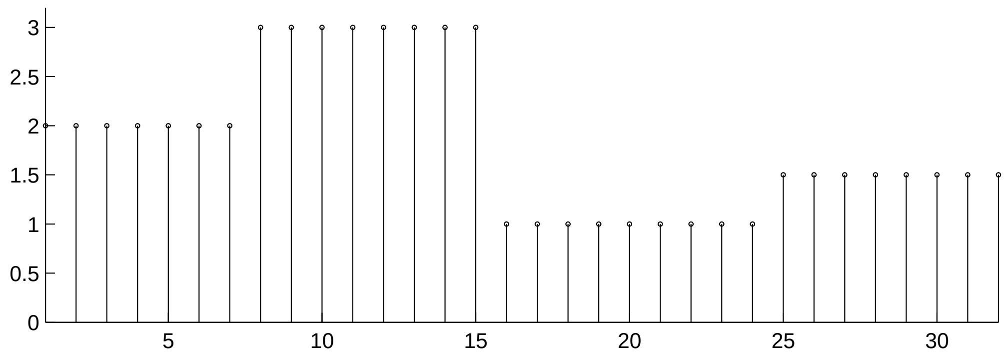
EHB372E Week 10

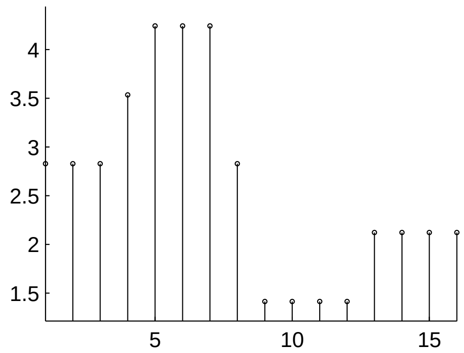
Haar Wavelet Transform

1D Haar Wavelet Transform

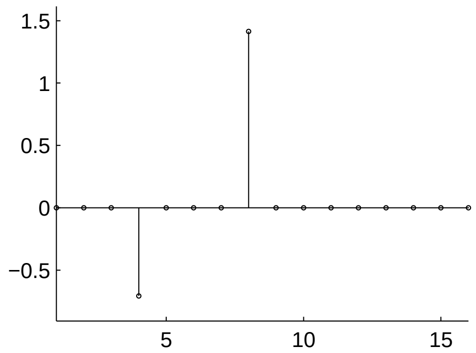
Consider a piecewise constant input signal



Applying the Haar FB, we obtain,



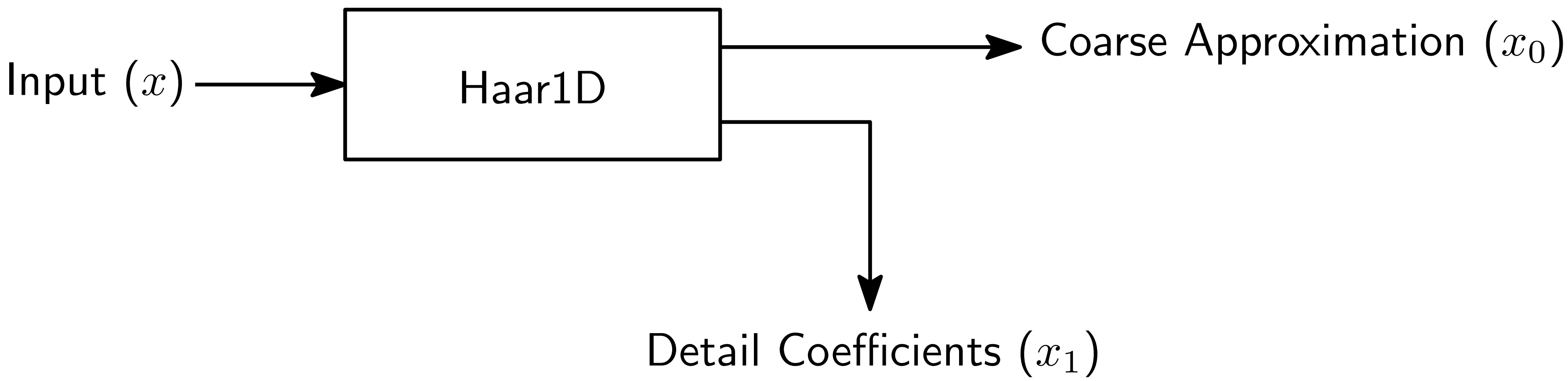
Coarse Approximation



Detail Coefficients

- The coarse approximation is also piecewise constant.
- The detail coefficients are mostly zero.

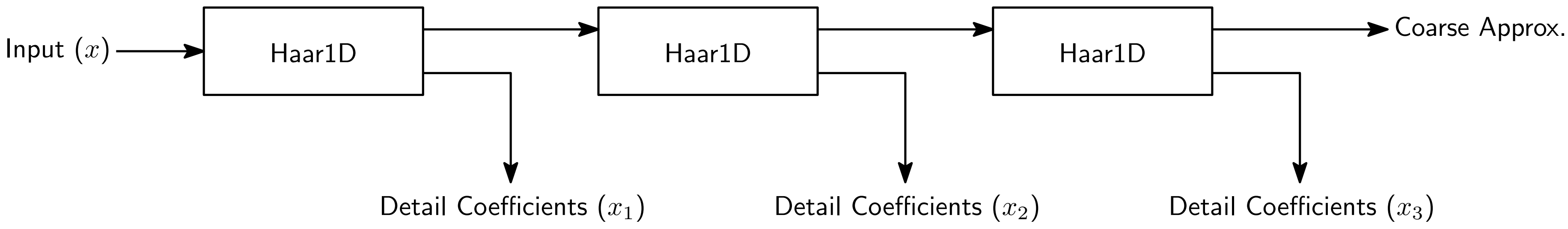
1D Haar Filter Bank



1. The coarse approximation is also piecewise constant.
2. The detail coefficients are mostly zero.

- The idea in multiresolution representations is to iterate on the coarse approximation to obtain sparse detail coefficients.
- For Haar DWT, this makes sense when the input can be well approximated by a piecewise constant function.

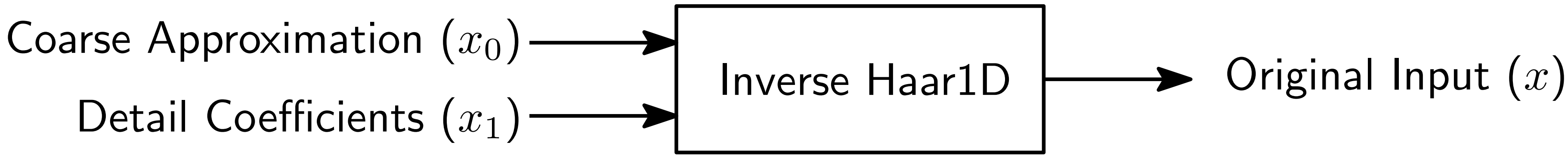
1D Haar Discrete Wavelet Transform



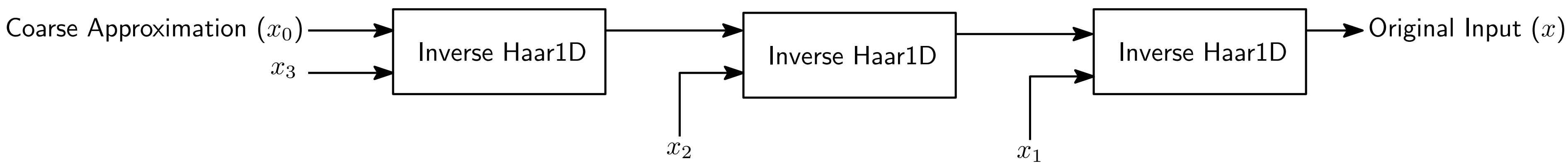
- The idea in multiresolution representations is to iterate on the coarse approximation to obtain sparse detail coefficients.
- For Haar DWT, this makes sense when the input can be well approximated by a piecewise constant function.

1D Inverse Haar Filter Bank/DWT

The Inverse Haar Filter Bank



The Inverse Haar Discrete Wavelet Transform



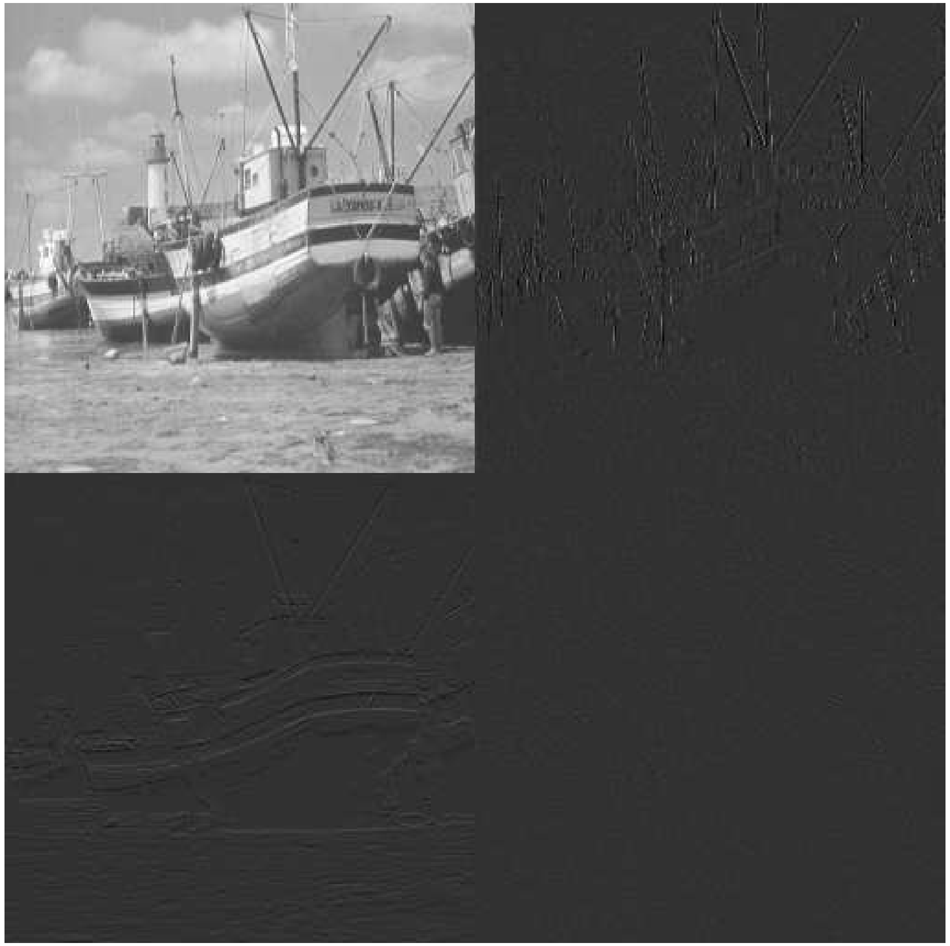
2D Haar Wavelet Transform

Input Image

2D Haar Wavelet Transform

Apply 1D Haar Wavelet Transform along the rows

2D Haar Wavelet Transform

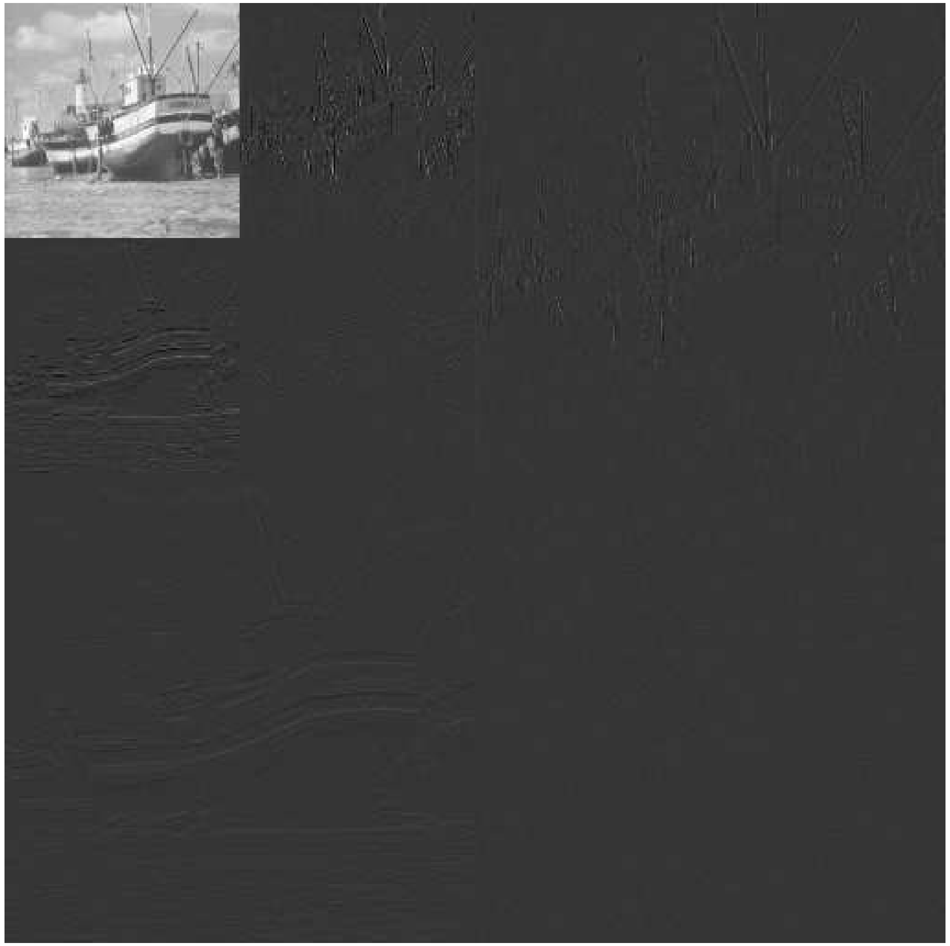


Then, apply 1D Haar Wavelet Transform along the columns

2D Haar Wavelet Transform

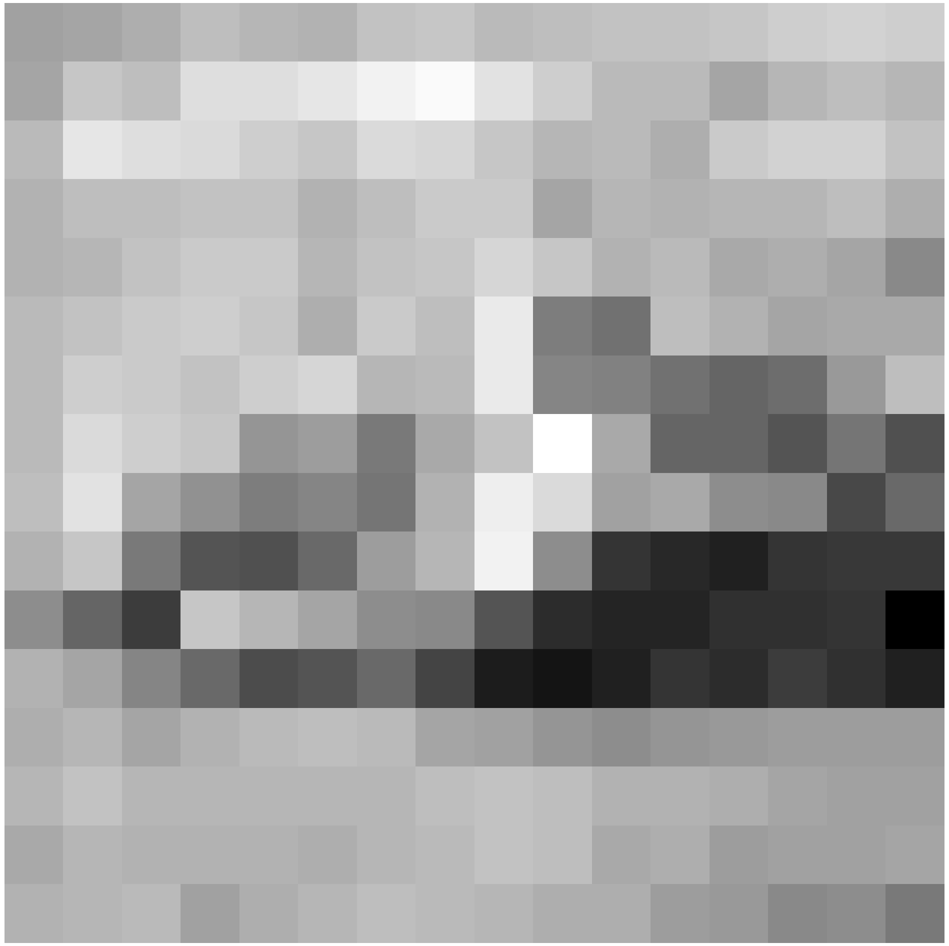
Iterate on the coarse image...

2D Haar Wavelet Transform



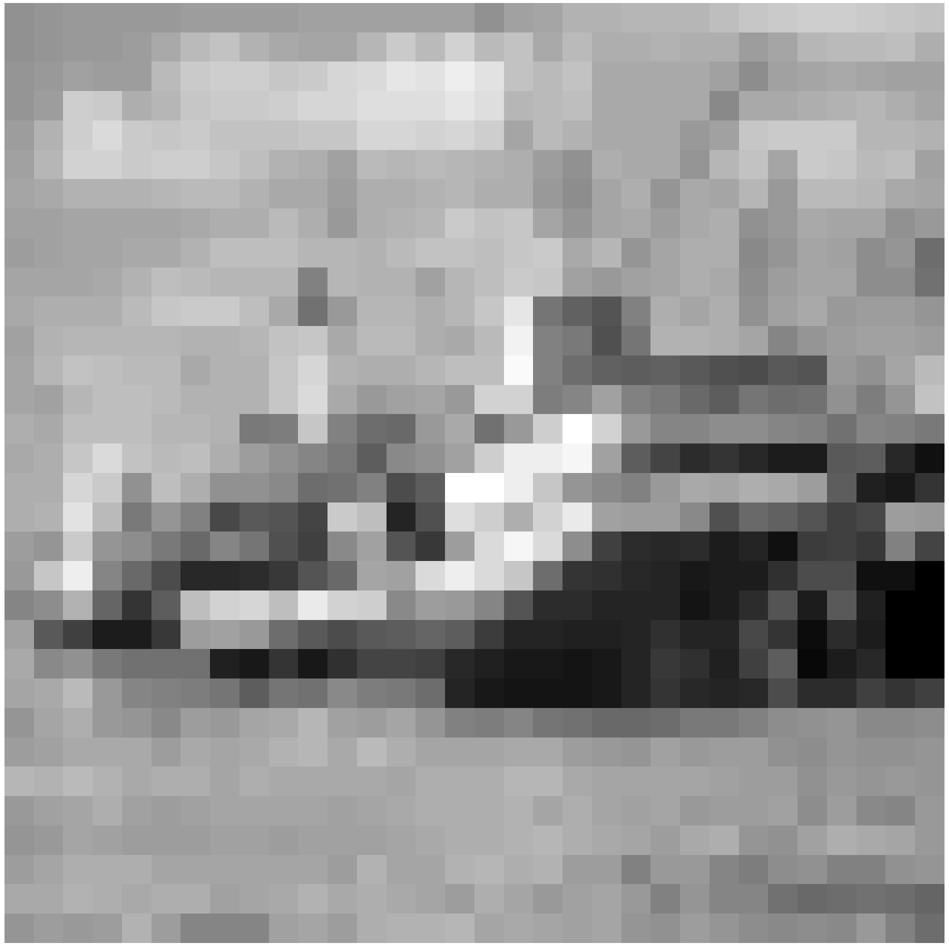
Iterate on the coarse image...

2D Haar Wavelet Transform



Approximation at Level-5 (Projection to V_0)

2D Haar Wavelet Transform



Approximation at Level-4 (Projection to V_1)

2D Haar Wavelet Transform

Approximation at Level-3 (Projection to V_2)

2D Haar Wavelet Transform

Approximation at Level-2 (Projection to V_3)

2D Haar Wavelet Transform

Approximation at Level-1 (Projection to V_4)

2D Haar Wavelet Transform

Original Image (which we assumed was in V_5)