Time Series Analysis & Recurrent Neural Networks

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WS2019/2020

Exercise 2

To be uploaded before the exercise group on November 6th, 2019

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) 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 expected error variation for one-step ahead 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].