

Time Series Analysis & Recurrent Neural Networks

lecturer: Daniel Durstewitz

tutors: Georgia Koppe, Manuel Brenner, Daniel Kramer, Leonard Bereska

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Exercise 2

To be uploaded before the exercise group on November 25th, 2020

Task 1. AR(p) models

Consider the univariate time series contained in file 'Tut2_file1.mat' (Tut2_file1.txt):

1. Estimate the coefficients $\{a_0, a_1\}$ of an AR(1) process from this series using linear regression. Why do you obtain this specific value for a_1 and how does it relate to the properties of the time series?
2. Detrend the time series by performing linear regression on time (see last exercise sheet) and repeat the analysis above. How does the coefficient (and the AR process) change?
3. Generate predictions from your estimated AR(1) model up to five time steps ahead. How well do they agree with the true signal (averaged across the whole series)? What is the error for one-step ahead prediction as compared to five step ahead predictions?
4. Consider the univariate time series contained in file 'Tut2_file2.mat' (Tut2_file2.txt). Estimate the coefficients $\{a_0, a_1\}$ of an AR(1) process from this series as above, using linear regression. Is a linear time series model suitable for this type of signal? Plot the signal in various ways (refer back to last tutorial), and examine the autocorrelations in the residuals.

Task 2. Autocorrelation and partial autocorrelation.

The file 'Tut2_file3.mat' (Tut2_file3.txt) contains two time-series (termed x_{AR} and x_{MA}) generated by an AR and a MA process, respectively. Determine the order of both processes by plotting the autocorrelation and the partial autocorrelation function of x_{AR} and x_{MA} [implement the functions yourself].