National Institute of Technology Rourkela

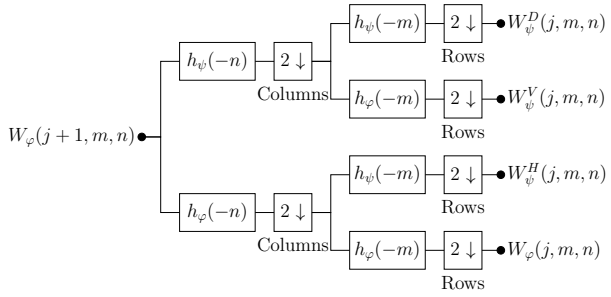
Department of Computer Science & Engineering

Lab Assignments, 2019

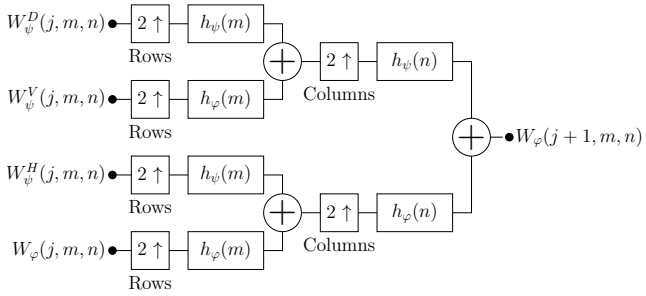
Subject: **Image Processing LAB** Subject Code: **CS-673**

Assignments 10

1. The basic element of the fast wavelet transform is a one-dimensional two-band filter bank, which is applied to each row and column of the image, as shown in the figure below:



The input (highest resolution) image is $W_\varphi(j+1,m,n)$ and the result consists of four "images", each of which is one-fourth the size of the original. The output labeled $W_\varphi(j,m,n)$ looks like a down-sampled version of the original. For each additional stage of decomposition a similar decomposition is applied to the signal $W_\varphi(j,m,n)$; a third stage would apply the decomposition to $W_\varphi(j-1,m,n)$, and so on. The inverse transform reverses the process as shown in the next figure.



The filter $h_\varphi[n]$, which generates the scaling function, is an FIR lowpass filter; the filter $h_\psi[n]$, which generates the wavelet terms is a highpass. For exact reconstruction the filters must satisfy the relationship

$$h_\psi[n] = (-1)^n h_\varphi[n]$$

The filters that correspond to the Haar wavelet are simple two-point filters defined by

$$h_\varphi[n] = \begin{cases} 0.7071068, & n = 0 \\ 0.7071068, & n = 1 \\ 0, & \textbf{otherwise} \end{cases}$$

Write a program to compute a one-stage decomposition of CAMERAMAN image that image using the Haar wavelet and use the decomposed components to reconstruct the original image. Find the MSE with respect to original image.