

Signal Analysis

Lab 6: Convolution and the Moving-Average Filter

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Due: Nov 13, Group A - 10:00am, Group B - 2.00pm

- 1) Write a code that performs the convolution of two real-valued sequences in the time domain.
- 2) The moving-average filter is a simple approach to remove noise and short-term fluctuations from data which replaces each sample in a sequence by the average of the sample at n and its $N - 1$ predecessors. A causal moving average filtering operation is given by

$$y[n] = \frac{1}{N} \sum_{k=0}^{N-1} x[n - k],$$

where $x[n]$ is the input sequence. What is the impulse response of this filter? Plot it.

- 3) The file *Lab6_t_T.csv* contains the temperature of Waterville, WA, USA recorded over several years. The 1st column is date in YYYYMMDD format, the 2nd column is the maximum temperature, and the 3rd column is the minimum temperature. Non-existent values are represented by -9999 and all values are given in tenths of °C. Remove seasonal variations from the data and plot it, both for the maximum and minimum temperatures.
- 4) Is there a delay introduced by the above filter? If yes, how can you design a filter that avoids introducing the delay in the processed signal? Plot the impulse response of this new filter. Apply this filter on the data and plot the results.