td2a_timeseries_correction

July 1, 2022

1 2A.ml - Séries temporelles - correction

Prédictions sur des séries temporelles.

[1]:
```
from jyquickhelper import add_notebook_menu
add_notebook_menu()
```

[1]:
```
<IPython.core.display.HTML object>
```

[2]:
```
%matplotlib inline
```

1.1 Une série temporelles

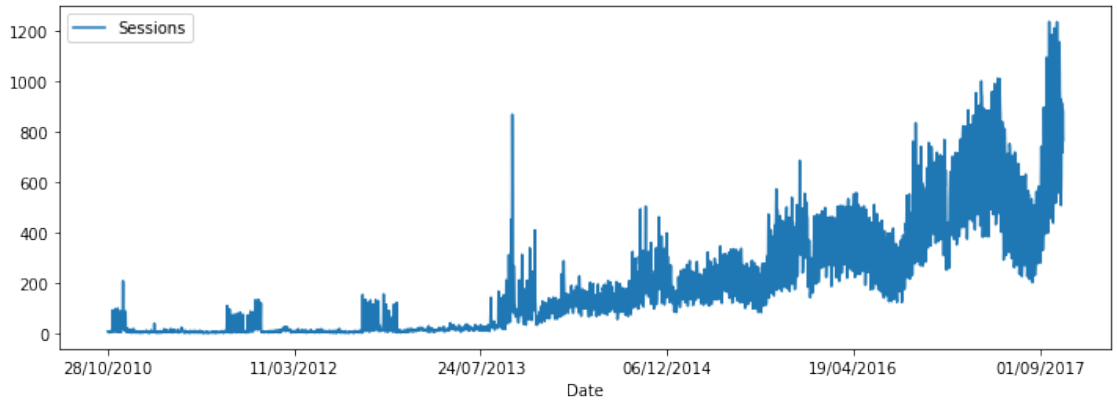
On récupère le nombre de sessions d'un site web.

[3]:
```
import pandas
data = pandas.read_csv("xavierdupre_sessions.csv", sep="\t")
data.set_index("Date", inplace=True)
data.head()
```

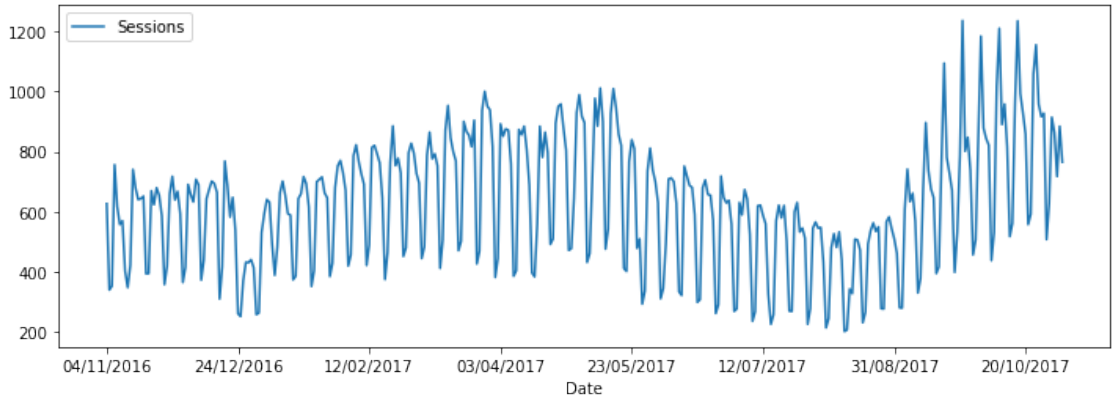
[3]:

Date	Sessions
28/10/2010	7
29/10/2010	6
30/10/2010	4
31/10/2010	6
01/11/2010	2

[4]:
```
data.plot(figsize=(12,4));
```



[5]:
```
data[-365:].plot(figsize=(12,4));
```



1.2 Trends

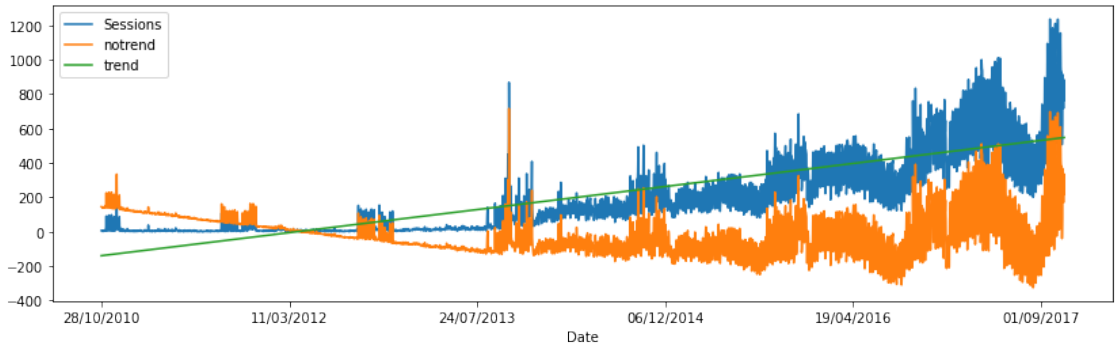
Fonction detrend.

[6]:
```
from statsmodels.tsa.tsatools import detrend
notrend = detrend(data['Sessions'])
data["notrend"] = notrend
data["trend"] = data['Sessions'] - notrend
data.tail()
```

[6]:

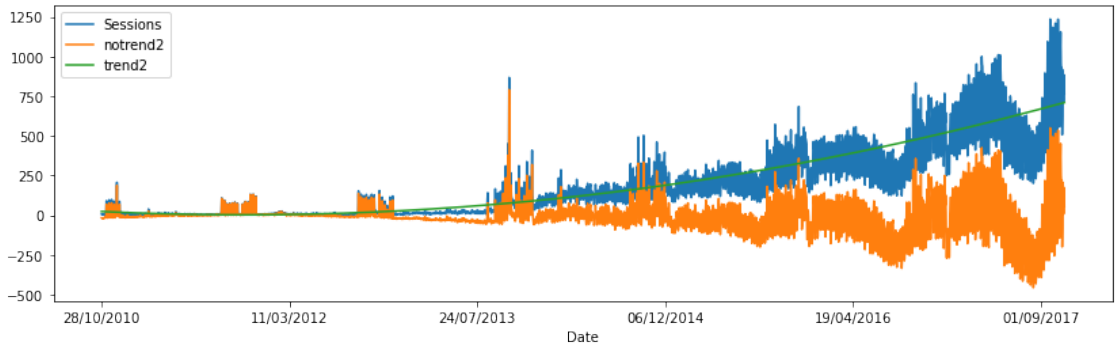
Date	Sessions	notrend	trend
30/10/2017	914	367.387637	546.612363
31/10/2017	863	316.119822	546.880178
01/11/2017	717	169.852008	547.147992
02/11/2017	884	336.584193	547.415807
03/11/2017	765	217.316379	547.683621

[7]:
```
data.plot(y=["Sessions", "notrend", "trend"], figsize=(14,4));
```



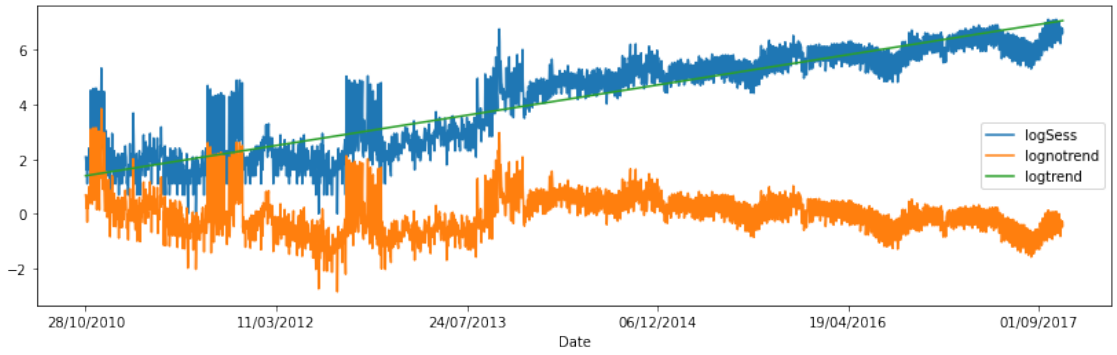
On essaye de calculer une tendance en minimisant : $Y = \alpha + \beta t + \gamma t^2$.

[8]:
```
notrend2 = detrend(data['Sessions'], order=2)
data["notrend2"] = notrend2
data["trend2"] = data["Sessions"] - data["notrend2"]
data.plot(y=["Sessions", "notrend2", "trend2"], figsize=(14,4));
```



On passe au log.

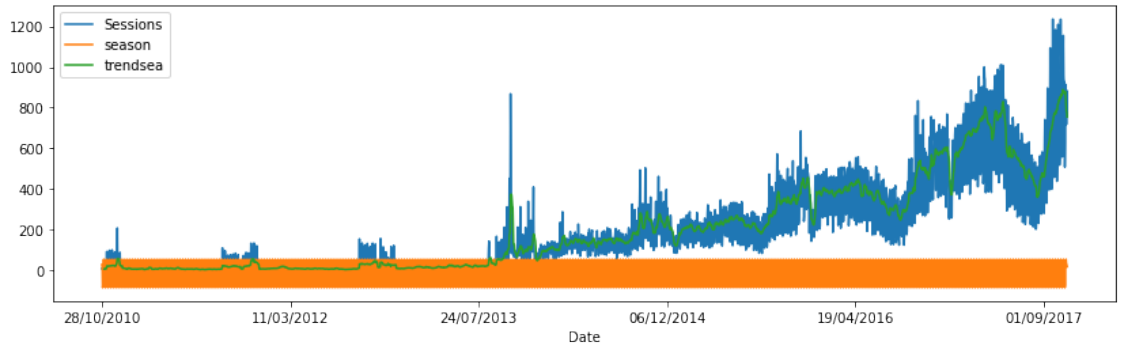
[9]:
```
import numpy
data["logSess"] = data["Sessions"].apply(lambda x: numpy.log(x+1))
lognotrend = detrend(data['logSess'])
data["lognotrend"] = lognotrend
data["logtrend"] = data["logSess"] - data["lognotrend"]
data.plot(y=["logSess", "lognotrend", "logtrend"], figsize=(14,4));
```



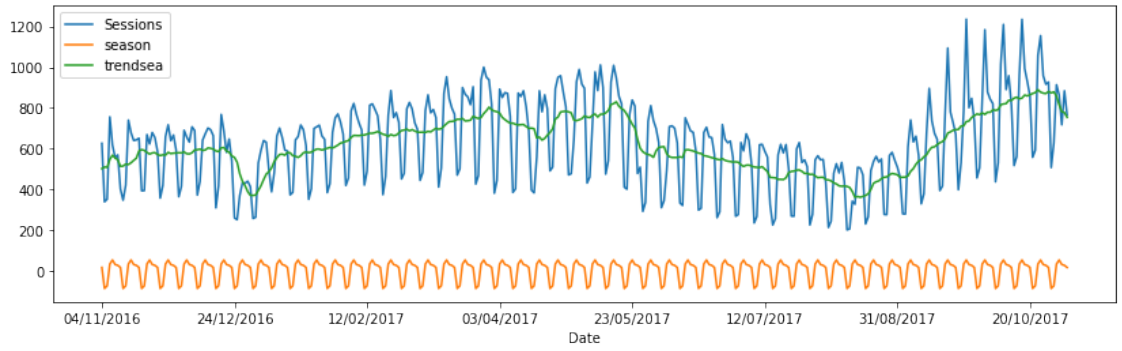
La série est assez particulière. Elle donne l'impression d'avoir un changement de régime. On extrait la composante saisonnière avec seasonal_decompose.

[10]:
```
from statsmodels.tsa.seasonal import seasonal_decompose
res = seasonal_decompose(data["Sessions"].values.ravel(), freq=7, two_sided=False)
data["season"] = res.seasonal
data["trendsea"] = res.trend
data.plot(y=["Sessions", "season", "trendsea"], figsize=(14,4));
```

```
<ipython-input-23-986850a44b5e>:2: FutureWarning: the 'freq'' keyword is
deprecated, use 'period' instead.
  res = seasonal_decompose(data["Sessions"].values.ravel(), freq=7,
two_sided=False)
```

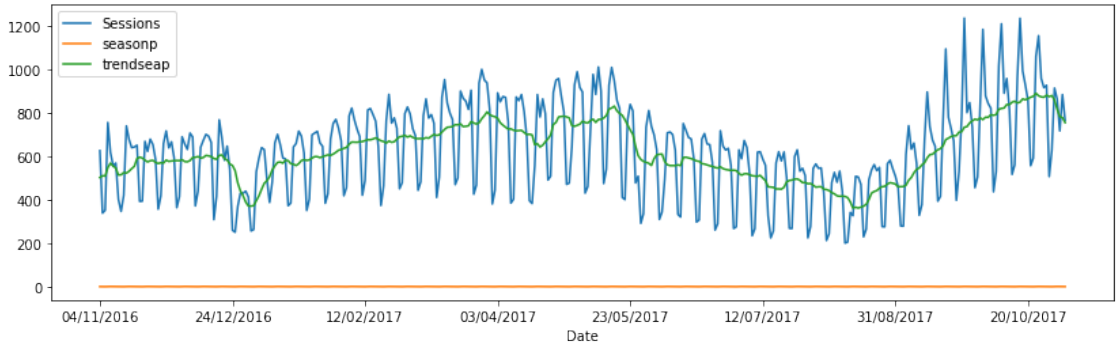


[11]:
```
data[-365:].plot(y=["Sessions", "season", "trendsea"], figsize=(14,4));
```



[12]:
```
res = seasonal_decompose(data["Sessions"].values.ravel() + 1, freq=7,
                         two_sided=False, model='multiplicative')
data["seasonp"] = res.seasonal
data["trendseap"] = res.trend
data[-365:].plot(y=["Sessions", "seasonp", "trendseap"], figsize=(14,4));
```

```
<ipython-input-25-c64a8f19748f>:1: FutureWarning: the 'freq'' keyword is
deprecated, use 'period' instead.
  res = seasonal_decompose(data["Sessions"].values.ravel() + 1, freq=7,
```

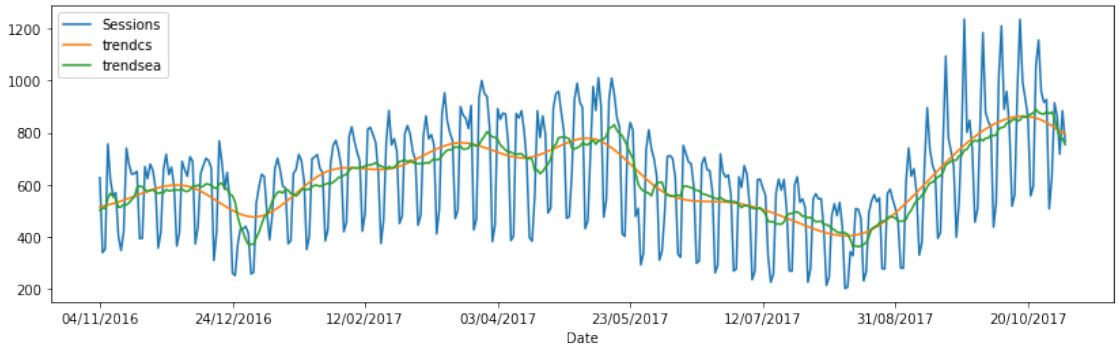


1.3 Enlever la saisonnalité sans la connaître

Avec fit_seasons.

[13]:
```
from seasonal import fit_seasons
cv_seasons, trend = fit_seasons(data["Sessions"])
print(cv_seasons)
# data["cs_seasons"] = cv_seasons
data["trendcs"] = trend
data[-365:].plot(y=["Sessions", "trendcs", "trendsea"], figsize=(14,4));
```

```
[ 26.66213008  16.33420353 -86.59519495 -73.57497492  33.23110565
  52.87820674  30.87516435]
```

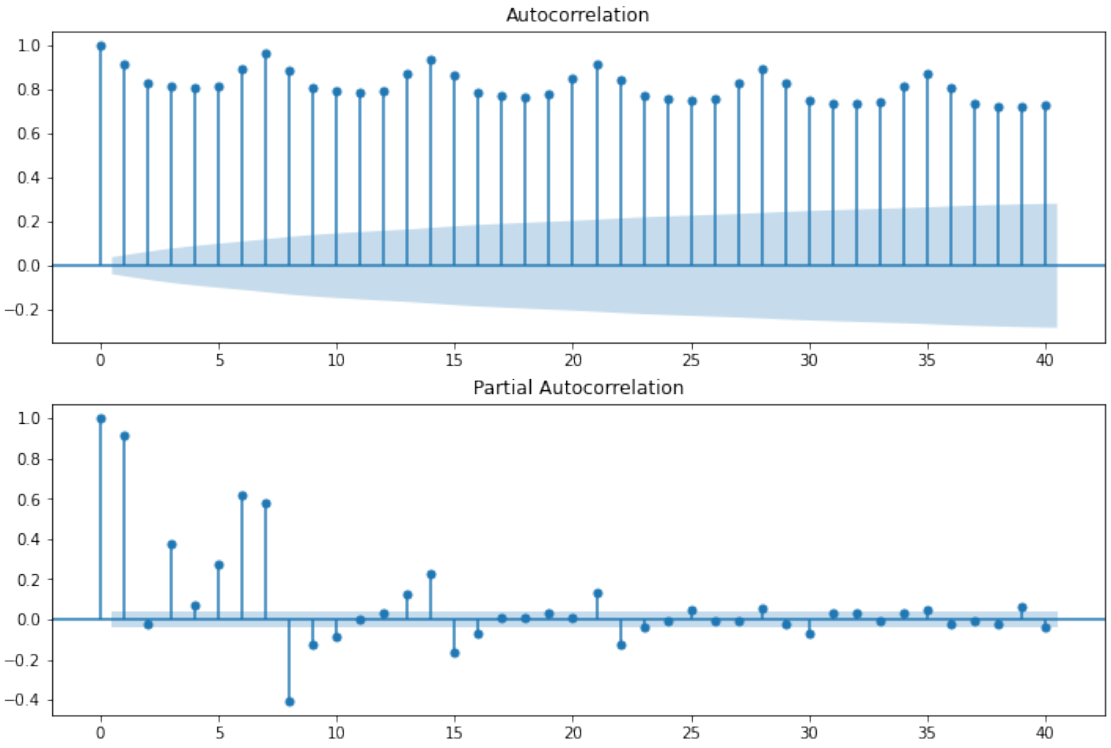


1.4 Autocorrélogramme

On s'inspire de l'exemple : Autoregressive Moving Average (ARMA): Sunspots data.

[14]:
```
import matplotlib.pyplot as plt
from statsmodels.graphics.tsaplots import plot_acf, plot_pacf
fig = plt.figure(figsize=(12,8))
ax1 = fig.add_subplot(211)
fig = plot_acf(data["Sessions"], lags=40, ax=ax1)
ax2 = fig.add_subplot(212)
fig = plot_pacf(data["Sessions"], lags=40, ax=ax2);
```

```
C:\Python395_x64\lib\site-packages\statsmodels\tsa\base\tsa_model.py:7:
FutureWarning: pandas.Int64Index is deprecated and will be removed from pandas
in a future version. Use pandas.Index with the appropriate dtype instead.
  from pandas import (to_datetime, Int64Index, DatetimeIndex, Period,
C:\Python395_x64\lib\site-packages\statsmodels\tsa\base\tsa_model.py:7:
FutureWarning: pandas.Float64Index is deprecated and will be removed from pandas
in a future version. Use pandas.Index with the appropriate dtype instead.
  from pandas import (to_datetime, Int64Index, DatetimeIndex, Period,
```



On retrouve bien une période de 7.

1.5 Changements de régime

- Gaussian HMM of stock data
- MixedLM
- RLM
- Local Linear Trend
- MarkovAutoregression

[15]: