



Time Series Management

Michele Linardi Ph.D.

michele.linardi@orange.fr



TD

Model selection and forecasting

TS Analysis in Python

- SciPy
- NumPy;
- Matplotlib;
- Pandas;

 statsmodels

<https://www.statsmodels.org/stable/index.html>
<https://github.com/statsmodels/statsmodels/>



ACF and PACF statsmodels

Import the data in a Pandas DataFrame

- `from pandas import read_excel`
- `series = read_excel([filename], sheet_name='MAdata',)`

https://pandas.pydata.org/docs/reference/api/pandas.read_excel.html

ACF and PACF



Import functions to plot ACF and PACF

- `from statsmodels.graphics.tsaplots import plot_acf, plot_pacf`
- `from statsmodels.tsa.tsatools import detrend`

- `plot_acf([series], title='', lags=xx)`
- `plot_pacf([series], title='', lags=xx)`

https://www.statsmodels.org/stable/generated/statsmodels.graphics.tsaplots.plot_acf.html#statsmodels.graphics.tsaplots.plot_acf

ARIMA MODEL statsmodels

Compute ARIMA MODEL

```
from statsmodels.tsa.arima.model import ARIMA.
```

```
model = ARIMA([series], order=(p, d, q)),
```

where p , d , and q represent the parameters of the model

<https://www.statsmodels.org/stable/generated/statsmodels.tsa.arima.model.ARIMA.html>

<https://www.statsmodels.org/stable/dev/generated/statsmodels.base.model.GenericLikelihoodModelResults.aic.html#statsmodels.base.model.GenericLikelihoodModelResults.aic>

TD - Consignes

- Given the file **priceData.xlsx**
- Write a Python program to **compute the ACF and PACF** (test several lags) of the time series contained in **priceData.xlsx**. **Pay attention to TS trend. Try to use the detrend function to remove TS trend (statsmodels.tsa.tsatools)** What can you say? What is the difference compared to simple integration?
- Write a Python program to **estimate and compute the best ARIMA** model of the time series in **priceData.xlsx**, based on **AIC** criterion.
- Which kind of model is chosen (ARIMA orders) ?

You can write your solution directly in Colab. Here an example, where to start:

<https://colab.research.google.com/drive/182kwm9aT2Wn179Di1nPMJ8qEEj0vLq4?usp=sharing>

References

- Andrew V. Metcalfe, **Paul S.P. Cowpertwait, Introductory Time Series with R** (2009).
- Aileen Nielsen, **Practical Time Series Analysis: Prediction with Statistics and Machine Learning** (2019).
- Changquan Huang , Alla Petukhina, **Applied Time Series Analysis and Forecasting with Python** (2022)
- Peter J. Brockwell, Richard A. Davis, **Introduction to Time Series and Forecasting** (2022)