EQ2330 – Image and Video Processing

Assignment 6

The following preparation assignment is to be solved before the next exercise session indicated by the due date of the assignment. You bring your solution to the exercise session and one of your peers will correct it during that session. After that you will discuss the correction with your peers and resolve any open questions. If necessary, the teaching assistant can help you. It is required to solve all the assignments and correct at least one peer solution of each assignment in order to pass the course.

Problem

Consider the multiresolution processing of an image with the Haar wavelet.

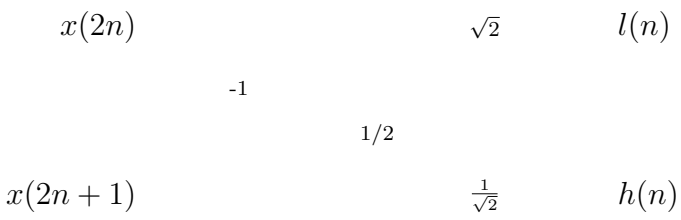

Figure 1: Lifting implementation of the Haar wavelet.

Preparatory question: Draw the system such that Fig.1 represents the lifting implementation of the Haar wavelet.

Coefficients of the lifting implementation of the Haar wavelet for the columns of the image are given in Figure 1, Make sure, in your drawing that triangles denote multiplication, x a column, l are the low-band samples and h are the high-band samples.

(a) Is the resulting multiresolution representation critically sampled? Explain your answer.

(b) Derive the two wavelet basis vectors from the lifting implementation of the analysis filters as given in Figure 1.

(c) Show that this is an orthonormal wavelet.

(d) Construct the synthesis filters that allow for perfect reconstruction.
Hint: Use the advantage of the lifting implementation.

(e) Is the Haar wavelet biorthogonal? Explain your answer.