SF2702 Wavelets

Homework nr 3

Handed out October 5, 2009
To be handed in October 19, 2009

Begin building your own wavelet routines in Matlab

1. Make shure you have wavelet filterering and reconstruction in Homework nr 2 done correctly, also that you have coefficients in Daubeshies orthogonal wavelet filter of length 4. (it is not one uniqe solution - but orthonormality conditions of the filters and the 0th an and the 1st vanishing moment condition on the highpass fillter has to be satisfied

2. Make an own directory in your computer: "mywavelets" for storing Matlab routines where you can store some Matlab files created in this project: "command.m" files and "data.mat" files.

3. SUGGESTIONS (or do it your own way):

4. Create a matlab function periodize():

$$[a_per] = \text{periodize}(a, N)$$

   which periodize a colomn vector a in periods of length N where N is a positiv integer and a_{per} is the resulting periodic vector

5. Create a matlab function LHfilter();

$$[L, H] = \text{LHfilter}(a, h, g)$$

   where a is a coloumn vector of data of even length, and h and g are colomn vector of the lowpass resp. highpass filters. The resulting lowpass vector L and highpass array H sould both be colomn vectors both of half the length of the length of a.

6. Create a matlab function wavelettree:

$$[S, D] = \text{wavelettree}(a, g, h)$$

   where S and D are matlab cellstructures $S\{k\}$ containing the lowpass wavelet coefficients on level k and $D\{k\}$ containing the highpass wavelet coefficients on level k

7. Make the invers routine reconstruction the original data from th coefficients in Daubeshies orthogonal wavelet filter of length 4.

(a) We assume your original is of length 2^N and we have the structure $D = D\{1\}, D\{2\}, \ldots, D\{M\}$ of wavelet coefficients and the matrix $S_M = S\{N_0\}$ of scaling function coeffisients where $1 \leq M \leq N$

(b) Create a matlab function:

$$[data] = \text{wavl\_rec}(D, S_M, h, g, M)$$

8. Test your wavelet filter and its inverse on a signal. Get a test signal from website

   http://www.math.kth.se/ janolov/SF2702/signals_1.mat

   use command: load signals_1.mat
   and you will find a signal called: x