

# Worksheet: temporal time series analysis (part II)

Joaquin Rapela

January 23, 2025

1. The goal of this forecasting exercise is to produce a figure similar to that in slide *Example (Forecasting with an AR(1) model)* but for an AR(7) model.

Simulate  $N = 10,000$  samples from an AR(7) model with parameters

$$\begin{aligned}\phi &= [5.0/6, -1.0/6, 0.5/6, -0.25/6, 0.5/6, -0.1/6, 0.05/6] \\ \sigma &= 5.0\end{aligned}$$

Use the  $m = 500$  samples before the last sample to forecast  $h = 50$  samples into the future.

You may want to use the script `plot_arForecastingYWCOR` and complete the code for the function `forecast` in the module `tsAnalysisUtils.py`.

You should build a plot similar to that in Figure 1.

2. Reproduce the figure in the slide *Estimate coefficients of AR(3) model using the Yule-Walker estimators* in [lecture 2](#). You may want to use the sample script available [here](#). To run this code, you will need to complete the function `estimateCoefsAndNoisVarARpYW` in the module `tsAnalysisUtils.py`, imported in the previous script.

Hints:

**solving the system of equations  $Ax = b$  in Numpy** to estimate the vector  $x$  that best approximates the previous equations in Numpy you can use `x = np.linalg.solve(A, x)`.

**computing inner products  $x^T y$  in Numpy** to calculate the previous inner product between vector  $x$  and  $y$  in Numpy you can use `np.inner(x, y)`.

**computing the inverse  $A^{-1}$  of matrix  $A$  in Numpy** to calculate the previous inverse of matrix  $A$  in Numpy you can use `np.linalg.inv(A)`.

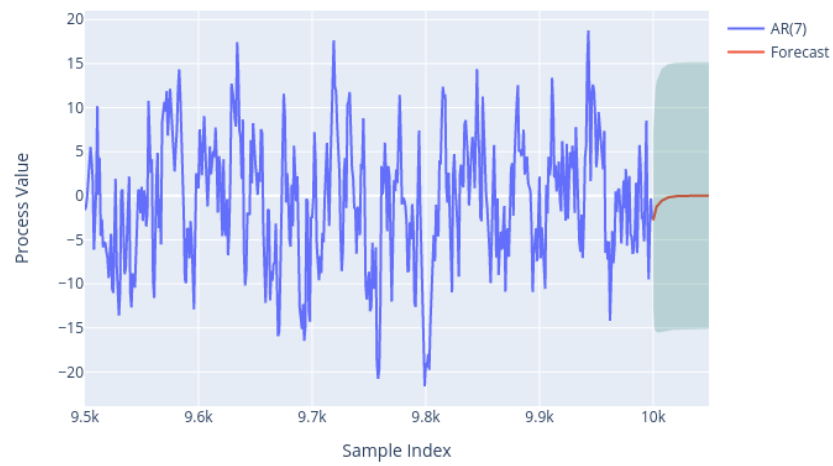


Figure 1: Forecasting result for an AR(7) model