Lab: Wavelet Transform

Please go to http://www4.comp.polyu.edu.hk/~cslzhang/comp5422/wt downloading the Matlab files and images.

1. 1D Haar wavelet transform

Run Wavelet_1d.m and see all the experimental results.

Haar1d.m: decompose 1d signal using Haar wavelet

Haar1r.m: reconstruct 1d signal using Haar wavelet

Wavelet_1d.m: a demo program to decompose and reconstruct a 1d signal using the Haar wavelet at multiple scales.

After wavelet decomposition, we can obtain WT (wavelet transform) approximation coefficients and WT detail coefficients. Fig.1 shows the original signal; Fig.2 shows the approximation coefficients and detail coefficients at scale 1; Fig.3 shows those coefficients at scale 2; and Fig.4 shows those coefficients at scale 3.

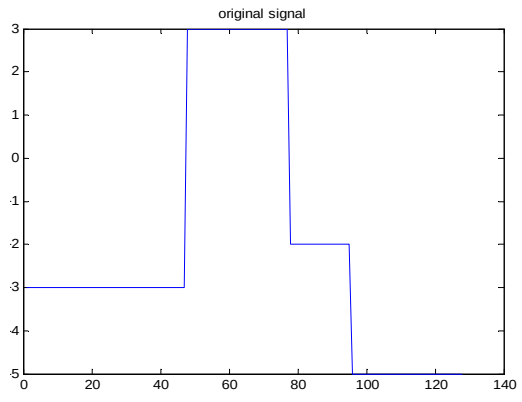

Fig.1 Original signal

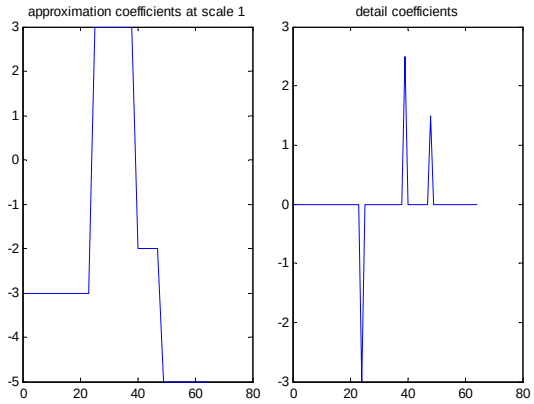

Fig.2 Decomposition at scale 1

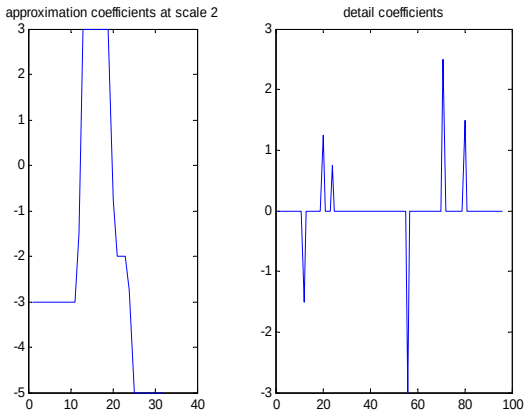

Fig.3 Decomposition at scale 2

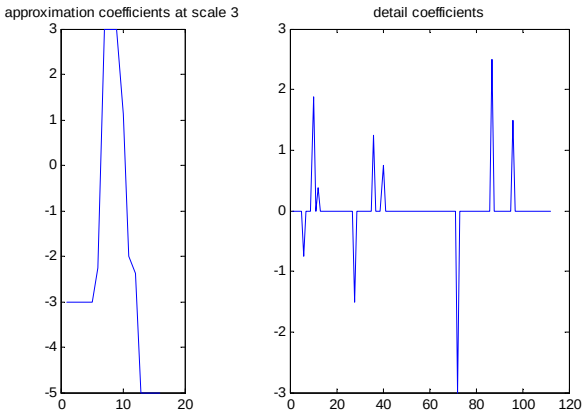

Fig.4 Decomposition at scale 3

With the decomposed wavelet coefficients as input, we can reconstruct the original signal scale by scale. Fig.5 shows the reconstructed signal at scale 2. Fig.6 shows the reconstructed signal at scale 1. Fig.7 shows the reconstructed original signal. Fig.8 shows the reconstruction error. We see that the reconstruction error is 0, which means that the original signal is perfectly reconstructed.

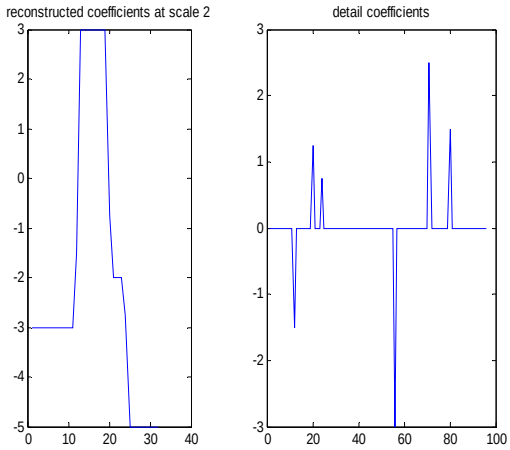

Fig.5 Reconstructed coefficients at scale 2

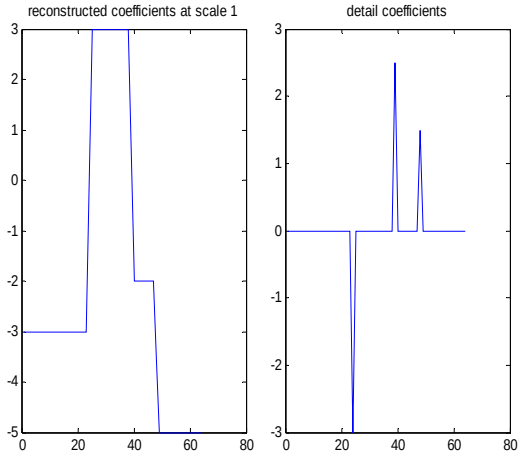

Fig.6 Reconstructed coefficients at scale 1

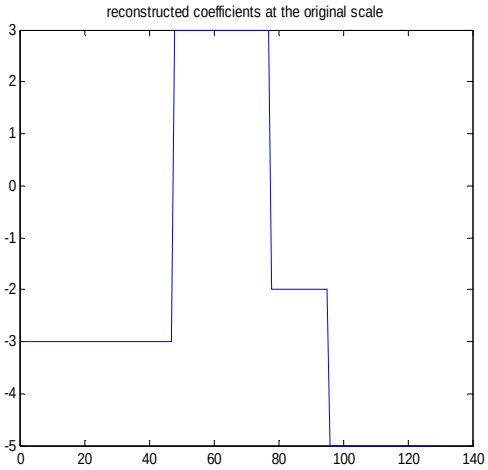

Fig.7 Reconstructed original signal

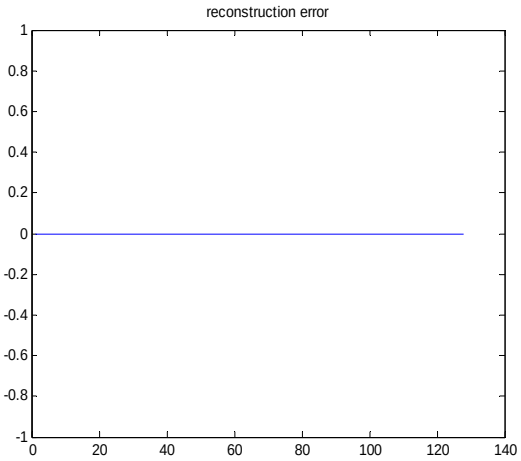

Fig.8 Reconstruction error

2. 2D Haar wavelet transform

Run Wavelet_2d.m and see all the experimental results.

Haar2d.m: decompose 2d image

Haar2r.m: reconstruct 2d image

Wavelet_2d.m: a demo to decompose and reconstruct a 2d image using the Haar wavelet. Fig.1 shows the original image. Fig.2 shows the approximation coefficients and detail coefficients at scale 1. Fig.3 shows approximation coefficients and detail coefficients at scale 2. Fig.4 shows approximation coefficients and detail coefficients at scale 3.

Fig.1 Original image

Fig.2 Decomposition at scale 1

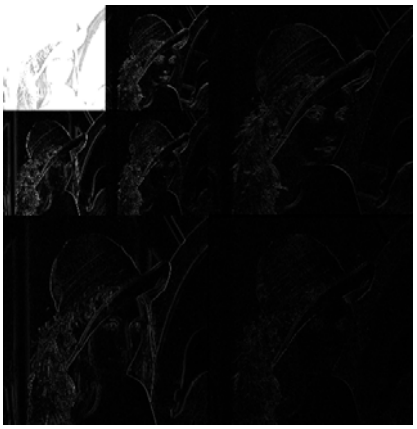

Fig.3 Decomposition at scale 2

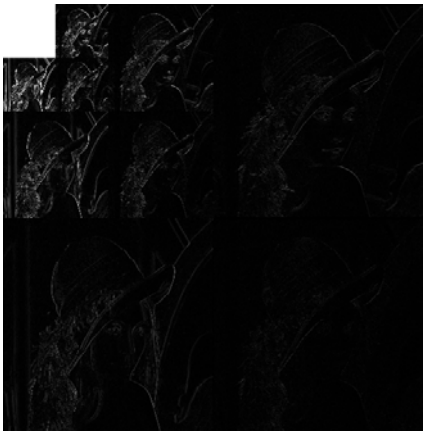

Fig.4 Decomposition at scale 3

We can reconstruct the original image with the 2D WT coefficients. Fig.5 shows the reconstructed coefficients at scale 2. Fig.6 shows the reconstructed coefficients at scale 1. Fig.7 shows the reconstructed image. Fig.8 shows the reconstruction error. Actually, all the coefficients in the reconstruction error are 0, which means that the original image is perfectly reconstructed.

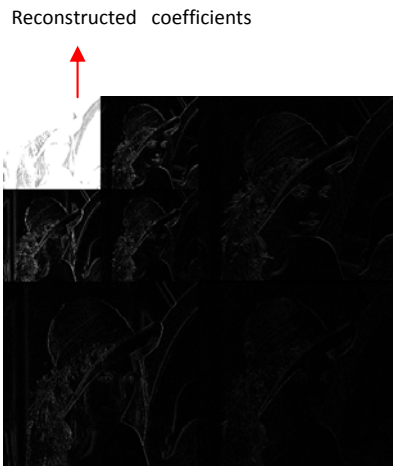

Fig.5 Reconstructed coefficients at scale 2

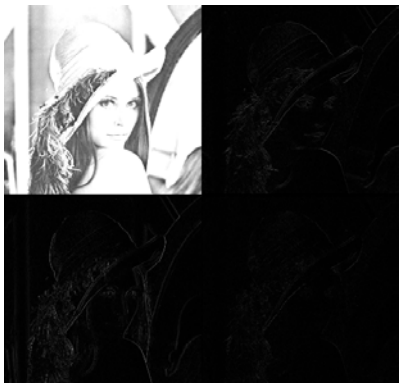

Fig.6 Reconstructed coefficients at scale 1

Fig.7 Reconstructed image

Fig.8 Reconstruction error