MM6 _Xarxa_walkforward_normalitzat_multivariate2_multistep_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
```

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/I
        daily.head(5)
```

Out[3]:

	date	apparentTemperatureMax	sunsetTimeHour	weekday	season	\
0	2013-01-16	-0.15	16	3	winter	
1	2013-01-20	-0.46	16	7	winter	
2	2013-01-10	2.36	16	4	winter	
3	2013-01-06	6.98	16	7	winter	
4	2012-01-31	1.13	16	2	winter	

	cloudCover	humidity	visibility	month	energy_sum
0	0.48	0.91	4.12	1	13.147536
1	0.85	0.91	5.10	1	15.021900
2	0.70	0.94	5.21	1	12.066789

```
3         0.67       0.96         5.50       1    12.422263
4         0.55       0.84         5.62       1    13.890518
```

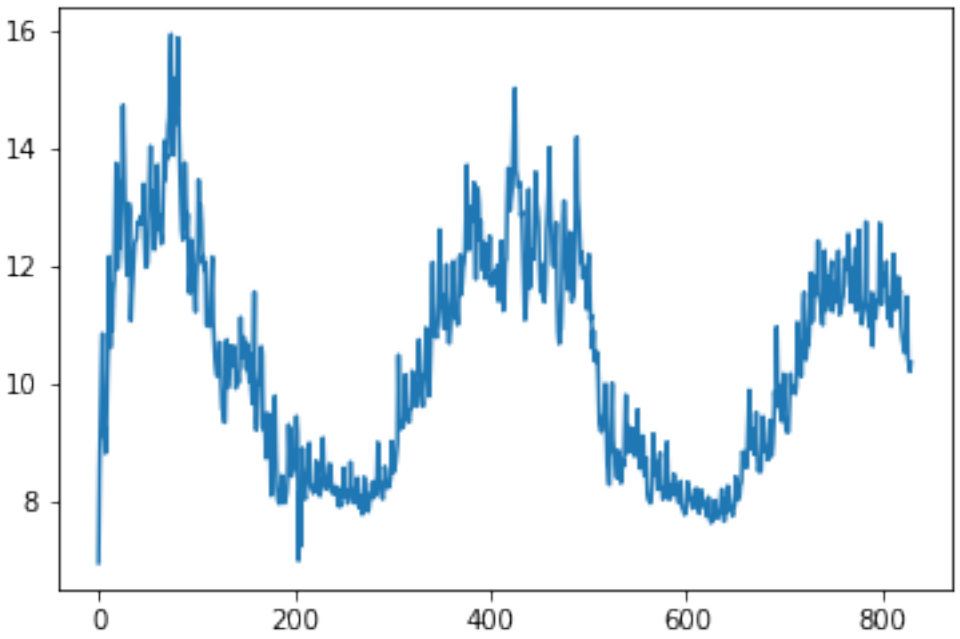
In [4]:
```
#Ens quedem amb date i energy_sum, ordenem valors per data i resetejem index
daily_dia=daily[['date','energy_sum','apparentTemperatureMax','humidity']].sort_values
daily_dia.head(5)
```

Out[4]:

	index	date	energy_sum	apparentTemperatureMax	humidity
0	677	2011-11-23	6.952692	10.36	0.93
1	691	2011-11-24	8.536480	12.93	0.89
2	713	2011-11-25	9.499781	13.03	0.79
3	728	2011-11-26	10.267707	12.96	0.81
4	729	2011-11-27	10.850805	13.54	0.72

In [16]:
```
plt.plot(daily_dia )
```

Out[16]:
```
[<matplotlib.lines.Line2D at 0x24f9e752240>]
```



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['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
```

Out[5]:

	index	date	energy_sum	apparentTemperatureMax	humidity	\
0	677	2011-11-23	6.952692	10.36	0.93	
1	691	2011-11-24	8.536480	12.93	0.89	
2	713	2011-11-25	9.499781	13.03	0.79	
3	728	2011-11-26	10.267707	12.96	0.81	
4	729	2011-11-27	10.850805	13.54	0.72	
5	704	2011-11-28	9.103382	12.58	0.86	
6	718	2011-11-29	9.274873	13.47	0.82	
7	727	2011-11-30	8.813513	11.87	0.78	
8	778	2011-12-01	9.227707	12.15	0.82	
9	773	2011-12-02	10.145910	5.33	0.87	
10	791	2011-12-03	10.780273	11.42	0.79	
11	822	2011-12-04	12.163127	6.66	0.82	
12	807	2011-12-05	10.609714	3.13	0.77	
13	813	2011-12-06	11.673417	3.77	0.83	
14	810	2011-12-07	10.889362	5.14	0.68	
15	788	2011-12-08	11.525150	12.89	0.81	
16	797	2011-12-09	11.759837	3.99	0.71	
17	799	2011-12-10	12.633801	3.14	0.81	
18	776	2011-12-11	13.749174	5.72	0.88	
19	775	2011-12-12	11.951958	5.94	0.84	
20	786	2011-12-13	11.957446	12.08	0.75	
21	818	2011-12-14	12.392776	2.88	0.79	
22	795	2011-12-15	12.307079	4.38	0.77	
23	763	2011-12-16	13.376080	0.99	0.88	
24	770	2011-12-17	13.511968	1.72	0.86	
25	808	2011-12-18	14.732271	1.98	0.84	
26	757	2011-12-19	13.774471	4.02	0.94	
27	803	2011-12-20	12.709106	4.98	0.81	
28	748	2011-12-21	12.148570	12.14	0.94	
29	806	2011-12-22	11.839403	12.14	0.87	
..	...	...	...	...	...	
800	21	2014-01-29	11.800777	2.53	0.90	
801	10	2014-01-30	11.685169	5.86	0.91	
802	12	2014-01-31	11.857957	5.27	0.91	
803	129	2014-02-01	11.710582	6.86	0.76	
804	155	2014-02-02	12.078164	6.48	0.72	
805	145	2014-02-03	11.280011	4.59	0.79	
806	134	2014-02-04	11.095584	5.63	0.75	
807	123	2014-02-05	11.415105	5.86	0.77	
808	118	2014-02-06	11.445403	7.34	0.82	
809	122	2014-02-07	10.972318	8.44	0.79	
810	126	2014-02-08	11.569300	5.67	0.77	
811	149	2014-02-09	12.202967	3.91	0.66	

812	132	2014-02-10	11.264175	7.07	0.84
813	143	2014-02-11	11.452649	4.06	0.76
814	131	2014-02-12	11.679099	4.73	0.75
815	164	2014-02-13	11.285737	3.42	0.68
816	125	2014-02-14	11.816914	12.02	0.81
817	141	2014-02-15	11.490470	5.79	0.69
818	151	2014-02-16	11.582159	7.88	0.76
819	116	2014-02-17	10.979566	10.67	0.83
820	128	2014-02-18	10.781898	10.13	0.87
821	115	2014-02-19	10.674624	10.13	0.87
822	121	2014-02-20	10.573835	12.50	0.84
823	174	2014-02-21	10.518126	10.15	0.72
824	167	2014-02-22	10.776242	11.63	0.71
825	139	2014-02-23	11.480411	11.94	0.76
826	162	2014-02-24	10.411403	14.23	0.74
827	136	2014-02-25	10.294997	11.43	0.78
828	161	2014-02-26	10.202945	11.29	0.73
829	133	2014-02-27	10.356350	10.31	0.74

	y+1	y+2	y+3	y+4	y+5	...	\
0	8.536480	9.499781	10.267707	10.850805	9.103382	...	
1	9.499781	10.267707	10.850805	9.103382	9.274873	...	
2	10.267707	10.850805	9.103382	9.274873	8.813513	...	
3	10.850805	9.103382	9.274873	8.813513	9.227707	...	
4	9.103382	9.274873	8.813513	9.227707	10.145910	...	
5	9.274873	8.813513	9.227707	10.145910	10.780273	...	
6	8.813513	9.227707	10.145910	10.780273	12.163127	...	
7	9.227707	10.145910	10.780273	12.163127	10.609714	...	
8	10.145910	10.780273	12.163127	10.609714	11.673417	...	
9	10.780273	12.163127	10.609714	11.673417	10.889362	...	
10	12.163127	10.609714	11.673417	10.889362	11.525150	...	
11	10.609714	11.673417	10.889362	11.525150	11.759837	...	
12	11.673417	10.889362	11.525150	11.759837	12.633801	...	
13	10.889362	11.525150	11.759837	12.633801	13.749174	...	
14	11.525150	11.759837	12.633801	13.749174	11.951958	...	
15	11.759837	12.633801	13.749174	11.951958	11.957446	...	
16	12.633801	13.749174	11.951958	11.957446	12.392776	...	
17	13.749174	11.951958	11.957446	12.392776	12.307079	...	
18	11.951958	11.957446	12.392776	12.307079	13.376080	...	
19	11.957446	12.392776	12.307079	13.376080	13.511968	...	
20	12.392776	12.307079	13.376080	13.511968	14.732271	...	
21	12.307079	13.376080	13.511968	14.732271	13.774471	...	
22	13.376080	13.511968	14.732271	13.774471	12.709106	...	
23	13.511968	14.732271	13.774471	12.709106	12.148570	...	
24	14.732271	13.774471	12.709106	12.148570	11.839403	...	
25	13.774471	12.709106	12.148570	11.839403	12.254989	...	
26	12.709106	12.148570	11.839403	12.254989	13.065317	...	
27	12.148570	11.839403	12.254989	13.065317	12.949429	...	

```
28   11.839403  12.254989  13.065317  12.949429  11.065577  ...
29   12.254989  13.065317  12.949429  11.065577  11.494944  ...
..         ...        ...        ...        ...        ...  ...
800  11.685169  11.857957  11.710582  12.078164  11.280011  ...
801  11.857957  11.710582  12.078164  11.280011  11.095584  ...
802  11.710582  12.078164  11.280011  11.095584  11.415105  ...
803  12.078164  11.280011  11.095584  11.415105  11.445403  ...
804  11.280011  11.095584  11.415105  11.445403  10.972318  ...
805  11.095584  11.415105  11.445403  10.972318  11.569300  ...
806  11.415105  11.445403  10.972318  11.569300  12.202967  ...
807  11.445403  10.972318  11.569300  12.202967  11.264175  ...
808  10.972318  11.569300  12.202967  11.264175  11.452649  ...
809  11.569300  12.202967  11.264175  11.452649  11.679099  ...
810  12.202967  11.264175  11.452649  11.679099  11.285737  ...
811  11.264175  11.452649  11.679099  11.285737  11.816914  ...
812  11.452649  11.679099  11.285737  11.816914  11.490470  ...
813  11.679099  11.285737  11.816914  11.490470  11.582159  ...
814  11.285737  11.816914  11.490470  11.582159  10.979566  ...
815  11.816914  11.490470  11.582159  10.979566  10.781898  ...
816  11.490470  11.582159  10.979566  10.781898  10.674624  ...
817  11.582159  10.979566  10.781898  10.674624  10.573835  ...
818  10.979566  10.781898  10.674624  10.573835  10.518126  ...
819  10.781898  10.674624  10.573835  10.518126  10.776242  ...
820  10.674624  10.573835  10.518126  10.776242  11.480411  ...
821  10.573835  10.518126  10.776242  11.480411  10.411403  ...
822  10.518126  10.776242  11.480411  10.411403  10.294997  ...
823  10.776242  11.480411  10.411403  10.294997  10.202945  ...
824  11.480411  10.411403  10.294997  10.202945  10.356350  ...
825  10.411403  10.294997  10.202945  10.356350        NaN  ...
826  10.294997  10.202945  10.356350        NaN        NaN  ...
827  10.202945  10.356350        NaN        NaN        NaN  ...
828  10.356350        NaN        NaN        NaN        NaN  ...
829        NaN        NaN        NaN        NaN        NaN  ...

     humidity(t-5)  humidity(t-6)  humidity(t-7)  humidity(t-8)  \
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             0.93            NaN            NaN            NaN
6             0.89           0.93            NaN            NaN
7             0.79           0.89           0.93            NaN
8             0.81           0.79           0.89           0.93
9             0.72           0.81           0.79           0.89
10            0.86           0.72           0.81           0.79
11            0.82           0.86           0.72           0.81
12            0.78           0.82           0.86           0.72
```

13	0.82	0.78	0.82	0.86
14	0.87	0.82	0.78	0.82
15	0.79	0.87	0.82	0.78
16	0.82	0.79	0.87	0.82
17	0.77	0.82	0.79	0.87
18	0.83	0.77	0.82	0.79
19	0.68	0.83	0.77	0.82
20	0.81	0.68	0.83	0.77
21	0.71	0.81	0.68	0.83
22	0.81	0.71	0.81	0.68
23	0.88	0.81	0.71	0.81
24	0.84	0.88	0.81	0.71
25	0.75	0.84	0.88	0.81
26	0.79	0.75	0.84	0.88
27	0.77	0.79	0.75	0.84
28	0.88	0.77	0.79	0.75
29	0.86	0.88	0.77	0.79
..	...	...	...	...
800	0.83	0.82	0.87	0.89
801	0.83	0.83	0.82	0.87
802	0.79	0.83	0.83	0.82
803	0.79	0.79	0.83	0.83
804	0.83	0.79	0.79	0.83
805	0.90	0.83	0.79	0.79
806	0.91	0.90	0.83	0.79
807	0.91	0.91	0.90	0.83
808	0.76	0.91	0.91	0.90
809	0.72	0.76	0.91	0.91
810	0.79	0.72	0.76	0.91
811	0.75	0.79	0.72	0.76
812	0.77	0.75	0.79	0.72
813	0.82	0.77	0.75	0.79
814	0.79	0.82	0.77	0.75
815	0.77	0.79	0.82	0.77
816	0.66	0.77	0.79	0.82
817	0.84	0.66	0.77	0.79
818	0.76	0.84	0.66	0.77
819	0.75	0.76	0.84	0.66
820	0.68	0.75	0.76	0.84
821	0.81	0.68	0.75	0.76
822	0.69	0.81	0.68	0.75
823	0.76	0.69	0.81	0.68
824	0.83	0.76	0.69	0.81
825	0.87	0.83	0.76	0.69
826	0.87	0.87	0.83	0.76
827	0.84	0.87	0.87	0.83
828	0.72	0.84	0.87	0.87
829	0.71	0.72	0.84	0.87

	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	
5	NaN	NaN	NaN	NaN	
6	NaN	NaN	NaN	NaN	
7	NaN	NaN	NaN	NaN	
8	NaN	NaN	NaN	NaN	
9	0.93	NaN	NaN	NaN	
10	0.89	0.93	NaN	NaN	
11	0.79	0.89	0.93	NaN	
12	0.81	0.79	0.89	0.93	
13	0.72	0.81	0.79	0.89	
14	0.86	0.72	0.81	0.79	
15	0.82	0.86	0.72	0.81	
16	0.78	0.82	0.86	0.72	
17	0.82	0.78	0.82	0.86	
18	0.87	0.82	0.78	0.82	
19	0.79	0.87	0.82	0.78	
20	0.82	0.79	0.87	0.82	
21	0.77	0.82	0.79	0.87	
22	0.83	0.77	0.82	0.79	
23	0.68	0.83	0.77	0.82	
24	0.81	0.68	0.83	0.77	
25	0.71	0.81	0.68	0.83	
26	0.81	0.71	0.81	0.68	
27	0.88	0.81	0.71	0.81	
28	0.84	0.88	0.81	0.71	
29	0.75	0.84	0.88	0.81	
..	...	...	...	...	
800	0.89	0.80	0.83	0.87	
801	0.89	0.89	0.80	0.83	
802	0.87	0.89	0.89	0.80	
803	0.82	0.87	0.89	0.89	
804	0.83	0.82	0.87	0.89	
805	0.83	0.83	0.82	0.87	
806	0.79	0.83	0.83	0.82	
807	0.79	0.79	0.83	0.83	
808	0.83	0.79	0.79	0.83	
809	0.90	0.83	0.79	0.79	
810	0.91	0.90	0.83	0.79	
811	0.91	0.91	0.90	0.83	
812	0.76	0.91	0.91	0.90	
813	0.72	0.76	0.91	0.91	
814	0.79	0.72	0.76	0.91	

815	0.75	0.79	0.72	0.76
816	0.77	0.75	0.79	0.72
817	0.82	0.77	0.75	0.79
818	0.79	0.82	0.77	0.75
819	0.77	0.79	0.82	0.77
820	0.66	0.77	0.79	0.82
821	0.84	0.66	0.77	0.79
822	0.76	0.84	0.66	0.77
823	0.75	0.76	0.84	0.66
824	0.68	0.75	0.76	0.84
825	0.81	0.68	0.75	0.76
826	0.69	0.81	0.68	0.75
827	0.76	0.69	0.81	0.68
828	0.83	0.76	0.69	0.81
829	0.87	0.83	0.76	0.69

	humidity(t-13)	humidity(t-14)
0	NaN	NaN
1	NaN	NaN
2	NaN	NaN
3	NaN	NaN
4	NaN	NaN
5	NaN	NaN
6	NaN	NaN
7	NaN	NaN
8	NaN	NaN
9	NaN	NaN
10	NaN	NaN
11	NaN	NaN
12	NaN	NaN
13	0.93	NaN
14	0.89	0.93
15	0.79	0.89
16	0.81	0.79
17	0.72	0.81
18	0.86	0.72
19	0.82	0.86
20	0.78	0.82
21	0.82	0.78
22	0.87	0.82
23	0.79	0.87
24	0.82	0.79
25	0.77	0.82
26	0.83	0.77
27	0.68	0.83
28	0.81	0.68
29	0.71	0.81
..	...	...

```
800            0.83            0.90
801            0.87            0.83
802            0.83            0.87
803            0.80            0.83
804            0.89            0.80
805            0.89            0.89
806            0.87            0.89
807            0.82            0.87
808            0.83            0.82
809            0.83            0.83
810            0.79            0.83
811            0.79            0.79
812            0.83            0.79
813            0.90            0.83
814            0.91            0.90
815            0.91            0.91
816            0.76            0.91
817            0.72            0.76
818            0.79            0.72
819            0.75            0.79
820            0.77            0.75
821            0.82            0.77
822            0.79            0.82
823            0.77            0.79
824            0.66            0.77
825            0.84            0.66
826            0.76            0.84
827            0.75            0.76
828            0.68            0.75
829            0.81            0.68

[830 rows x 53 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', 'humidity'], axis=1)
#daily_dia=daily_dia[['energy_sum','t-1','t-2','t-3','t-4','t-5','t-6','t-7','t-8','te
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  ...  humidity(t-5)  \
0   9.274873        NaN        NaN        NaN  ...            NaN
```

```
1   8.813513   6.952692       NaN       NaN  ...            NaN
2   9.227707   8.536480  6.952692       NaN  ...            NaN
3  10.145910   9.499781  8.536480  6.952692  ...            NaN
4  10.780273  10.267707  9.499781  8.536480  ...            NaN

   humidity(t-6)  humidity(t-7)  humidity(t-8)  humidity(t-9)  humidity(t-10)  \
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-11)  humidity(t-12)  humidity(t-13)  humidity(t-14)
0             NaN             NaN             NaN             NaN
1             NaN             NaN             NaN             NaN
2             NaN             NaN             NaN             NaN
3             NaN             NaN             NaN             NaN
4             NaN             NaN             NaN             NaN

[5 rows x 49 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=daily_dia.drop([829,828,827,826,825,824,823])
```

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

Out[8]:
```
809
```

In [9]:
```
#normalitzem
scaler=preprocessing.MinMaxScaler(feature_range=(0, 1))
daily_dia_norm=scaler.fit_transform(daily_dia)
```

In [47]:

Out[47]:
```
array([0.25530572, 0.2361457 , 0.43137821, 0.36623108, 0.28043381,
       0.17280805, 0.        , 0.48124829, 0.45688475, 0.48316452,
       0.46728716, 0.46920339, 0.46646592, 0.39611278])
```

In [10]:
```
#Seleccionem dades per test i train
y_daily=daily_dia_norm[:,0:7]

X_daily=daily_dia_norm[:,7:50]

#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], 14,3))
```

In [11]:
```
        # definim model
        import tensorflow as tf
        model =Sequential()
        model.add(LSTM(50, activation='relu', input_shape=(14, 3)))
        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 [12]:
```
        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 [13]: #Dividim la suma de scores de test entre el nombre de prediccions per obtenir la mitj
         sumScores/(lenght-n_train)
```

```
Out[13]: 0.05973668613702809
```

```
In [14]: #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[14]: [[[0.5239460468292236,
            0.5246468782424927,
            0.5182017087936401,
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          [[0.5994706153869629,
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```

```
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```

```
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          0.4667884111404419,
          0.3897290825843811,
          0.45657479763031006,
          0.41683995723724365]]]
```

In [15]:
```
#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])
```

In [16]:
```
#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])
```

In [18]:
```
#Altres dies
```

```
        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 [ ]:

In [19]:
```
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))
```

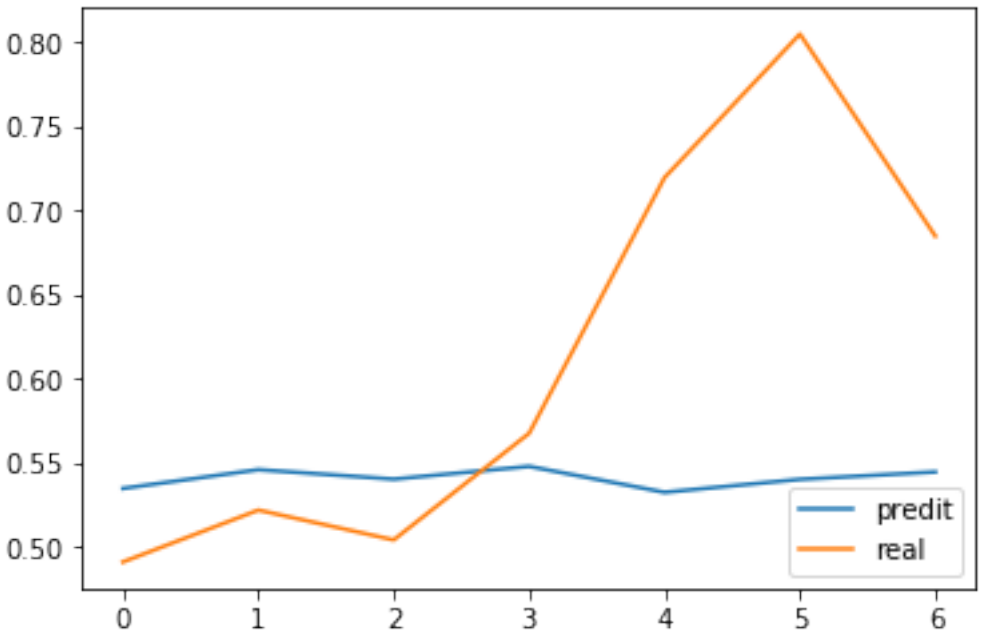
```
Error predicció 1 dia següent: 0.05802892670511248
Error predicció 2 dia següent: 0.06274021441520743
Error predicció 3 dia següent: 0.06919474326084486
Error predicció 4 dia següent: 0.0650357954749162
Error predicció 5 dia següent: 0.06776526886674641
Error predicció 6 dia següent: 0.07085060400346162
Error predicció 7 dia següent: 0.07036705918573186
```

In [20]:
```
predis=list()
```

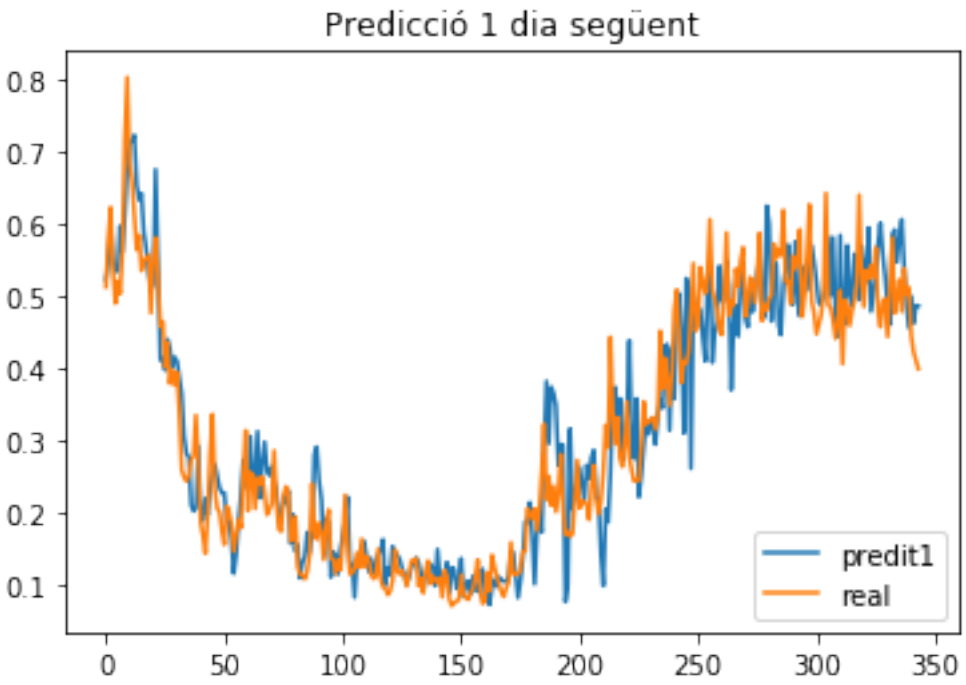
```
for i in range(len(llista_prediccions)):
    predi=llista_prediccions[i].tolist()
    predis.append(predi)

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

predis
```

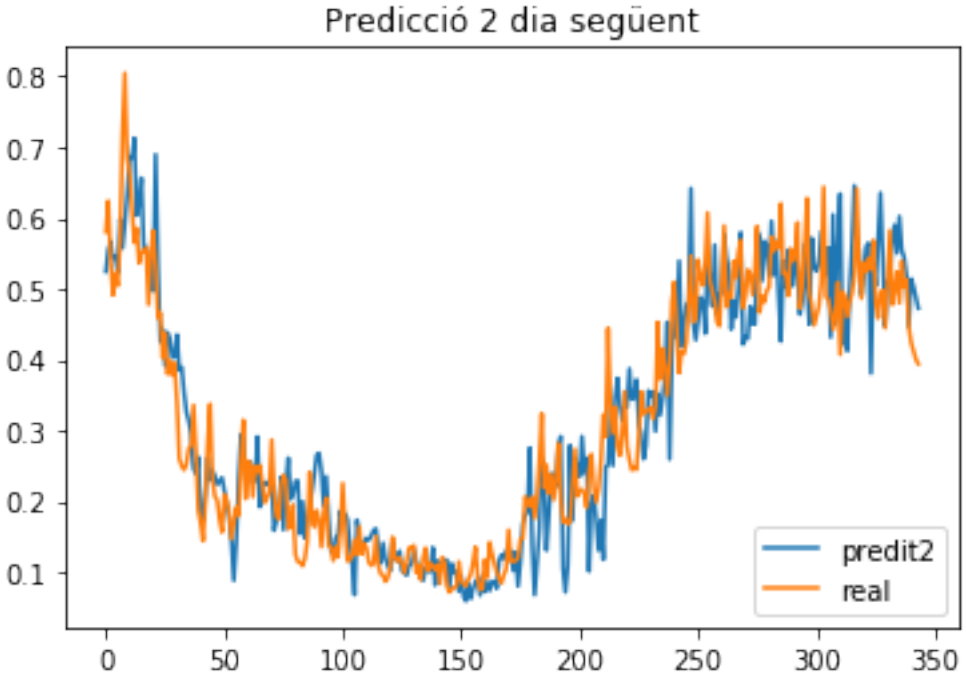
Out[20]:
```
array([[0.52394605, 0.52464688, 0.51820171, ..., 0.51649296, 0.52436602,
        0.52522826],
       [0.5478254 , 0.55546182, 0.53363448, ..., 0.53528208, 0.54268843,
        0.54238915],
       [0.59947062, 0.56691027, 0.58896339, ..., 0.53936958, 0.55779064,
        0.52234107],
       ...,
       [0.46357483, 0.50253528, 0.52855933, ..., 0.44993377, 0.43802783,
        0.44675982],
       [0.48841971, 0.48817033, 0.5389365 , ..., 0.39376712, 0.39520854,
        0.42812467],
       [0.48781255, 0.47268417, 0.48553607, ..., 0.38972908, 0.4565748 ,
        0.41683996]])
```

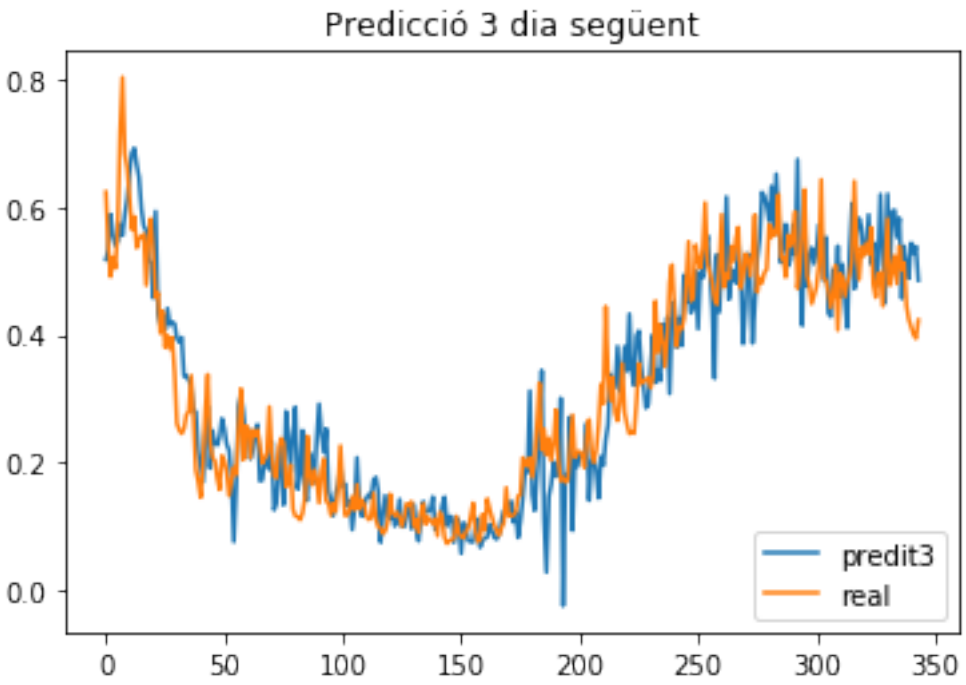
In [21]:
```
##Mostrem
plt.plot(predis[4], label="predit")
plt.plot(y_daily[n_train+4], label="real")
plt.legend(loc="lower right")
plt.show()
```

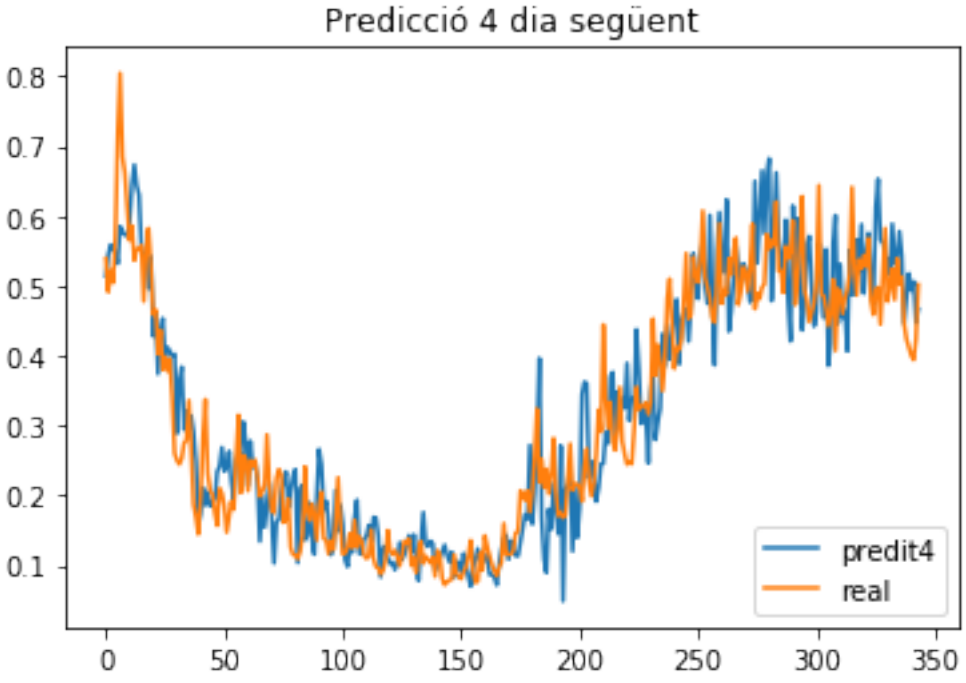


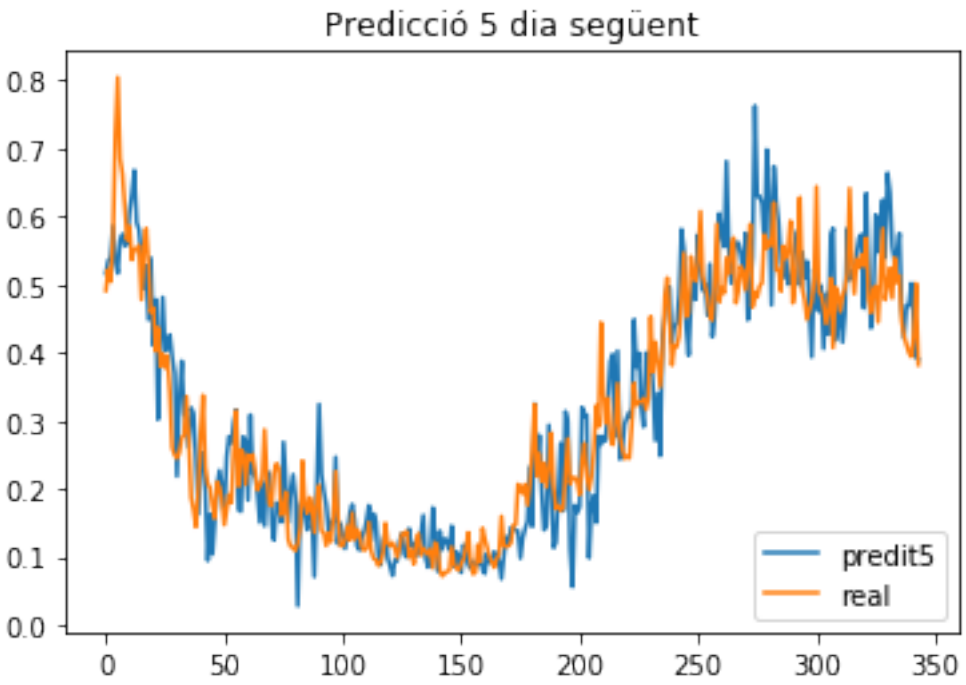
In [22]:
```
##Mostrem
plt.plot(llista_p0, label="predit1")
plt.plot(y_daily[n_train:lenght,0], label="real")
plt.legend(loc="lower right")
plt.title("Predicció 1 dia següent")
plt.show()

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()
```

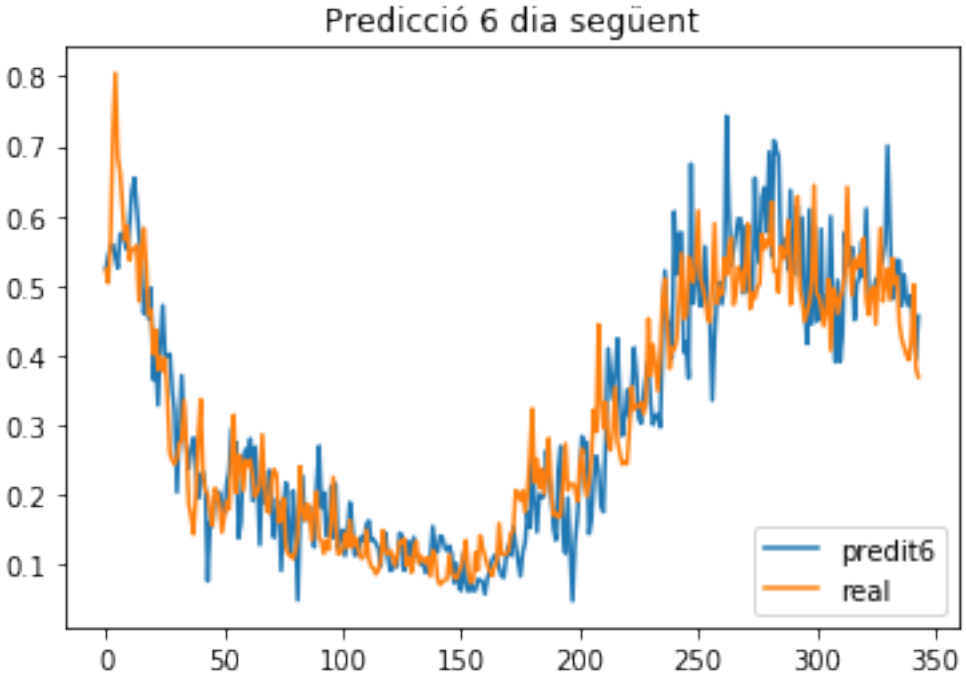

Predicció 1 dia següent
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
50
100
150
200
250
300
350
predit1
real

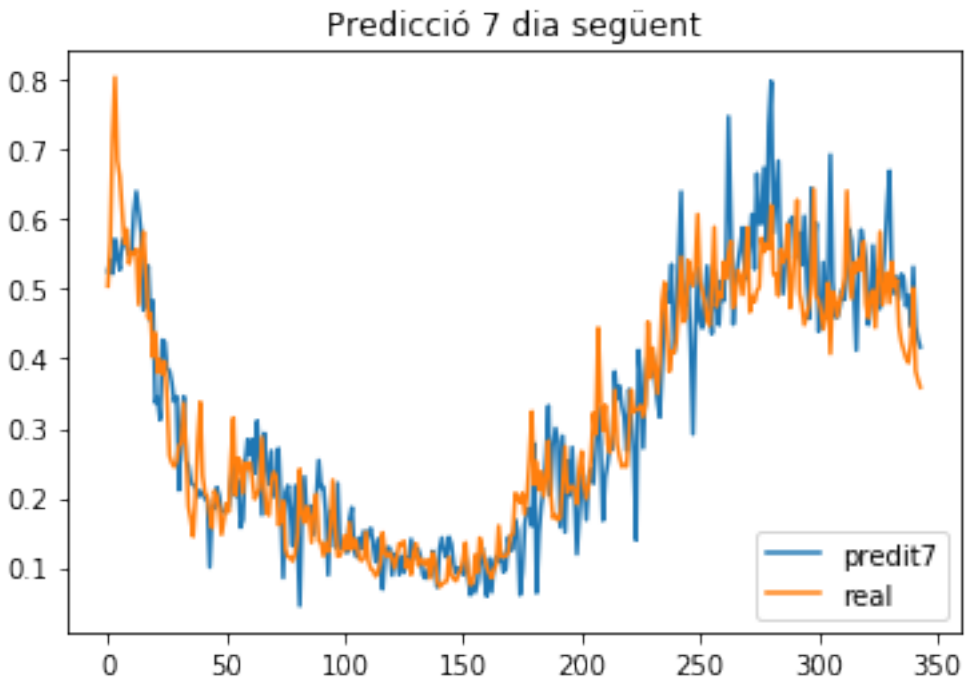

Predicció 2 dia següent
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
50
100
150
200
250
300
350
predit2
real


Predicció 3 dia següent
0.8
0.6
0.4
0.2
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 [ ]: