Worksheet: temporal time series analysis (part II)

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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

    $$\phi = [5.0/6, -1.0/6, 0.5/6, -0.25/6, 0.5/6, -0.1/6, 0.05/6]$$
    $$\sigma = 5.0$$

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

    You many want to use the script plot_arForecastingYWCor and complete the code for the function forecast in the module tsAnalysisUtils.py.

    You should obtain 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 $A\mathbf{x} = \mathbf{b}$ **in Numpy** to estimate the vector $\mathbf{x}$ that best approximates the previous equations in Numpy you can use `x = np.linealg.solve(A, x)`.

    computing inner products $\mathbf{x}^\intercal\mathbf{y}$ **in Numpy** to calculate the previous inner product between vector $\mathbf{x}$ and $\mathbf{y}$ 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)`.
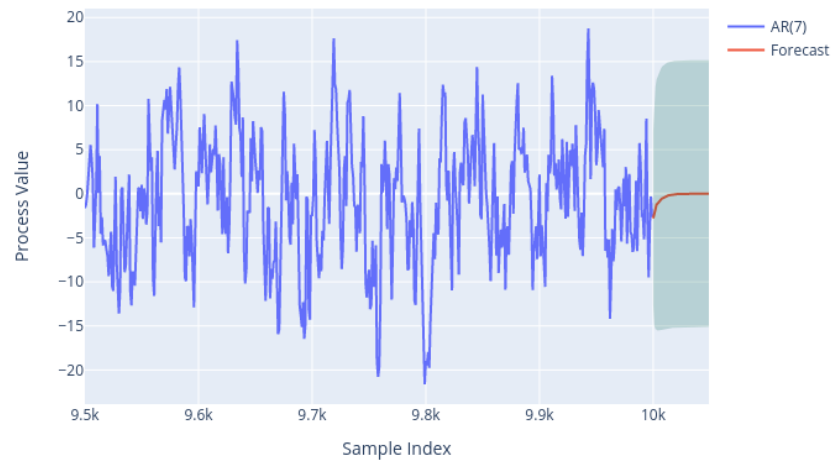
Figure 1: Forecasting result for an AR(7) model