.951958  11.957446  12.392776  12.307079  13.376080

          y+6        t-1        t-2        t-3  ...  weekday(t-5)  \
14  11.957446  11.673417  10.609714  12.163127  ...           5.0
15  12.392776  10.889362  11.673417  10.609714  ...           6.0
16  12.307079  11.525150  10.889362  11.673417  ...           7.0
17  13.376080  11.759837  11.525150  10.889362  ...           1.0
18  13.511968  12.633801  11.759837  11.525150  ...           2.0

    weekday(t-6)  weekday(t-7)  weekday(t-8)  weekday(t-9)  weekday(t-10)  \
```

```
14          4.0          3.0          2.0          1.0          7.0
15          5.0          4.0          3.0          2.0          1.0
16          6.0          5.0          4.0          3.0          2.0
17          7.0          6.0          5.0          4.0          3.0
18          1.0          7.0          6.0          5.0          4.0

    weekday(t-11)  weekday(t-12)  weekday(t-13)  weekday(t-14)
14            6.0            5.0            4.0            3.0
15            7.0            6.0            5.0            4.0
16            1.0            7.0            6.0            5.0
17            2.0            1.0            7.0            6.0
18            3.0            2.0            1.0            7.0

[5 rows x 77 columns]
```

```
In [8]: daily_dia=daily_dia.drop([829,828,827,826,825,824,823])
        daily_dia.tail(5)
```

Out[8]:

	energy_sum	y+1	y+2	y+3	y+4	y+5	\
818	11.582159	10.979566	10.781898	10.674624	10.573835	10.518126	
819	10.979566	10.781898	10.674624	10.573835	10.518126	10.776242	
820	10.781898	10.674624	10.573835	10.518126	10.776242	11.480411	
821	10.674624	10.573835	10.518126	10.776242	11.480411	10.411403	
822	10.573835	10.518126	10.776242	11.480411	10.411403	10.294997	

	y+6	t-1	t-2	t-3	...	weekday(t-5)	\
818	10.776242	11.490470	11.816914	11.285737	...	2.0	
819	11.480411	11.582159	11.490470	11.816914	...	3.0	
820	10.411403	10.979566	11.582159	11.490470	...	4.0	
821	10.294997	10.781898	10.979566	11.582159	...	5.0	
822	10.202945	10.674624	10.781898	10.979566	...	6.0	

	weekday(t-6)	weekday(t-7)	weekday(t-8)	weekday(t-9)	weekday(t-10)	\
818	1.0	7.0	6.0	5.0	4.0	
819	2.0	1.0	7.0	6.0	5.0	
820	3.0	2.0	1.0	7.0	6.0	
821	4.0	3.0	2.0	1.0	7.0	
822	5.0	4.0	3.0	2.0	1.0	

	weekday(t-11)	weekday(t-12)	weekday(t-13)	weekday(t-14)
818	3.0	2.0	1.0	7.0
819	4.0	3.0	2.0	1.0
820	5.0	4.0	3.0	2.0
821	6.0	5.0	4.0	3.0
822	7.0	6.0	5.0	4.0

[5 rows x 77 columns]

```
In [9]: len(daily_dia)
```

```
Out[9]: 809

In [10]: #normalitzem
         scaler=preprocessing.MinMaxScaler(feature_range=(0, 1))
         daily_dia_norm=scaler.fit_transform(daily_dia)

In [11]: #Seleccionem dades per test i train
         y_daily=daily_dia_norm[:,0:7]
         X_daily=daily_dia_norm[:,7:82]

         #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 [12]: # definim model
         import tensorflow as tf
         model =Sequential()
         model.add(LSTM(50, activation='relu', input_shape=(14, 5)))
         model.add(Dense(7))
         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 [13]: 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 [14]: #Dividim la suma de scores de test entre el nombre de prediccions per obtenir la mitj
         sumScores/(lenght-n_train)
```

```
Out[14]: 0.05628868543321863
```

```
In [15]: #Fem llista amb les prediccions
         llista_p=list()
         for i in range(len(llista_prediccions)):
             llista_p.append(llista_prediccions[i].tolist())

         llista_p
```

```
Out[15]: [[[0.5439959764480591,
            0.5489190816879272,
            0.5729941725730896,
            0.5136330127716064,
            0.5401157140731812,
            0.4811445474624634,
```

```
  0.5250736474990845]],
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```

```
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```
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```

```
       0.4966426193714142,
       0.4889878034591675]]]
```

In [16]:
```
#Fem llista amb la predicció de només el dia següent
llista_p0=list()
for i in range(len(llista_p)):
    llista_p0.append(llista_p[i][0][0])

#Fem llista amb la predicció de 2 dies
llista_p1=list()
for i in range(len(llista_p)):
    llista_p1.append(llista_p[i][0][1])

llista_p2=list()
for i in range(len(llista_p)):
    llista_p2.append(llista_p[i][0][2])

llista_p3=list()
for i in range(len(llista_p)):
    llista_p3.append(llista_p[i][0][3])

llista_p4=list()
for i in range(len(llista_p)):
    llista_p4.append(llista_p[i][0][4])

llista_p5=list()
for i in range(len(llista_p)):
    llista_p5.append(llista_p[i][0][5])

llista_p6=list()
for i in range(len(llista_p)):
    llista_p6.append(llista_p[i][0][6])
```

In [17]:
```
score0=math.sqrt(mean_squared_error(y_daily[n_train:lenght,0], llista_p0))
print("Error predicció 1 dia següent: {}".format(score0))
score1=math.sqrt(mean_squared_error(y_daily[n_train:lenght,1], llista_p1))
print("Error predicció 2 dia següent: {}".format(score1))
score2=math.sqrt(mean_squared_error(y_daily[n_train:lenght,2], llista_p2))
print("Error predicció 3 dia següent: {}".format(score2))
score3=math.sqrt(mean_squared_error(y_daily[n_train:lenght,3], llista_p3))
print("Error predicció 4 dia següent: {}".format(score3))
score4=math.sqrt(mean_squared_error(y_daily[n_train:lenght,4], llista_p4))
print("Error predicció 5 dia següent: {}".format(score4))
score5=math.sqrt(mean_squared_error(y_daily[n_train:lenght,5], llista_p5))
print("Error predicció 6 dia següent: {}".format(score5))

score6=math.sqrt(mean_squared_error(y_daily[n_train:lenght,6], llista_p6))
print("Error predicció 7 dia següent: {}".format(score6))
```

```
Error predicció 1 dia següent: 0.04440560194722621
Error predicció 2 dia següent: 0.05305027129342371
Error predicció 3 dia següent: 0.05878823185519177
Error predicció 4 dia següent: 0.06708710186404082
Error predicció 5 dia següent: 0.07098120810029249
Error predicció 6 dia següent: 0.07406943970167362
Error predicció 7 dia següent: 0.07479595370174597
```

```
In [18]: predis=list()

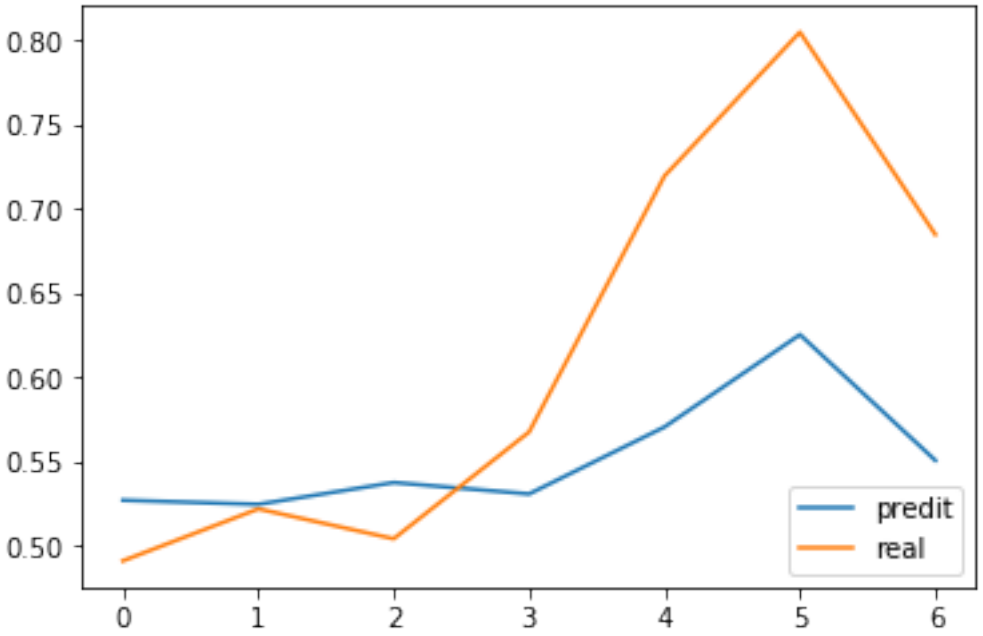
         for i in range(len(llista_prediccions)):
             predi=llista_prediccions[i].tolist()
             predis.append(predi)

         predis=np.reshape(predis, (len(llista_prediccions),7)  )

         predis
```

```
Out[18]: array([[0.54399598, 0.54891908, 0.57299417, ..., 0.54011571, 0.48114455,
                 0.52507365],
                [0.54781693, 0.59293991, 0.54667693, ..., 0.49254039, 0.48037234,
                 0.50201267],
                [0.62705654, 0.55885285, 0.52742958, ..., 0.52394843, 0.53961098,
                 0.56603187],
                ...,
                [0.48271245, 0.4430176 , 0.44325811, ..., 0.42807445, 0.4735783 ,
                 0.37127984],
                [0.46226591, 0.48913702, 0.40772158, ..., 0.68955225, 0.56432664,
                 0.54450661],
                [0.45324942, 0.41689128, 0.48498917, ..., 0.54805219, 0.49664262,
                 0.4889878 ]])
```

```
In [19]: ##Mostrem
         plt.plot(predis[4], label="predit")
         plt.plot(y_daily[n_train+4], label="real")
         plt.legend(loc="lower right")
         plt.show()
```



In [20]:
```
##Mostrem
plt.plot(llista_p0, label="predit1")
plt.plot(y_daily[n_train:lenght,0], label="real")
plt.legend(loc="lower right")
plt.title("Predicció 1 dia següent")
plt.show()

plt.plot(llista_p1, label="predit2")
plt.plot(y_daily[n_train:lenght,1], label="real")
plt.legend(loc="lower right")
plt.title("Predicció 2 dia següent")
plt.show()

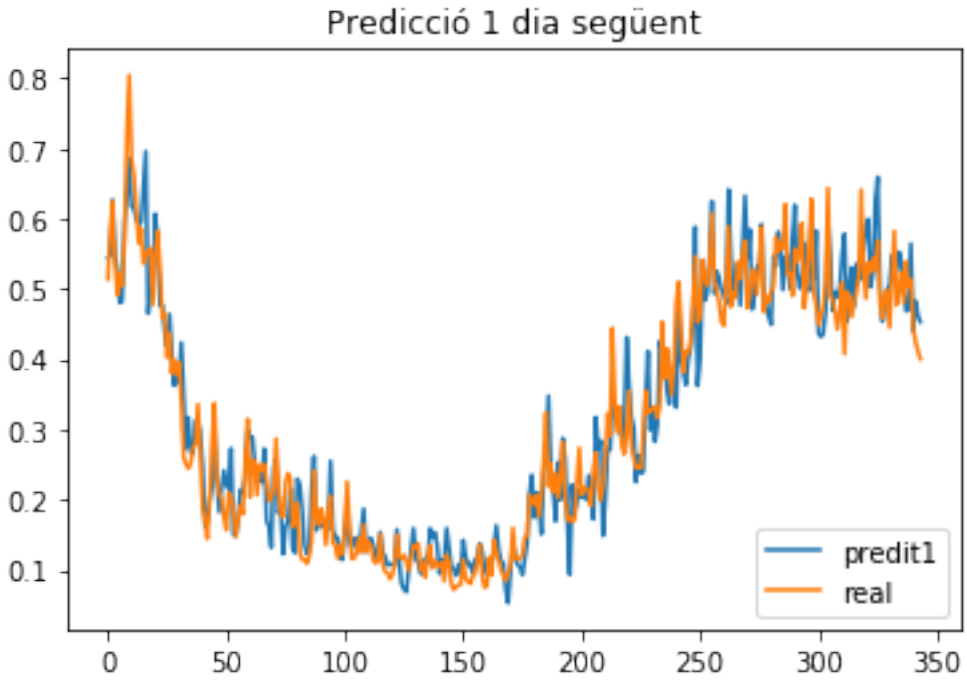

plt.plot(llista_p2, label="predit3")
plt.plot(y_daily[n_train:lenght,2], label="real")
plt.legend(loc="lower right")
plt.title("Predicció 3 dia següent")
plt.show()

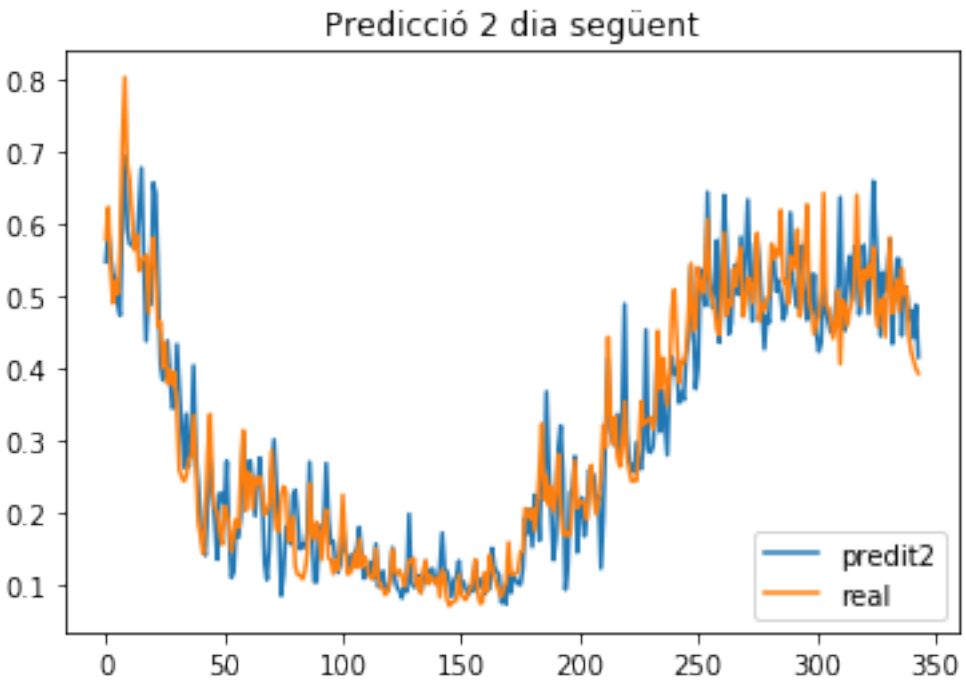
plt.plot(llista_p3, label="predit4")
plt.plot(y_daily[n_train:lenght,3], label="real")
plt.legend(loc="lower right")
plt.title("Predicció 4 dia següent")
plt.show()
```

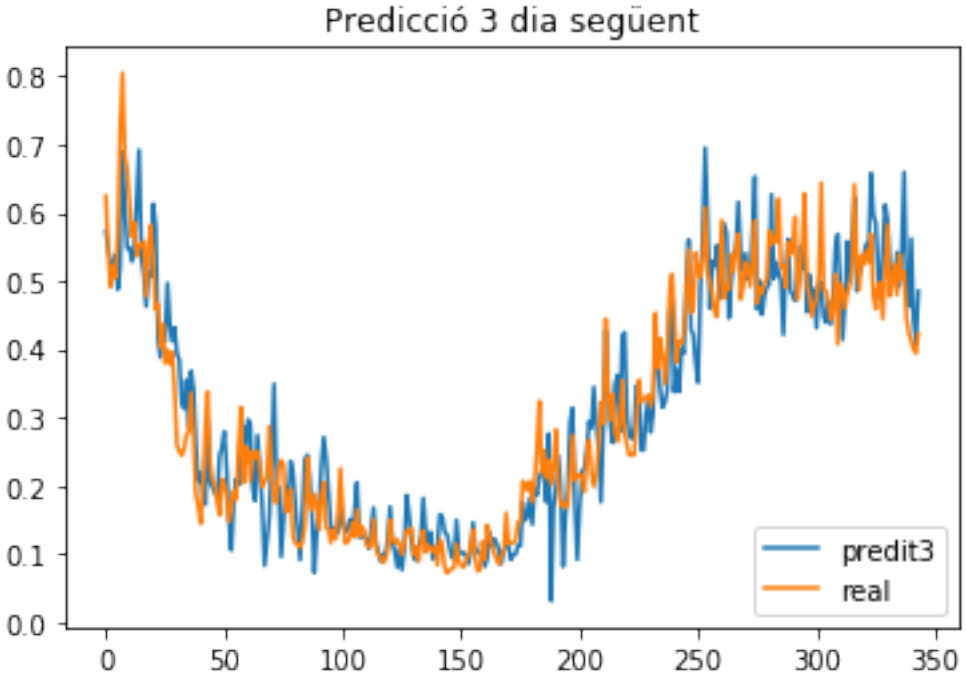
```
plt.plot(llista_p4, label="predit5")
plt.plot(y_daily[n_train:lenght,4], label="real")
plt.legend(loc="lower right")
plt.title("Predicció 5 dia següent")
plt.show()

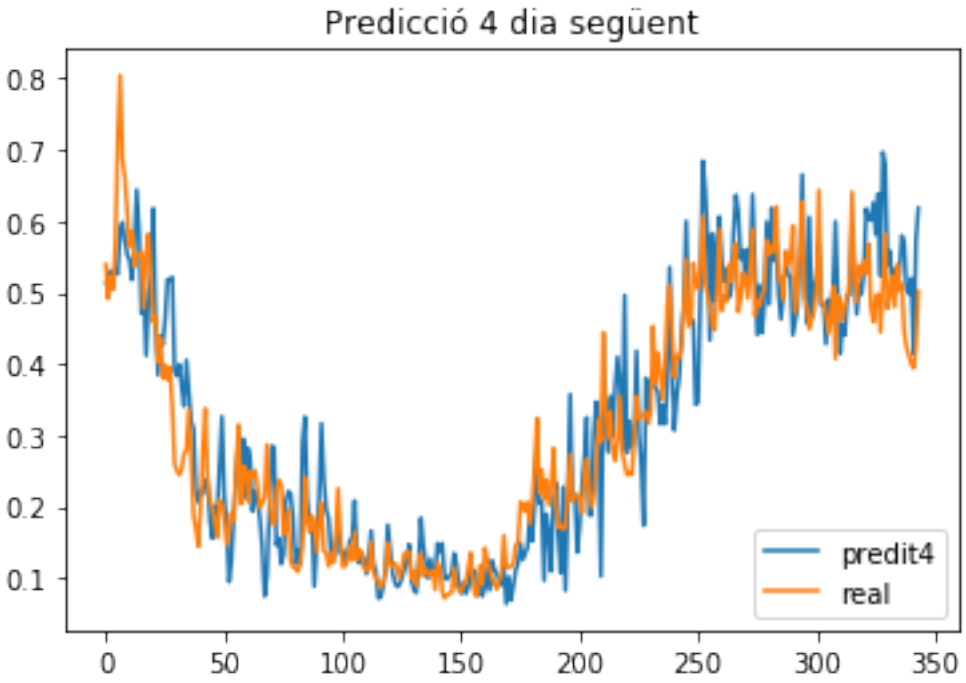
plt.plot(llista_p5, label="predit6")
plt.plot(y_daily[n_train:lenght,5], label="real")
plt.legend(loc="lower right")
plt.title("Predicció 6 dia següent")
plt.show()

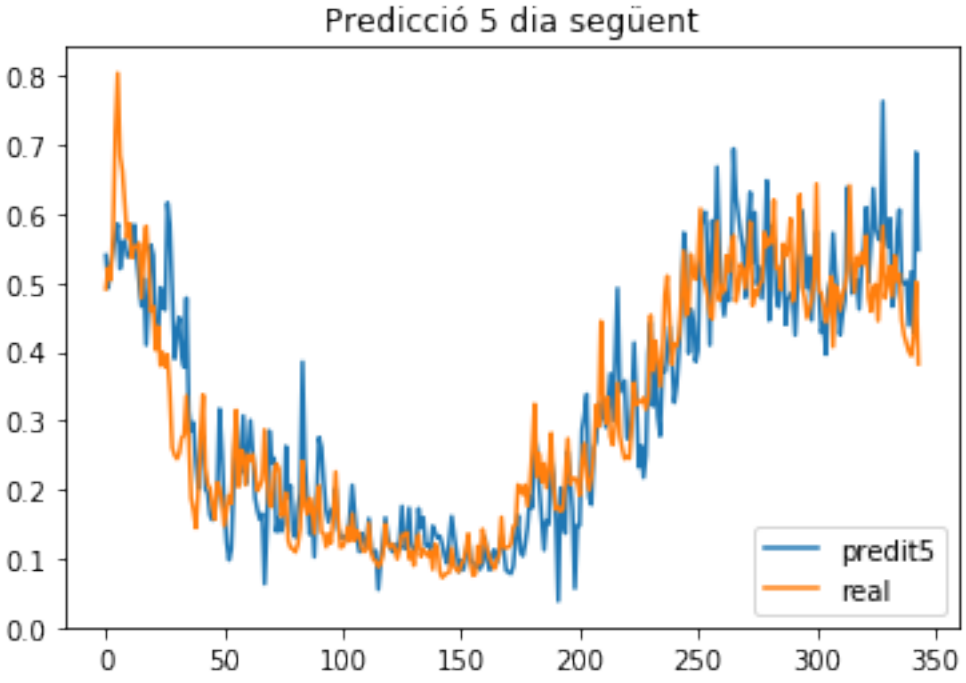
plt.plot(llista_p6, label="predit7")
plt.plot(y_daily[n_train:lenght,6], label="real")
plt.legend(loc="lower right")
plt.title("Predicció 7 dia següent")
plt.show()
```

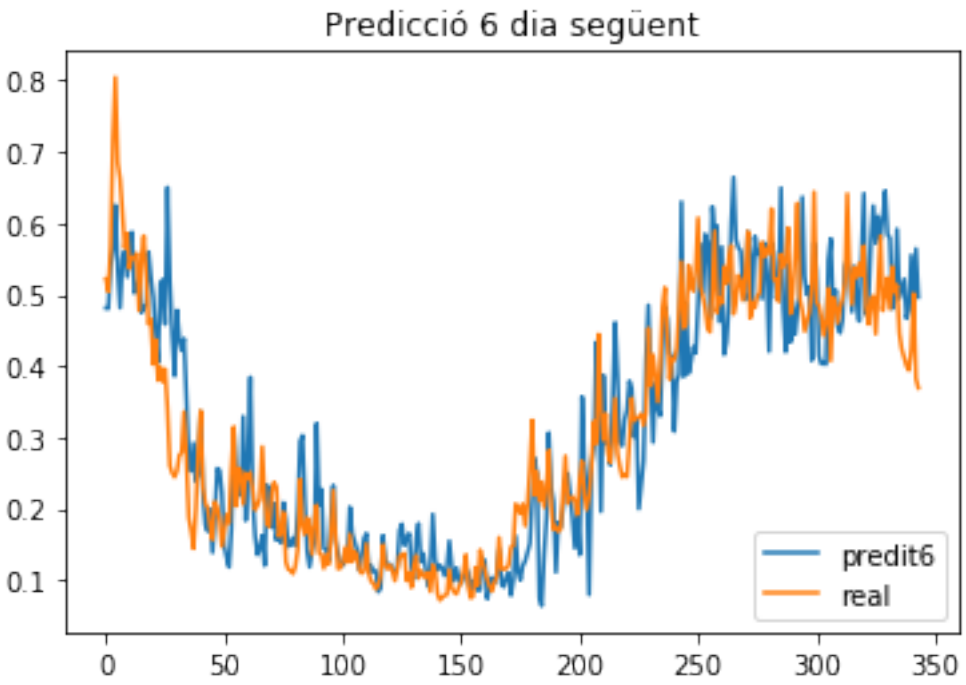


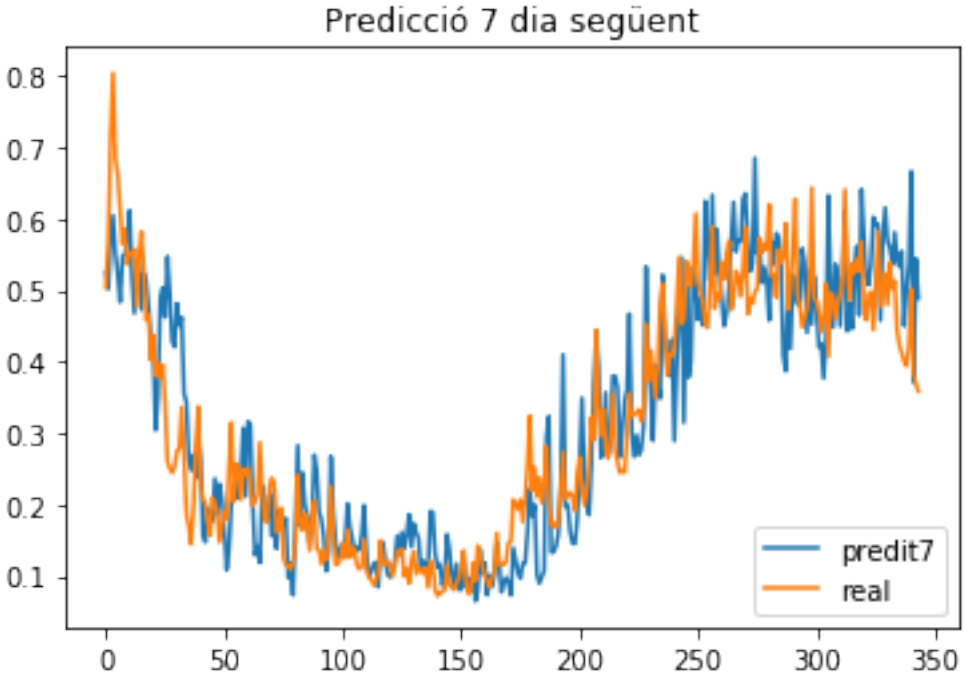

Predicció 2 dia següent
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
50
100
150
200
250
300
350
predit2
real


Predicció 3 dia següent
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
50
100
150
200
250
300
350
predit3
real


Predicció 4 dia següent
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
50
100
150
200
250
300
350
predit4
real


Predicció 5 dia següent
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
50
100
150
200
250
300
350
predit5
real


Predicció 6 dia següent
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
50
100
150
200
250
300
350
predit6
real


Predicció 7 dia següent
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
50
100
150
200
250
300
350
predit7
real

In [ ]:

```
In [21]: llista_scores

Out[21]: [0.0371817722124926,
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```
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0.043622851109008,
```

```
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 0.06944661252430619,
 0.11953115501402746,
 0.03299575748418651,
 0.13752100871769296,
 0.10778401655275965]
```
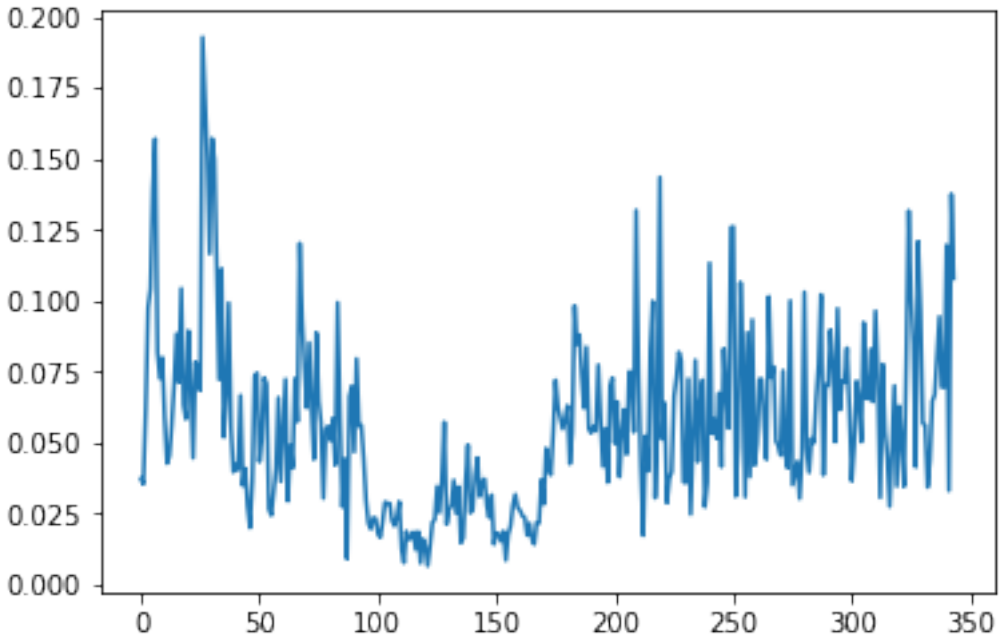

In [22]:
```
plt.plot(llista_scores)
```

Out[22]:
```
[<matplotlib.lines.Line2D at 0x1ec1f158c18>]
```



In [23]:
```
#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['predi1']=llista_p0
        prova['predi2']=llista_p1
        prova['predi3']=llista_p2
        prova['predi4']=llista_p3
        prova['predi5']=llista_p4
        prova['predi6']=llista_p5
        prova['predi7']=llista_p6

        prova['y1']=y_daily[n_train:lenght,0]
        prova['y2']=y_daily[n_train:lenght,1]
        prova['y3']=y_daily[n_train:lenght,2]
        prova['y4']=y_daily[n_train:lenght,3]
        prova['y5']=y_daily[n_train:lenght,4]
        prova['y6']=y_daily[n_train:lenght,5]
        prova['y7']=y_daily[n_train:lenght,6]


        prova=prova.drop(['energy_sum','t-1','t-2','t-3', 't-4', 't-5', 't-6', 't-7'], axis=1)
        prova

        prova=prova[['predi1','predi2','predi3','predi4','predi5','predi6','predi7','y1','y2'
        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
  del 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

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
  from ipykernel import kernelapp as app
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
  app.launch_new_instance()
```

```
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
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.
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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:
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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.
Try using .loc[row_indexer,col_indexer] = value instead

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.
Try using .loc[row_indexer,col_indexer] = value instead

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.
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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.
Try using .loc[row_indexer,col_indexer] = value instead

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.
Try using .loc[row_indexer,col_indexer] = value instead

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.
Try using .loc[row_indexer,col_indexer] = value instead
```

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

Out[23]:

	predi1	predi2	predi3	predi4	predi5	predi6	predi7
479	0.543996	0.548919	0.572994	0.513633	0.540116	0.481145	0.525074
480	0.547817	0.592940	0.546677	0.520203	0.492540	0.480372	0.502013
481	0.627057	0.558853	0.527430	0.530988	0.523948	0.539611	0.566032
482	0.548098	0.532257	0.512222	0.519302	0.546633	0.564169	0.605092
483	0.527252	0.524840	0.537755	0.530981	0.570690	0.625390	0.550886
484	0.480346	0.491204	0.487838	0.525908	0.585406	0.534816	0.522579
485	0.482393	0.474317	0.519154	0.589225	0.520588	0.481469	0.483753
486	0.595548	0.618827	0.689237	0.598297	0.559036	0.550894	0.547559
487	0.634829	0.694552	0.611133	0.572575	0.561619	0.561562	0.550584
488	0.686662	0.594219	0.548427	0.553394	0.537697	0.524842	0.573439
489	0.618013	0.573732	0.548953	0.545752	0.539407	0.572718	0.611909
490	0.613973	0.571494	0.528366	0.518158	0.552239	0.587749	0.519941
491	0.600125	0.575429	0.545157	0.564133	0.584611	0.502440	0.468203
492	0.591124	0.569559	0.614573	0.644074	0.536423	0.506026	0.539651
493	0.595576	0.627871	0.692052	0.586241	0.499208	0.522674	0.539447
494	0.648891	0.678968	0.532627	0.470670	0.465990	0.474801	0.473153
495	0.695847	0.549873	0.510202	0.504106	0.505988	0.483137	0.524814
496	0.465365	0.438965	0.462857	0.411706	0.409872	0.484429	0.513068
497	0.497175	0.517888	0.511516	0.489216	0.483795	0.559646	0.477671
498	0.504143	0.489765	0.506607	0.522062	0.554955	0.524397	0.430430
499	0.607062	0.658351	0.612787	0.618316	0.539658	0.496426	0.416076
500	0.568316	0.643697	0.580563	0.455933	0.416828	0.442832	0.304208
501	0.476060	0.527760	0.415167	0.384725	0.412637	0.404734	0.352342
502	0.476694	0.407225	0.388082	0.438879	0.493131	0.515819	0.489959
503	0.438957	0.385054	0.422796	0.426818	0.464583	0.521108	0.503907
504	0.417687	0.393774	0.412114	0.461678	0.461083	0.458406	0.462535
505	0.463969	0.439198	0.496619	0.518603	0.616281	0.650325	0.547573
506	0.407577	0.393543	0.436339	0.517958	0.584657	0.519530	0.493688
507	0.362562	0.345901	0.412113	0.521520	0.485565	0.444540	0.428524
508	0.382680	0.348723	0.431840	0.389498	0.389971	0.385932	0.420985
..	...	...	...	...	...	...	...
793	0.530620	0.556626	0.499028	0.496681	0.545289	0.532906	0.480715
794	0.474524	0.497012	0.551201	0.596808	0.484476	0.475641	0.446167
795	0.535869	0.570063	0.622517	0.527324	0.502619	0.539438	0.533424
796	0.512074	0.533592	0.485376	0.469811	0.504872	0.495494	0.562178
797	0.517033	0.475821	0.509942	0.510738	0.461882	0.462872	0.465132
798	0.557512	0.496831	0.521397	0.497744	0.524029	0.557470	0.641520
799	0.590465	0.572144	0.537143	0.530252	0.552419	0.641781	0.575755
800	0.599541	0.536551	0.554303	0.617553	0.609375	0.471708	0.519519
801	0.502873	0.476950	0.541757	0.604178	0.501711	0.493536	0.507711
802	0.523420	0.551452	0.657789	0.601833	0.561017	0.576414	0.535708
803	0.625708	0.660647	0.597243	0.625808	0.637236	0.624541	0.602670
804	0.659529	0.587575	0.585501	0.581361	0.577865	0.571794	0.593210

805	0.497697	0.531890	0.511510	0.638313	0.566261	0.609706	0.593180
806	0.453928	0.445950	0.474277	0.523294	0.561415	0.576683	0.458108
807	0.478551	0.534136	0.549937	0.696843	0.763576	0.607696	0.572899
808	0.498594	0.508531	0.611617	0.679494	0.584077	0.645482	0.616009
809	0.506203	0.535053	0.588667	0.538426	0.553165	0.584406	0.568328
810	0.547809	0.580097	0.523272	0.558504	0.593482	0.579198	0.559519
811	0.547283	0.434852	0.501778	0.505238	0.466004	0.480347	0.536027
812	0.525158	0.506521	0.500445	0.532237	0.485008	0.492912	0.581368
813	0.552638	0.553026	0.541810	0.505590	0.571900	0.591771	0.543158
814	0.537823	0.552220	0.492446	0.524452	0.606306	0.494614	0.533591
815	0.498107	0.446410	0.547101	0.579718	0.500968	0.508950	0.555076
816	0.468619	0.507044	0.659339	0.570723	0.498991	0.521737	0.450168
817	0.470268	0.513760	0.497407	0.504412	0.503086	0.466782	0.497984
818	0.564481	0.468978	0.462265	0.498577	0.437951	0.478584	0.537135
819	0.440227	0.481475	0.562169	0.520144	0.516009	0.555231	0.667135
820	0.482712	0.443018	0.443258	0.413770	0.428074	0.473578	0.371280
821	0.462266	0.489137	0.407722	0.573554	0.689552	0.564327	0.544507
822	0.453249	0.416891	0.484989	0.618269	0.548052	0.496643	0.488988

	y1	y2	y3	...	weekday(t-5)	weekday(t-6)	\
479	0.514061	0.580609	0.624326	...	7.0	6.0	
480	0.580609	0.624326	0.539280	...	1.0	7.0	
481	0.624326	0.539280	0.491355	...	2.0	1.0	
482	0.539280	0.491355	0.522145	...	3.0	2.0	
483	0.491355	0.522145	0.504442	...	4.0	3.0	
484	0.522145	0.504442	0.567725	...	5.0	4.0	
485	0.504442	0.567725	0.719460	...	6.0	5.0	
486	0.567725	0.719460	0.804631	...	7.0	6.0	
487	0.719460	0.804631	0.684716	...	1.0	7.0	
488	0.804631	0.684716	0.662177	...	2.0	1.0	
489	0.684716	0.662177	0.615194	...	3.0	2.0	
490	0.662177	0.615194	0.565466	...	4.0	3.0	
491	0.615194	0.565466	0.585646	...	5.0	4.0	
492	0.565466	0.585646	0.536523	...	6.0	5.0	
493	0.585646	0.536523	0.552256	...	7.0	6.0	
494	0.536523	0.552256	0.552256	...	1.0	7.0	
495	0.552256	0.552256	0.557809	...	2.0	1.0	
496	0.552256	0.557809	0.477794	...	3.0	2.0	
497	0.557809	0.477794	0.551195	...	4.0	3.0	
498	0.477794	0.551195	0.582339	...	5.0	4.0	
499	0.551195	0.582339	0.529772	...	6.0	5.0	
500	0.582339	0.529772	0.458904	...	7.0	6.0	
501	0.529772	0.458904	0.465733	...	7.0	7.0	
502	0.458904	0.465733	0.402622	...	1.0	7.0	
503	0.465733	0.402622	0.436918	...	2.0	1.0	
504	0.402622	0.436918	0.380048	...	3.0	2.0	
505	0.436918	0.380048	0.398860	...	4.0	3.0	
506	0.380048	0.398860	0.377916	...	5.0	4.0	

```
507  0.398860  0.377916  0.395717  ...          6.0          5.0
508  0.377916  0.395717  0.341266  ...          7.0          6.0
..        ...       ...       ...  ...          ...          ...
793  0.460288  0.481611  0.493841  ...          5.0          4.0
794  0.481611  0.493841  0.517404  ...          6.0          5.0
795  0.493841  0.517404  0.641295  ...          7.0          6.0
796  0.517404  0.641295  0.532274  ...          1.0          7.0
797  0.641295  0.532274  0.486571  ...          2.0          1.0
798  0.532274  0.486571  0.537515  ...          3.0          2.0
799  0.486571  0.537515  0.524598  ...          4.0          3.0
800  0.537515  0.524598  0.543903  ...          5.0          4.0
801  0.524598  0.543903  0.527438  ...          6.0          5.0
802  0.543903  0.527438  0.568506  ...          7.0          6.0
803  0.527438  0.568506  0.479332  ...          1.0          7.0
804  0.568506  0.479332  0.458726  ...          2.0          1.0
805  0.479332  0.458726  0.494425  ...          3.0          2.0
806  0.458726  0.494425  0.497810  ...          4.0          3.0
807  0.494425  0.497810  0.444954  ...          5.0          4.0
808  0.497810  0.444954  0.511653  ...          6.0          5.0
809  0.444954  0.511653  0.582450  ...          7.0          6.0
810  0.511653  0.582450  0.477562  ...          1.0          7.0
811  0.582450  0.477562  0.498620  ...          2.0          1.0
812  0.477562  0.498620  0.523920  ...          3.0          2.0
813  0.498620  0.523920  0.479971  ...          4.0          3.0
814  0.523920  0.479971  0.539318  ...          5.0          4.0
815  0.479971  0.539318  0.502845  ...          6.0          5.0
816  0.539318  0.502845  0.513089  ...          7.0          6.0
817  0.502845  0.513089  0.445764  ...          1.0          7.0
818  0.513089  0.445764  0.423680  ...          2.0          1.0
819  0.445764  0.423680  0.411694  ...          3.0          2.0
820  0.423680  0.411694  0.400434  ...          4.0          3.0
821  0.411694  0.400434  0.394209  ...          5.0          4.0
822  0.400434  0.394209  0.423048  ...          6.0          5.0

     weekday(t-7)  weekday(t-8)  weekday(t-9)  weekday(t-10)  weekday(t-11)  \
479           5.0           4.0           3.0            2.0            1.0
480           6.0           5.0           4.0            3.0            2.0
481           7.0           6.0           5.0            4.0            3.0
482           1.0           7.0           6.0            5.0            4.0
483           2.0           1.0           7.0            6.0            5.0
484           3.0           2.0           1.0            7.0            6.0
485           4.0           3.0           2.0            1.0            7.0
486           5.0           4.0           3.0            2.0            1.0
487           6.0           5.0           4.0            3.0            2.0
488           7.0           6.0           5.0            4.0            3.0
489           1.0           7.0           6.0            5.0            4.0
490           2.0           1.0           7.0            6.0            5.0
491           3.0           2.0           1.0            7.0            6.0
```

492	4.0	3.0	2.0	1.0	7.0
493	5.0	4.0	3.0	2.0	1.0
494	6.0	5.0	4.0	3.0	2.0
495	7.0	6.0	5.0	4.0	3.0
496	1.0	7.0	6.0	5.0	4.0
497	2.0	1.0	7.0	6.0	5.0
498	3.0	2.0	1.0	7.0	6.0
499	4.0	3.0	2.0	1.0	7.0
500	5.0	4.0	3.0	2.0	1.0
501	6.0	5.0	4.0	3.0	2.0
502	7.0	6.0	5.0	4.0	3.0
503	7.0	7.0	6.0	5.0	4.0
504	1.0	7.0	7.0	6.0	5.0
505	2.0	1.0	7.0	7.0	6.0
506	3.0	2.0	1.0	7.0	7.0
507	4.0	3.0	2.0	1.0	7.0
508	5.0	4.0	3.0	2.0	1.0
..	...	...	...	...	...
793	3.0	2.0	1.0	7.0	6.0
794	4.0	3.0	2.0	1.0	7.0
795	5.0	4.0	3.0	2.0	1.0
796	6.0	5.0	4.0	3.0	2.0
797	7.0	6.0	5.0	4.0	3.0
798	1.0	7.0	6.0	5.0	4.0
799	2.0	1.0	7.0	6.0	5.0
800	3.0	2.0	1.0	7.0	6.0
801	4.0	3.0	2.0	1.0	7.0
802	5.0	4.0	3.0	2.0	1.0
803	6.0	5.0	4.0	3.0	2.0
804	7.0	6.0	5.0	4.0	3.0
805	1.0	7.0	6.0	5.0	4.0
806	2.0	1.0	7.0	6.0	5.0
807	3.0	2.0	1.0	7.0	6.0
808	4.0	3.0	2.0	1.0	7.0
809	5.0	4.0	3.0	2.0	1.0
810	6.0	5.0	4.0	3.0	2.0
811	7.0	6.0	5.0	4.0	3.0
812	1.0	7.0	6.0	5.0	4.0
813	2.0	1.0	7.0	6.0	5.0
814	3.0	2.0	1.0	7.0	6.0
815	4.0	3.0	2.0	1.0	7.0
816	5.0	4.0	3.0	2.0	1.0
817	6.0	5.0	4.0	3.0	2.0
818	7.0	6.0	5.0	4.0	3.0
819	1.0	7.0	6.0	5.0	4.0
820	2.0	1.0	7.0	6.0	5.0
821	3.0	2.0	1.0	7.0	6.0
822	4.0	3.0	2.0	1.0	7.0

	weekday(t-12)	weekday(t-13)	weekday(t-14)
479	7.0	6.0	5.0
480	1.0	7.0	6.0
481	2.0	1.0	7.0
482	3.0	2.0	1.0
483	4.0	3.0	2.0
484	5.0	4.0	3.0
485	6.0	5.0	4.0
486	7.0	6.0	5.0
487	1.0	7.0	6.0
488	2.0	1.0	7.0
489	3.0	2.0	1.0
490	4.0	3.0	2.0
491	5.0	4.0	3.0
492	6.0	5.0	4.0
493	7.0	6.0	5.0
494	1.0	7.0	6.0
495	2.0	1.0	7.0
496	3.0	2.0	1.0
497	4.0	3.0	2.0
498	5.0	4.0	3.0
499	6.0	5.0	4.0
500	7.0	6.0	5.0
501	1.0	7.0	6.0
502	2.0	1.0	7.0
503	3.0	2.0	1.0
504	4.0	3.0	2.0
505	5.0	4.0	3.0
506	6.0	5.0	4.0
507	7.0	6.0	5.0
508	7.0	7.0	6.0
..	...	...	...
793	5.0	4.0	3.0
794	6.0	5.0	4.0
795	7.0	6.0	5.0
796	1.0	7.0	6.0
797	2.0	1.0	7.0
798	3.0	2.0	1.0
799	4.0	3.0	2.0
800	5.0	4.0	3.0
801	6.0	5.0	4.0
802	7.0	6.0	5.0
803	1.0	7.0	6.0
804	2.0	1.0	7.0
805	3.0	2.0	1.0
806	4.0	3.0	2.0
807	5.0	4.0	3.0

```
808            6.0            5.0            4.0
809            7.0            6.0            5.0
810            1.0            7.0            6.0
811            2.0            1.0            7.0
812            3.0            2.0            1.0
813            4.0            3.0            2.0
814            5.0            4.0            3.0
815            6.0            5.0            4.0
816            7.0            6.0            5.0
817            1.0            7.0            6.0
818            2.0            1.0            7.0
819            3.0            2.0            1.0
820            4.0            3.0            2.0
821            5.0            4.0            3.0
822            6.0            5.0            4.0

[344 rows x 77 columns]
```

In [24]:
```
# Convert predictions back to normal values

predi = scaler.inverse_transform(prova)
print(predi)
#0-6 predi
print(predi[0][0])
print(predi[0][1])
print(predi[0][2])
print(predi[0][3])
print(predi[0][4])
print(predi[0][5])
print(predi[0][6])

#7-13 y

print(predi[0][7])
print(predi[0][8])
print(predi[0][9])
print(predi[0][10])
print(predi[0][11])
print(predi[0][12])
print(predi[0][13])
```

```
[[11.85878702 11.90285114 12.11833456 ... 43.         37.
  31.        ]
 [11.89298638 12.29685835 11.88278286 ...  7.         43.
  37.        ]
 [12.60221825 11.99176306 11.71050997 ... 13.          7.
  43.        ]
 ...
```

```
 [11.31027053 10.95498293 10.95713556 ... 25.         19.
  13.        ]
 [11.12726436 11.36777351 10.63906687 ... 31.         25.
  19.        ]
 [11.04656257 10.72114    11.33064823 ... 37.         31.
  25.        ]]
11.858787023288903
11.902851137854382
12.11833455964826
11.587024173461511
11.82405684436725
11.296237081232489
11.689423251842152
11.590859170709699
12.186486909458
12.5777825527296
11.816572589134799
11.3876267050719
11.6632140210701
11.5047561338867
```

In [25]:
```
llista1=list()
llista2=list()
llista3=list()
llista4=list()
llista5=list()
llista6=list()
llista7=list()
llista8=list()
llista9=list()
llista10=list()
llista11=list()
llista12=list()
llista13=list()
llista14=list()
```

```
llista_errors1=list()
llista_errorsabs1=list()
llista_errorsres1=list()
```

```
llista_errors2=list()
llista_errorsabs2=list()
llista_errorsres2=list()
```

```
llista_errors3=list()
llista_errorsabs3=list()
llista_errorsres3=list()

llista_errors4=list()
llista_errorsabs4=list()
llista_errorsres4=list()

llista_errors5=list()
llista_errorsabs5=list()
llista_errorsres5=list()

llista_errors6=list()
llista_errorsabs6=list()
llista_errorsres6=list()

llista_errors7=list()
llista_errorsabs7=list()
llista_errorsres7=list()



for i in range(len(predi)):

    llista1.append(predi[i][0])
    llista2.append(predi[i][1])
    llista3.append(predi[i][2])
    llista4.append(predi[i][3])
    llista5.append(predi[i][4])
    llista6.append(predi[i][5])
    llista7.append(predi[i][6])
    llista8.append(predi[i][7])
    llista9.append(predi[i][8])
    llista10.append(predi[i][9])
    llista11.append(predi[i][10])
    llista12.append(predi[i][11])
    llista13.append(predi[i][12])
    llista14.append(predi[i][13])

    valor1=predi[i][7] - predi[i][0]
    valorabs1=math.fabs(valor1)
    valorrespecte1=valorabs1/predi[i][7]
    llista_errors1.append(valor1)
    llista_errorsabs1.append(valorabs1)
    llista_errorsres1.append(valorrespecte1)
```

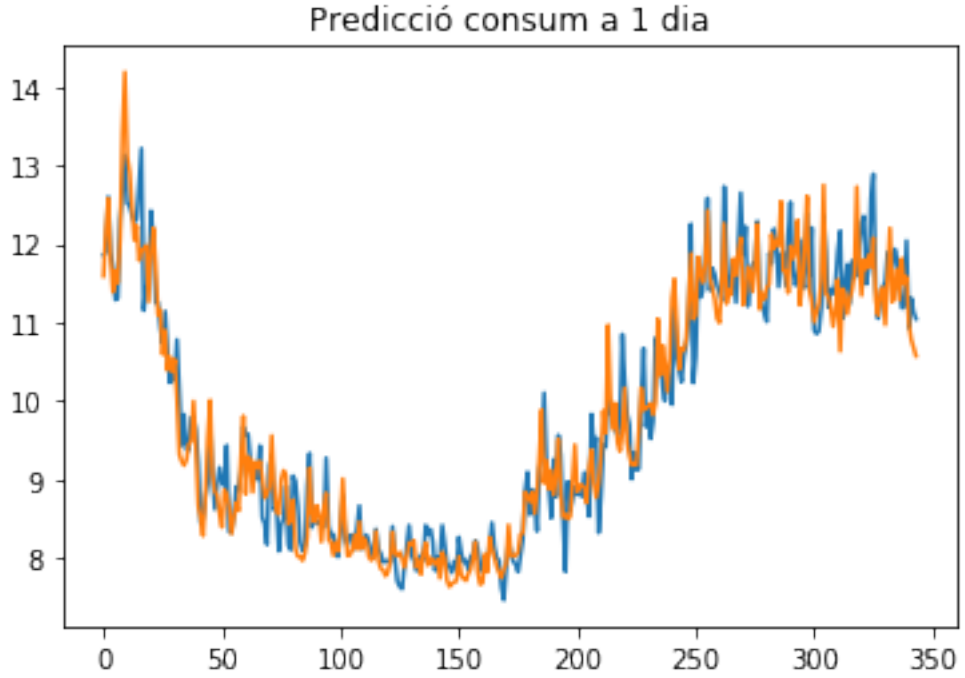
```
        valor2=predi[i][8] - predi[i][1]
        valorabs2=math.fabs(valor2)
        valorrespecte2=valorabs2/predi[i][8]
        llista_errors2.append(valor2)
        llista_errorsabs2.append(valorabs2)
        llista_errorsres2.append(valorrespecte2)

        valor3=predi[i][9] - predi[i][2]
        valorabs3=math.fabs(valor3)
        valorrespecte3=valorabs3/predi[i][9]
        llista_errors3.append(valor3)
        llista_errorsabs3.append(valorabs3)
        llista_errorsres3.append(valorrespecte3)

        valor4=predi[i][10] - predi[i][3]
        valorabs4=math.fabs(valor4)
        valorrespecte4=valorabs4/predi[i][10]
        llista_errors4.append(valor4)
        llista_errorsabs4.append(valorabs4)
        llista_errorsres4.append(valorrespecte4)

        valor5=predi[i][11] - predi[i][4]
        valorabs5=math.fabs(valor5)
        valorrespecte5=valorabs5/predi[i][11]
        llista_errors5.append(valor5)
        llista_errorsabs5.append(valorabs5)
        llista_errorsres5.append(valorrespecte5)

        valor6=predi[i][12] - predi[i][5]
        valorabs6=math.fabs(valor6)
        valorrespecte6=valorabs6/predi[i][12]
        llista_errors6.append(valor6)
        llista_errorsabs6.append(valorabs6)
        llista_errorsres6.append(valorrespecte6)

        valor7=predi[i][13] - predi[i][6]
        valorabs7=math.fabs(valor7)
        valorrespecte7=valorabs7/predi[i][13]
        llista_errors7.append(valor7)
        llista_errorsabs7.append(valorabs7)
        llista_errorsres7.append(valorrespecte7)


plt.plot(llista1)
plt.plot(llista8)
plt.title("Predicció consum a 1 dia")
plt.show()
```

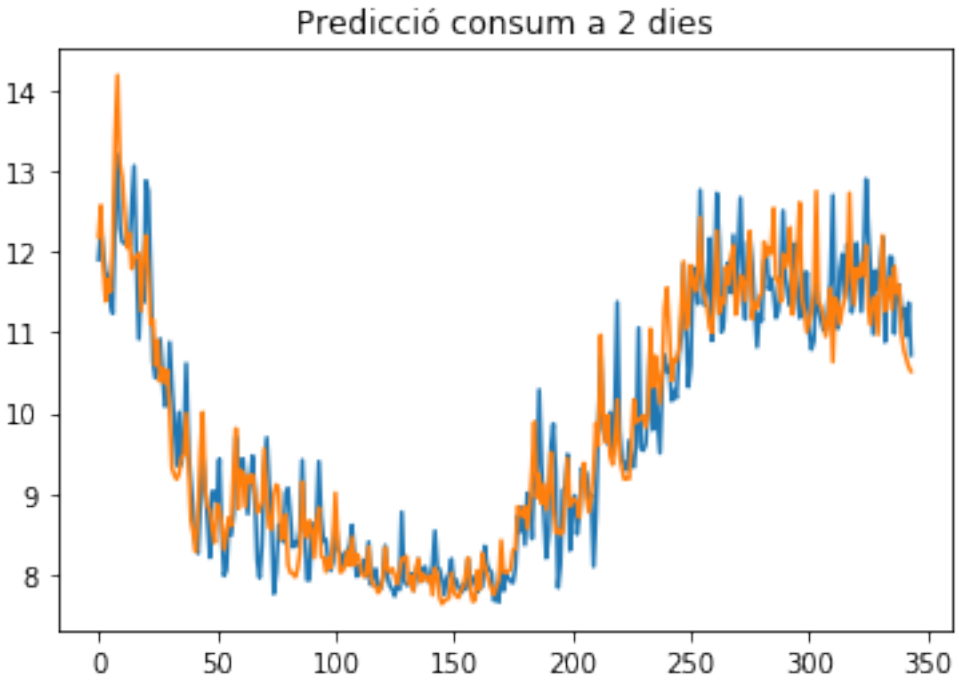
```
plt.plot(llista2)
plt.plot(llista9)
plt.title("Predicció consum a 2 dies")
plt.show()

plt.plot(llista3)
plt.plot(llista10)
plt.title("Predicció consum a 3 dies")
plt.show()

plt.plot(llista4)
plt.plot(llista11)
plt.title("Predicció consum a 4 dies")
plt.show()

plt.plot(llista5)
plt.plot(llista12)
plt.title("Predicció consum a 5 dies")
plt.show()

plt.plot(llista6)
plt.plot(llista13)
plt.title("Predicció consum a 6 dies")
plt.show()

plt.plot(llista7)
plt.plot(llista14)
plt.title("Predicció consum a 7 dies")
plt.show()



plt.plot(llista_errorsres1)
plt.title("Error percentual a 1 dia")
plt.show()
plt.plot(llista_errorsres2)
plt.title("Error percentual a 2 dies")
plt.show()
plt.plot(llista_errorsres3)
plt.title("Error percentual a 3 dies")
plt.show()
plt.plot(llista_errorsres4)
plt.title("Error percentual a 4 dies")
plt.show()
plt.plot(llista_errorsres5)
plt.title("Error percentual a 5 dies")
plt.show()
```

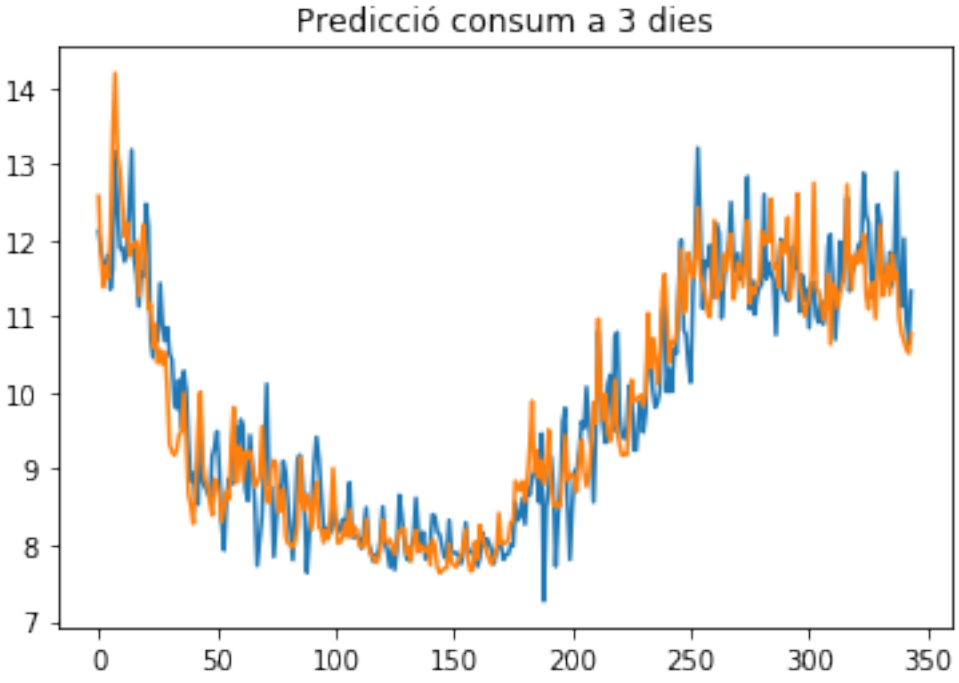
```
plt.plot(llista_errorsres6)
plt.title("Error percentual a 6 dies")
plt.show()
plt.plot(llista_errorsres7)
plt.title("Error percentual a 7 dies")
plt.show()
```

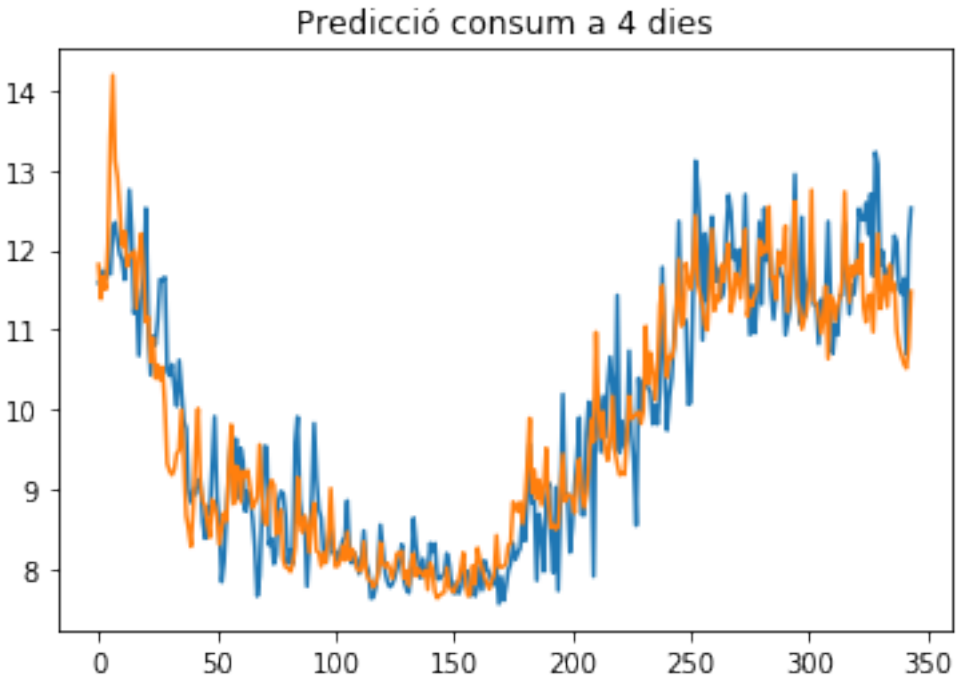
```
error_mitja1=sum(llista_errorsres1)/(len(llista_errorsres1))*100
error_mitja2=sum(llista_errorsres2)/(len(llista_errorsres2))*100
error_mitja3=sum(llista_errorsres3)/(len(llista_errorsres3))*100
error_mitja4=sum(llista_errorsres4)/(len(llista_errorsres4))*100
error_mitja5=sum(llista_errorsres5)/(len(llista_errorsres5))*100
error_mitja6=sum(llista_errorsres6)/(len(llista_errorsres6))*100
error_mitja7=sum(llista_errorsres7)/(len(llista_errorsres7))*100
```

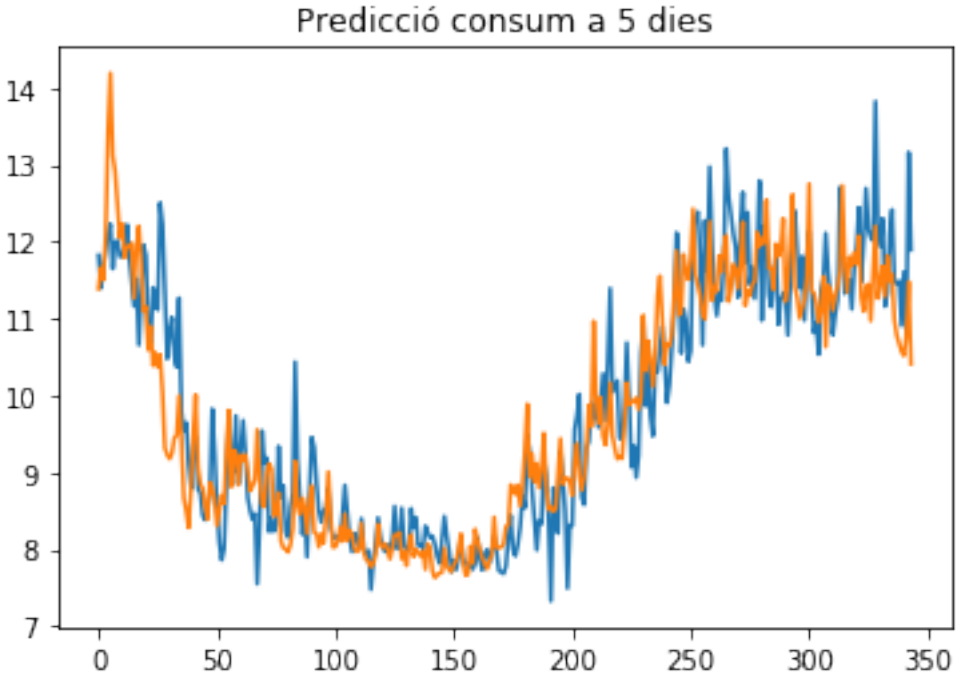
```
print("L'error mitjà a 1 dia és de {} % " .format(error_mitja1))
print("L'error mitjà a 2 dies és de {} % " .format(error_mitja2))
print("L'error mitjà a 3 dies és de {} % " .format(error_mitja3))
print("L'error mitjà a 4 dies és de {} % " .format(error_mitja4))
print("L'error mitjà a 5 dies és de {} % " .format(error_mitja5))
print("L'error mitjà a 6 dies és de {} % " .format(error_mitja6))
print("L'error mitjà a 7 dies és de {} % " .format(error_mitja7))
```

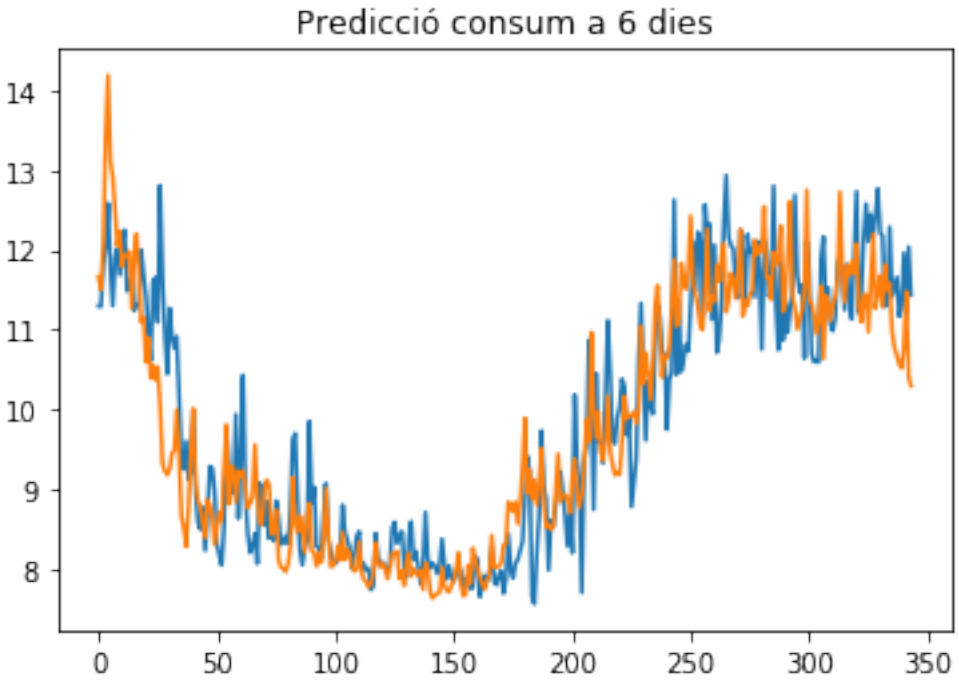


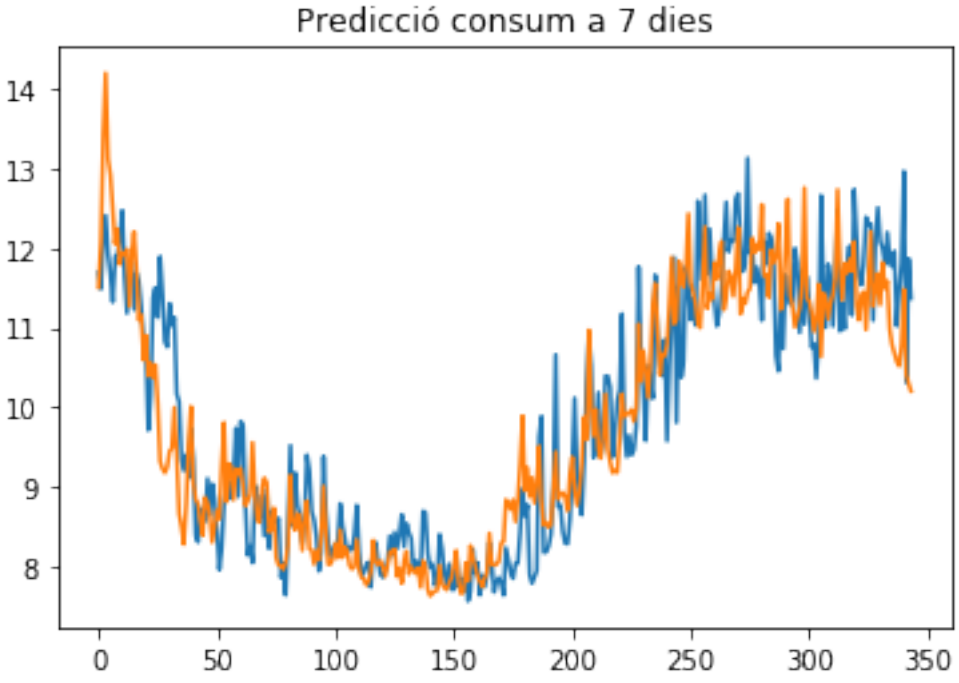

Predicció consum a 2 dies
14
13
12
11
10
9
8
0
50
100
150
200
250
300
350

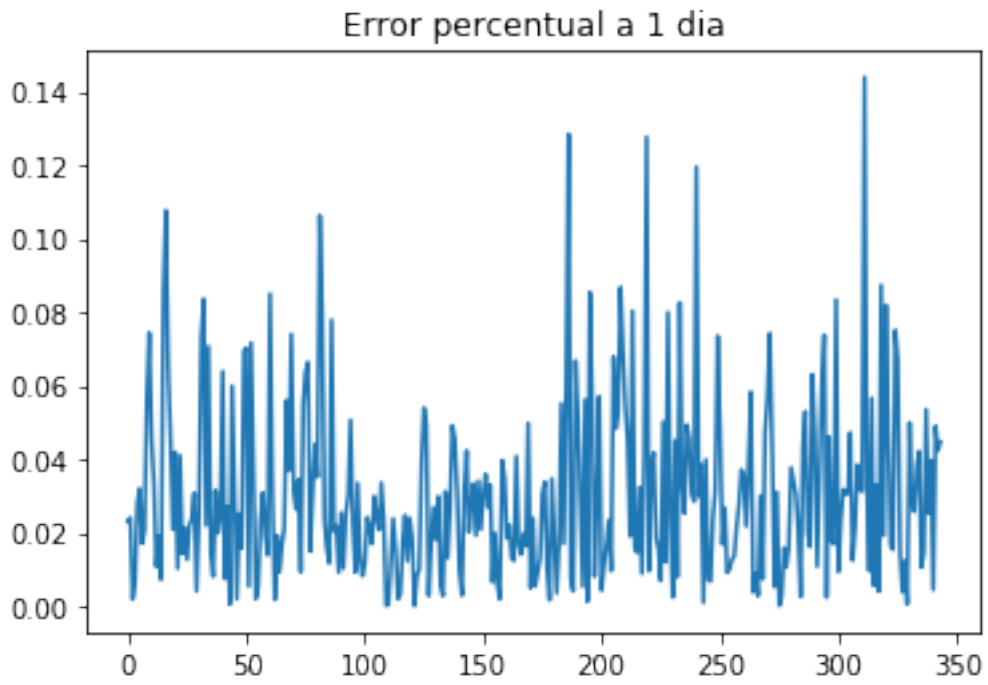

Predicció consum a 3 dies
14
13
12
11
10
9
8
7
0
50
100
150
200
250
300
350

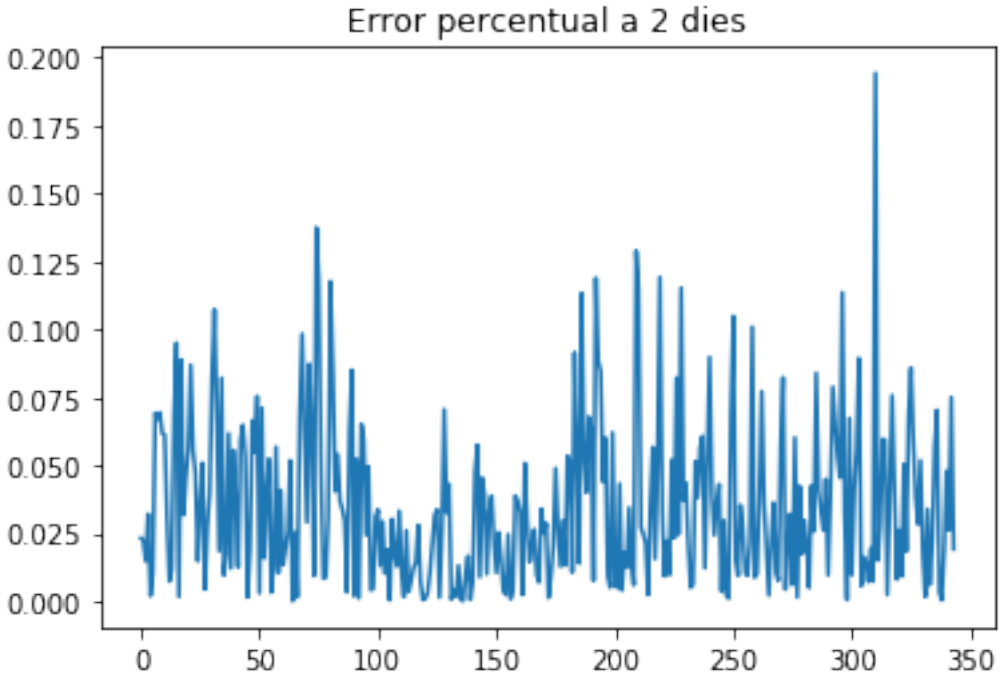

Predicció consum a 4 dies
14
13
12
11
10
9
8
0
50
100
150
200
250
300
350

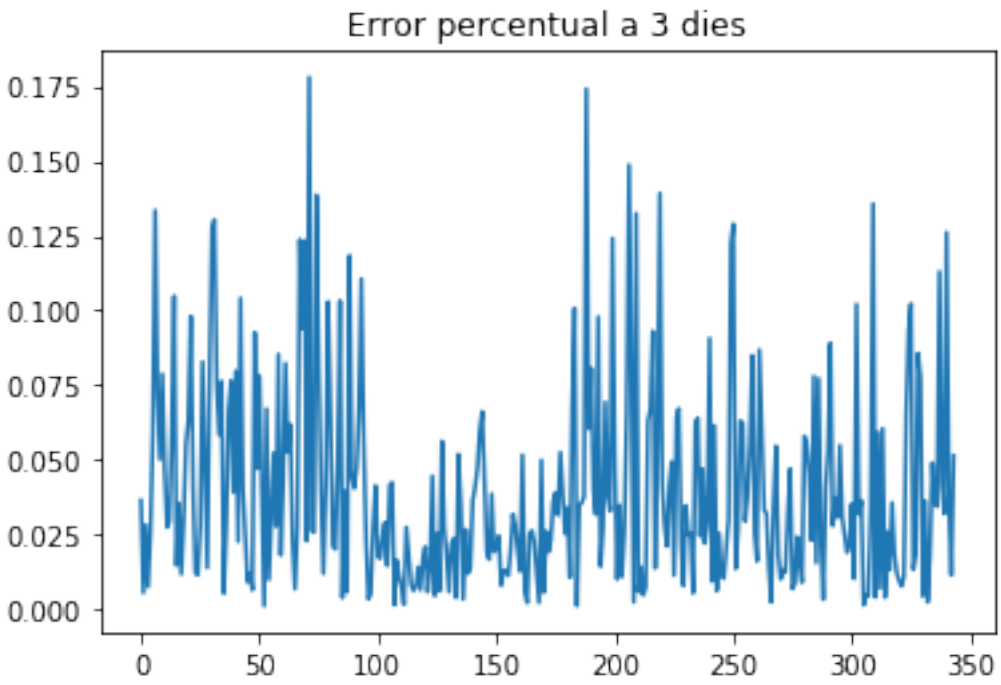

Predicció consum a 5 dies
14
13
12
11
10
9
8
7
0
50
100
150
200
250
300
350

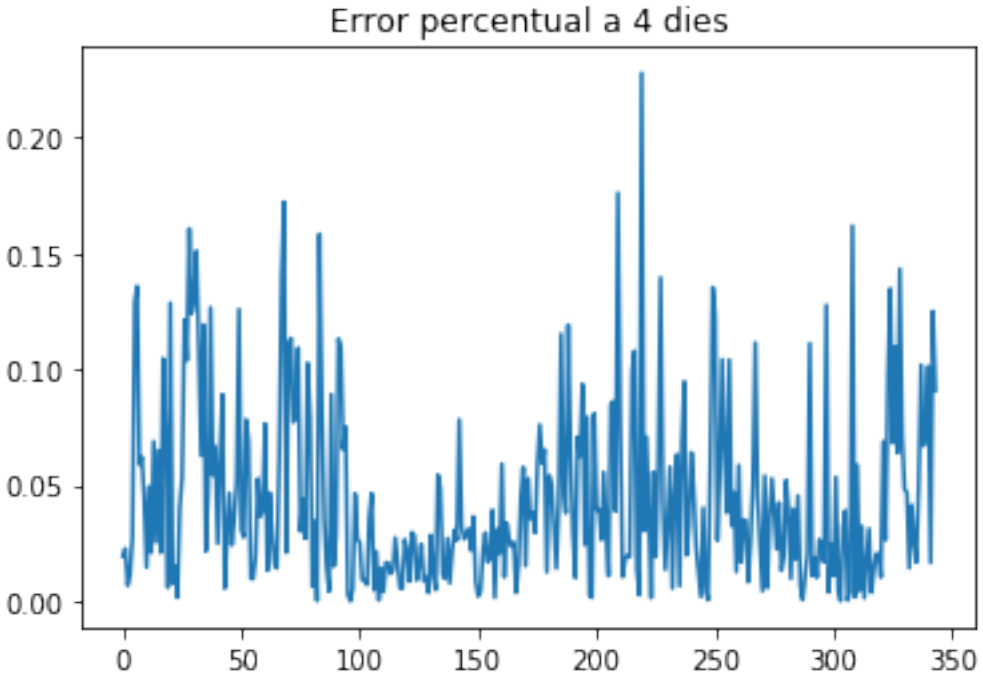

Predicció consum a 6 dies
14
13
12
11
10
9
8
0
50
100
150
200
250
300
350

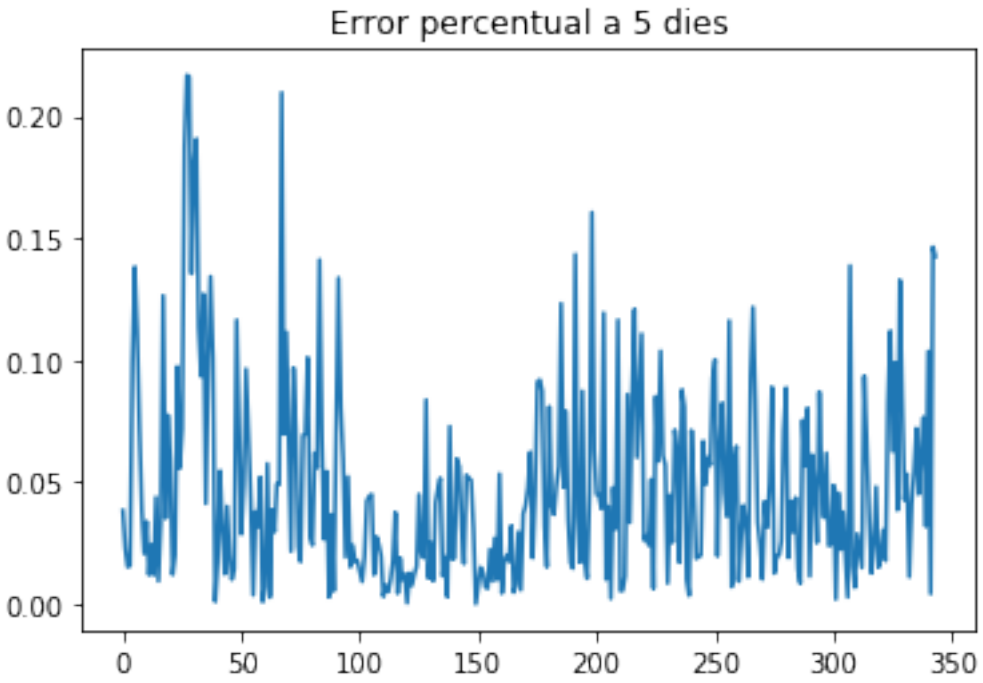

Predicció consum a 7 dies
14
13
12
11
10
9
8
0
50
100
150
200
250
300
350

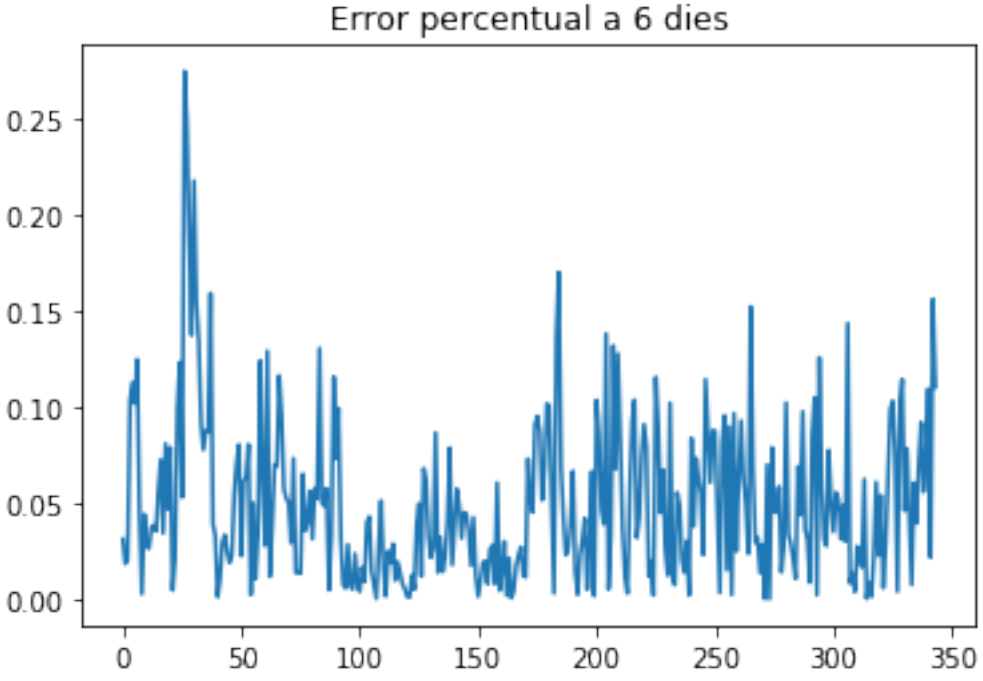

Error percentual a 1 dia
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
0
50
100
150
200
250
300
350

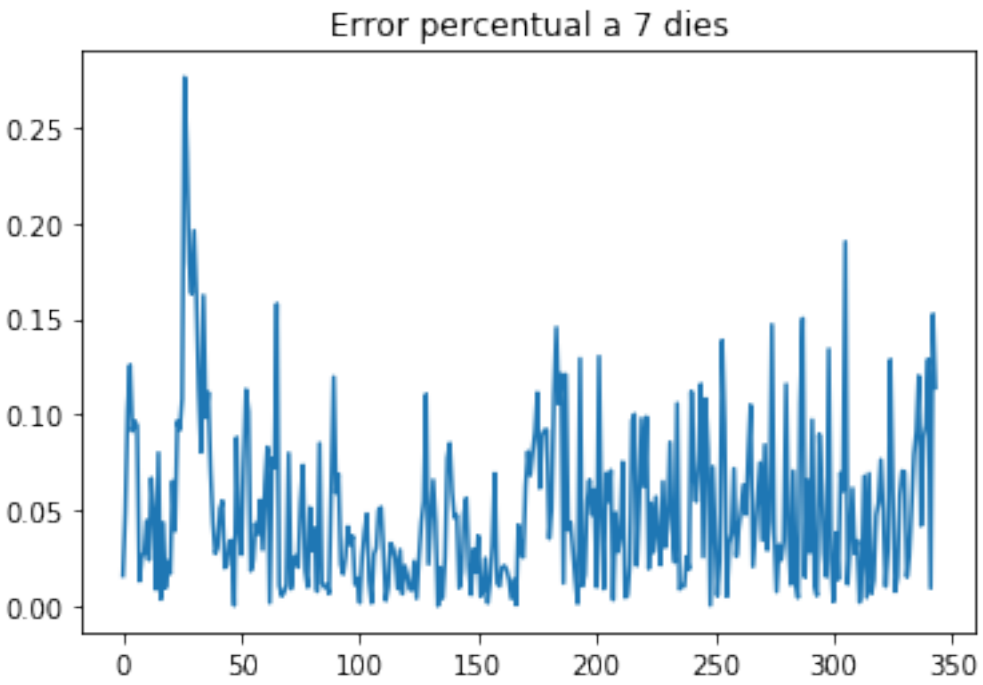

Error percentual a 2 dies
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
0
50
100
150
200
250
300
350


Error percentual a 3 dies
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
0
50
100
150
200
250
300
350


Error percentual a 4 dies
0.20
0.15
0.10
0.05
0.00
0
50
100
150
200
250
300
350


Error percentual a 5 dies
0.20
0.15
0.10
0.05
0.00
0
50
100
150
200
250
300
350


Error percentual a 6 dies
0.25
0.20
0.15
0.10
0.05
0.00
0
50
100
150
200
250
300
350




```
L'error mitjà a 1 dia és de 3.0568365749951054 %
L'error mitjà a 2 dies és de 3.533745618463487 %
L'error mitjà a 3 dies és de 4.002815889728186 %
L'error mitjà a 4 dies és de 4.439177931557118 %
L'error mitjà a 5 dies és de 4.804251124624361 %
L'error mitjà a 6 dies és de 5.017627755303729 %
L'error mitjà a 7 dies és de 5.053565397722889 %
```

```
In [26]: (error_mitja1+error_mitja2+error_mitja3+error_mitja4+error_mitja5+error_mitja6+error_
```

```
Out[26]: 4.272574327484982
```

```
In [ ]:
```