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)* in lecture 2, 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.py and complete the code for the function forecast in the module tsAnalysisUtils.py.

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

   Show your completed function forecast.

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 plot_estimateCoefsAR3YW.py. To run this code, you will need to complete the function estimateCoefsAndNoisVarARpYW in the module tsAnalysisUtils.py, imported in the previous script. Show your completed function estimateCoefsAndNoisVarARpYW.

   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)`.

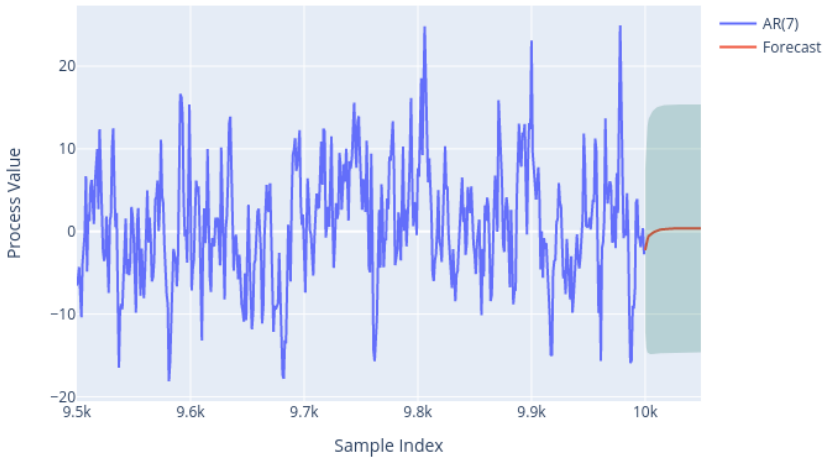

Figure 1: Forecasting result for an AR(7) model