Assignment 23 Report
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Sub-band filtering:

Sub band filtering is a good method for decomposing a source image and reducing the redundancy for compression and using the decomposed components to reconstruct the source image. Thus, it is an efficient method to use wavelets for compression or reducing the redundancy.

As per the class lecture presentation slide the whole reconstruction can be summed up in below flow-model.

Decomposition: Using h0 and h1, we can decompose the image into Approximation image, verticle image component, horizontal image component, diagonal image component. Which can later be fed for reconstruction for the original image.

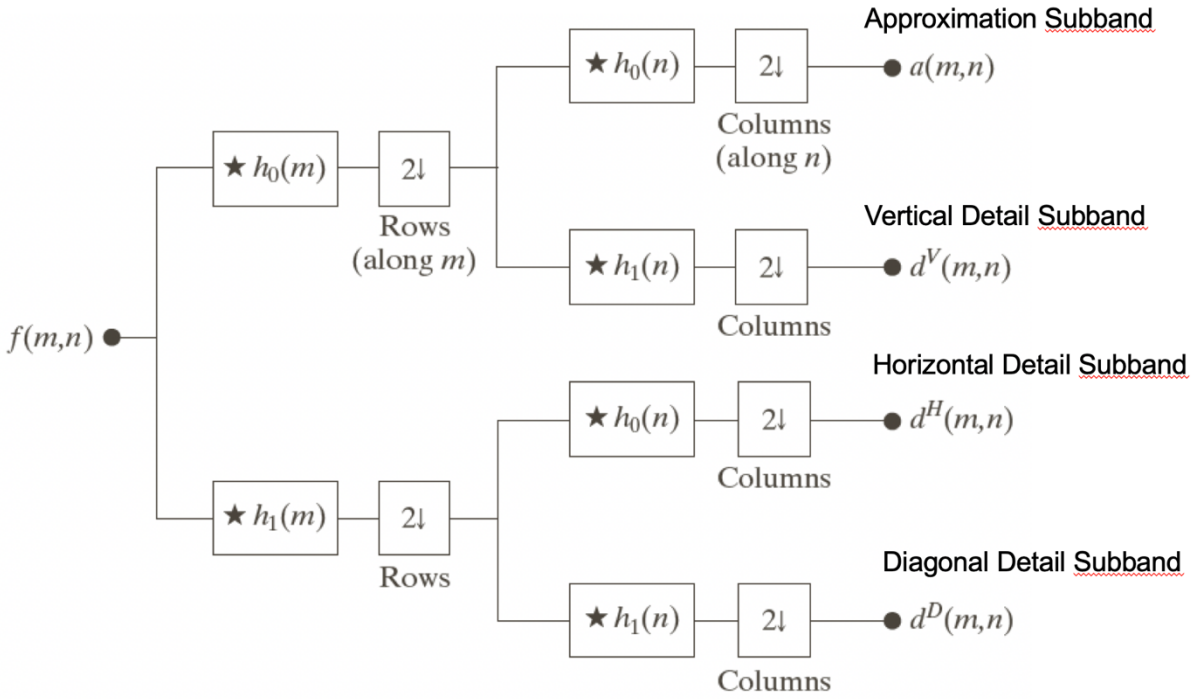

*Figure 1: Decomposition of biorthogonal wavelets (Source: Class lecture presentation) [512*512 -> 256*256]*

For 512*512 -> 256*256 -> 128*128, we can cascade the whole operation back for another layer and then can get the decomposed image components for 128*128.

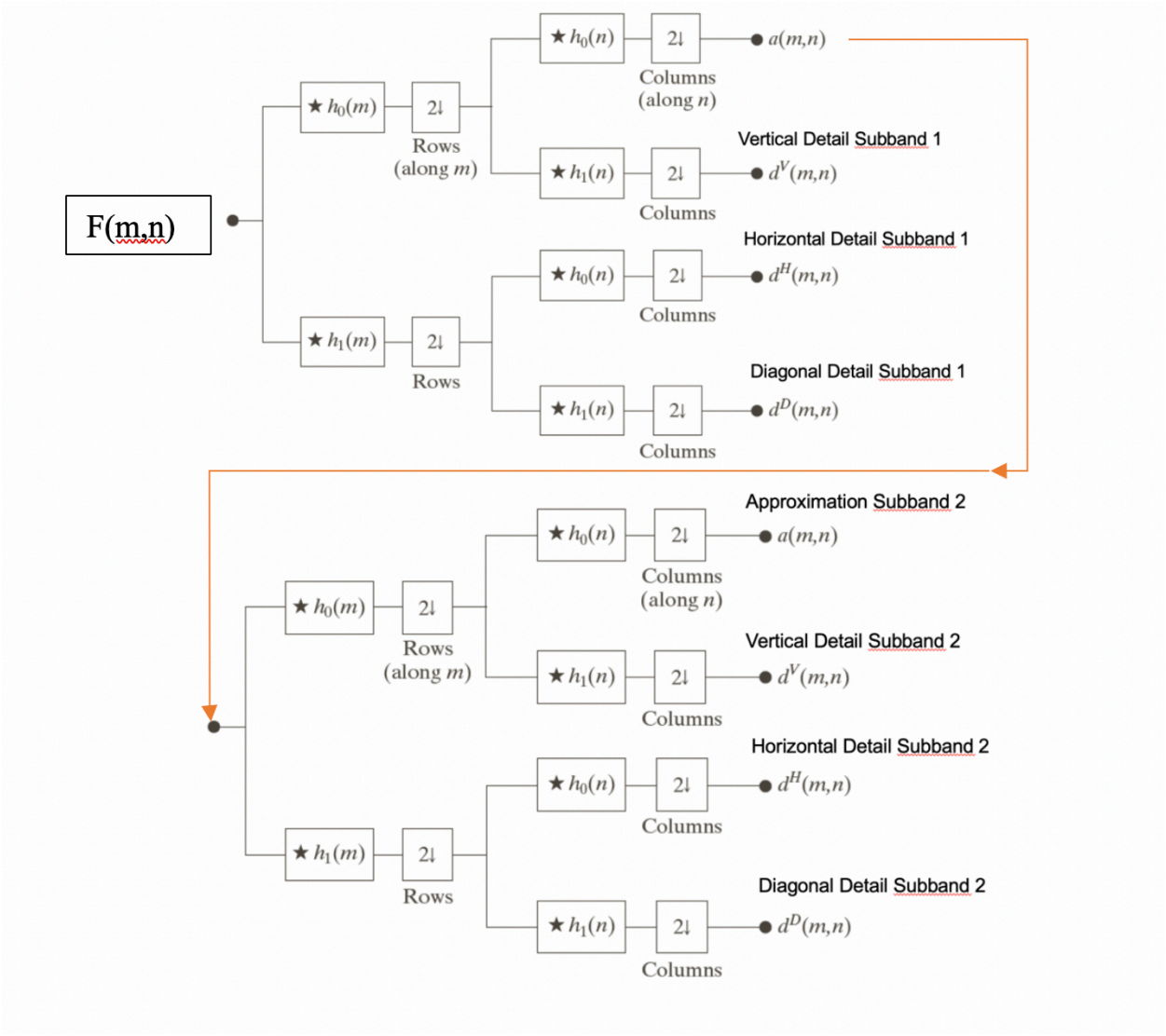

*Figure 2: a typical decomposition example for 512*512 -> 128*128 components*

Reconstruction

- To implement the reconstruction you have to do this:

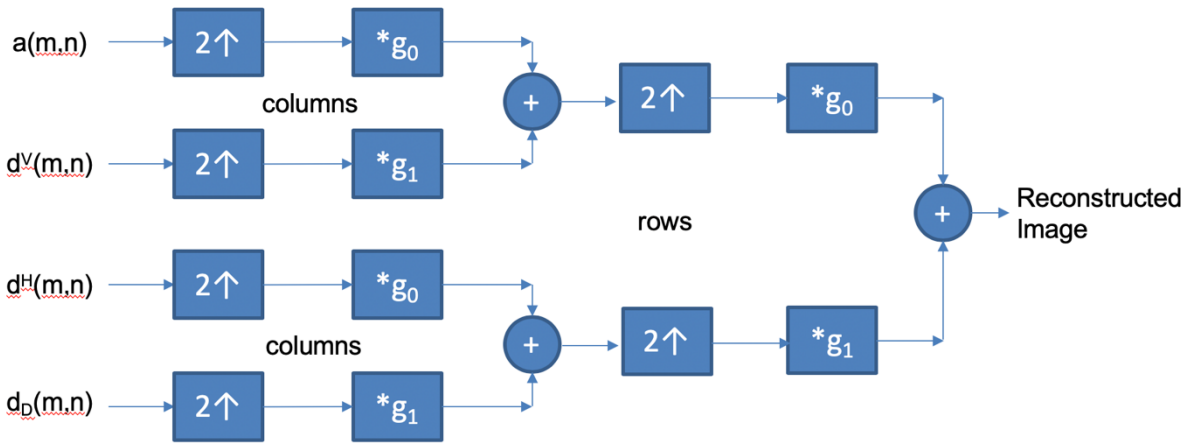

*Figure 3: reconstruction model (Source: Class lecture presentation) [256*256-> 512*512]*

Reconstruction of 128*128 image component to 512*512 image reconstruction:

For reconstruction of 512*512 the image components of 128*128 can be fed back to back in cascaded structure so that we can get our reconstructed image back.

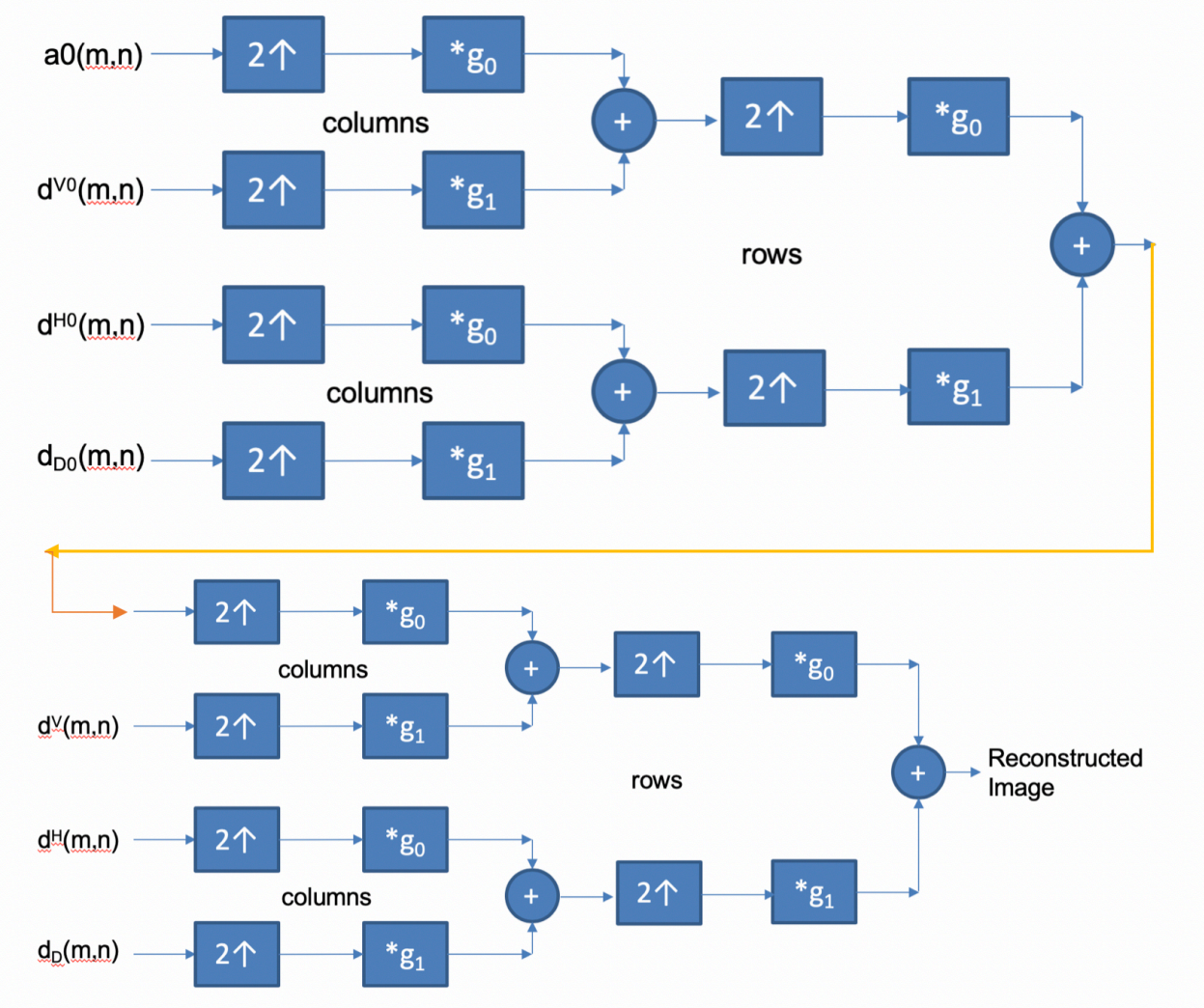

*Figure 4: a typical reconstruction example for 128*128-> 512*512 components*

Using Daubechies 4 wavelet filter :

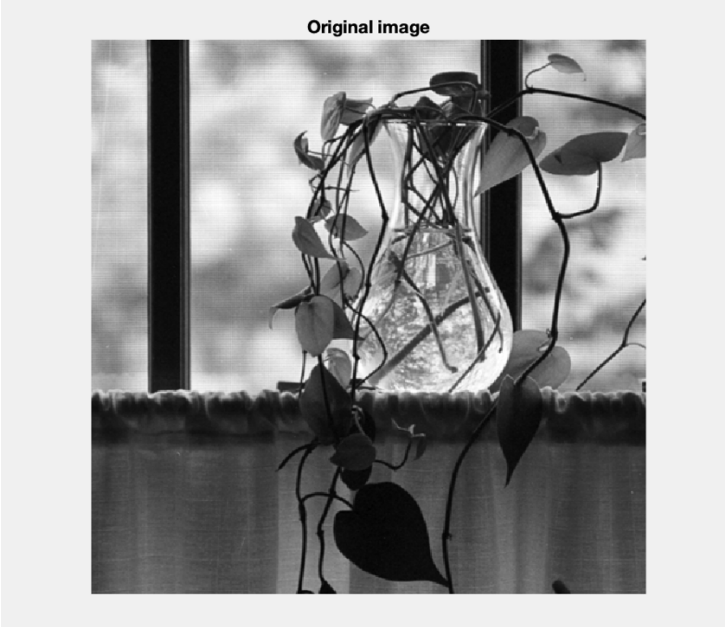

Figure 5: Original image

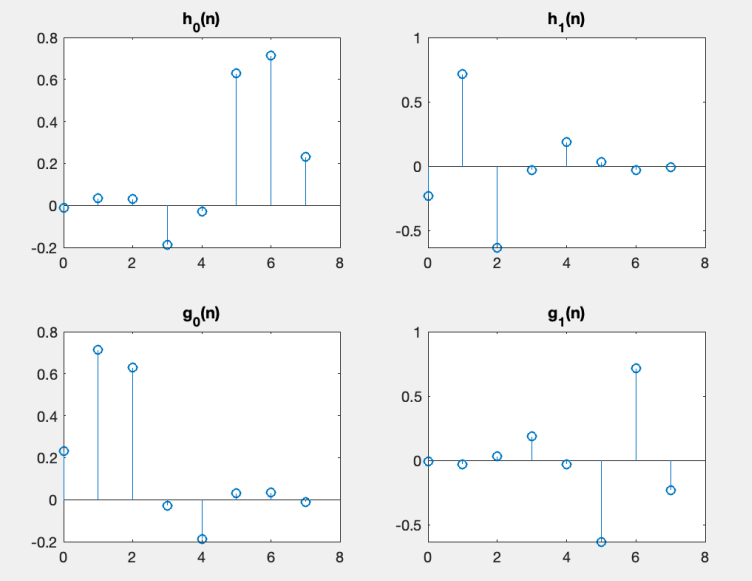

Figure 6: filter weights h0, h1 for decomposition and g0, g1 for reconstruction

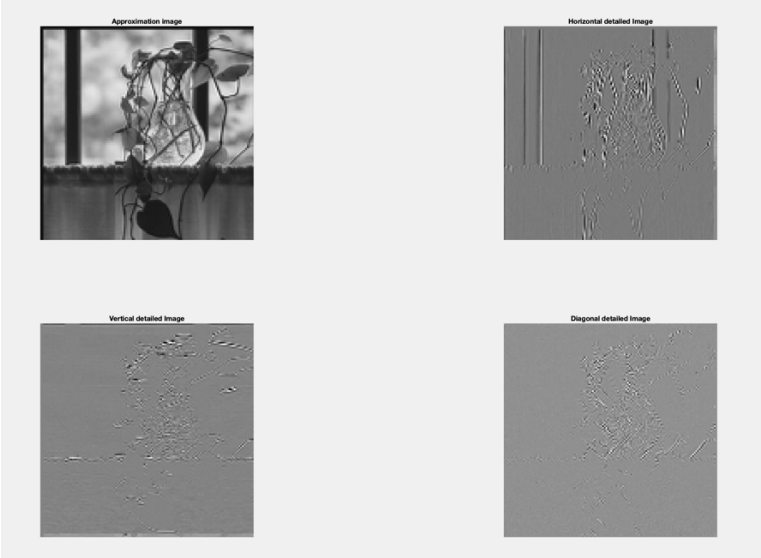

Figure 7: decomposed image components

Figure 8: reconstructed image using decomposed image components

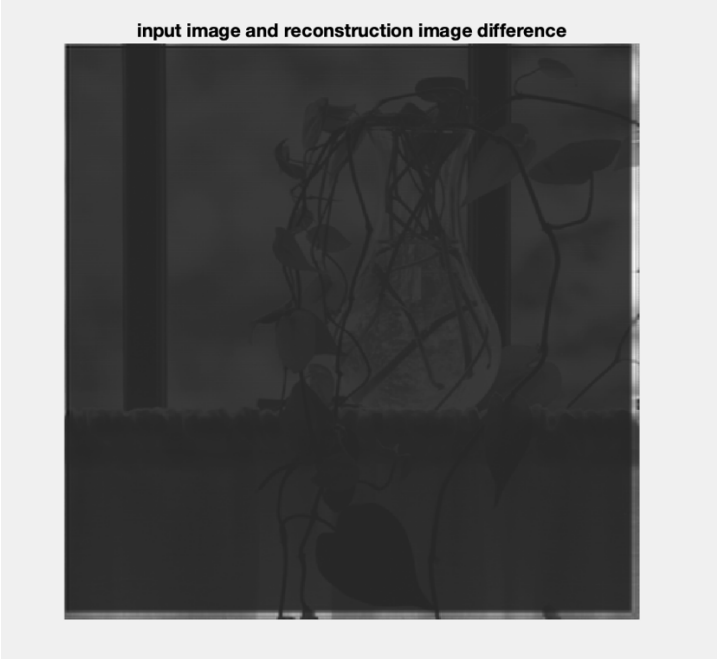

Figure 9: Difference between original and reconstructed image

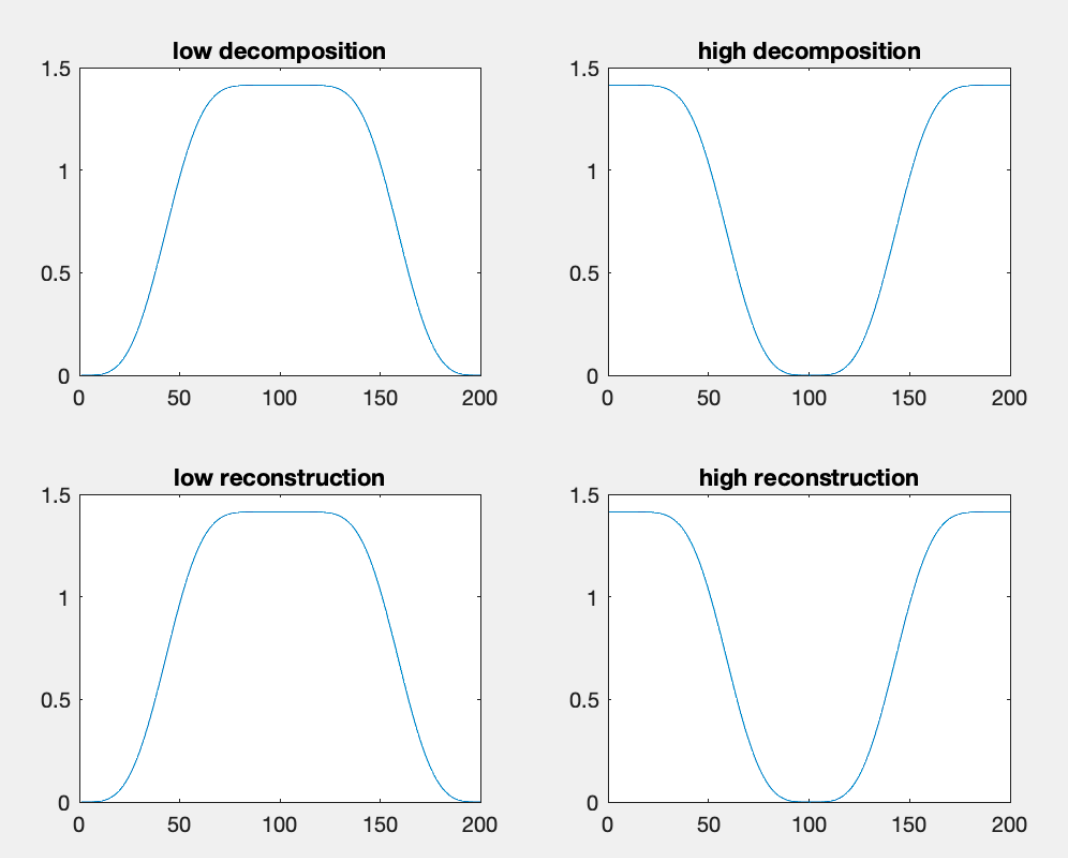

Figure 10: Filters associated with image for DB4 wavelet filter

Using Haar filter:

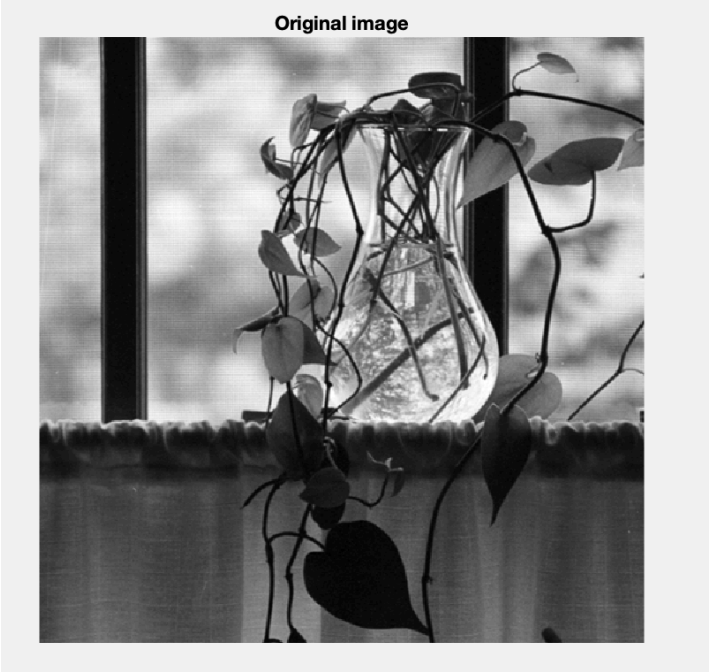

Figure 11: Original image

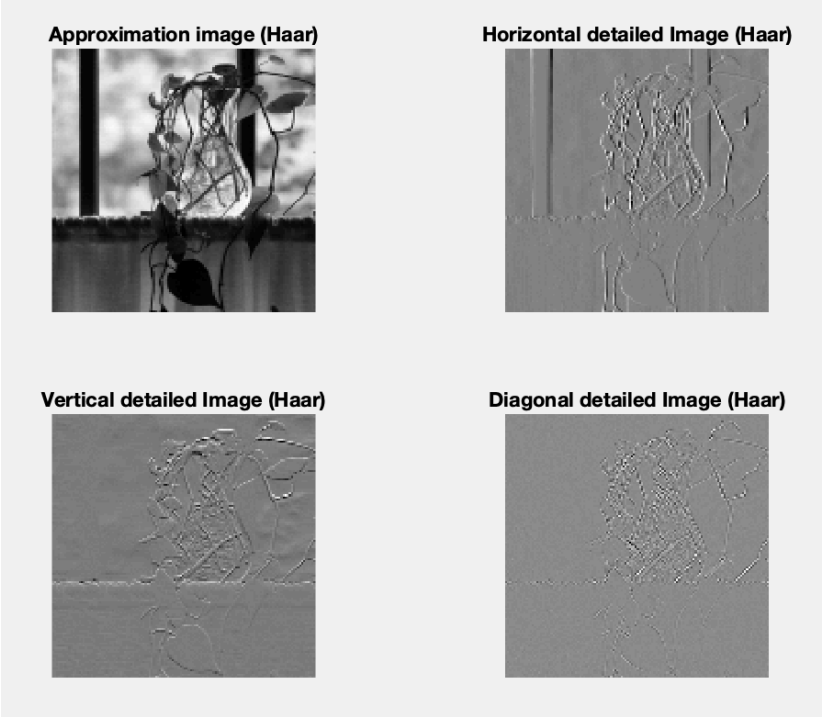

Figure 12:decomposed image components

Figure 13:reconstructed image using decomposed image components

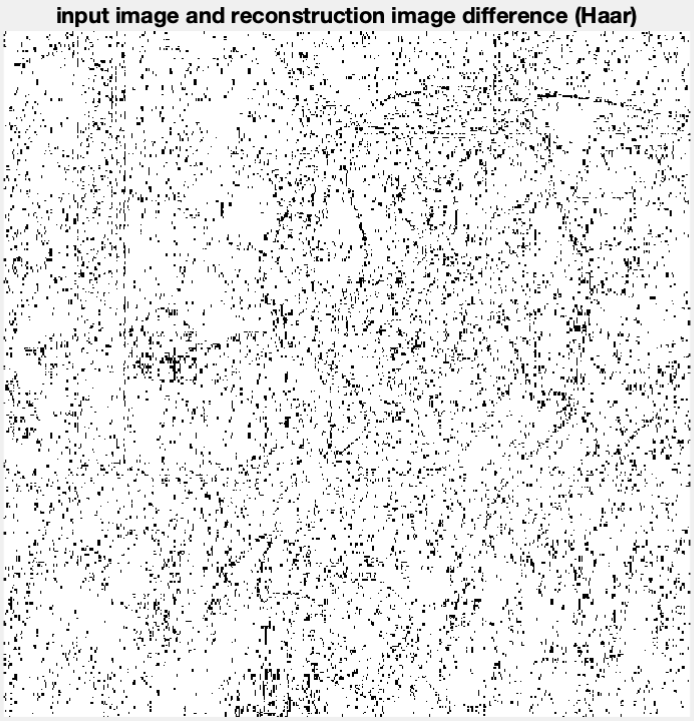

Figure 14: Difference between original and reconstructed image

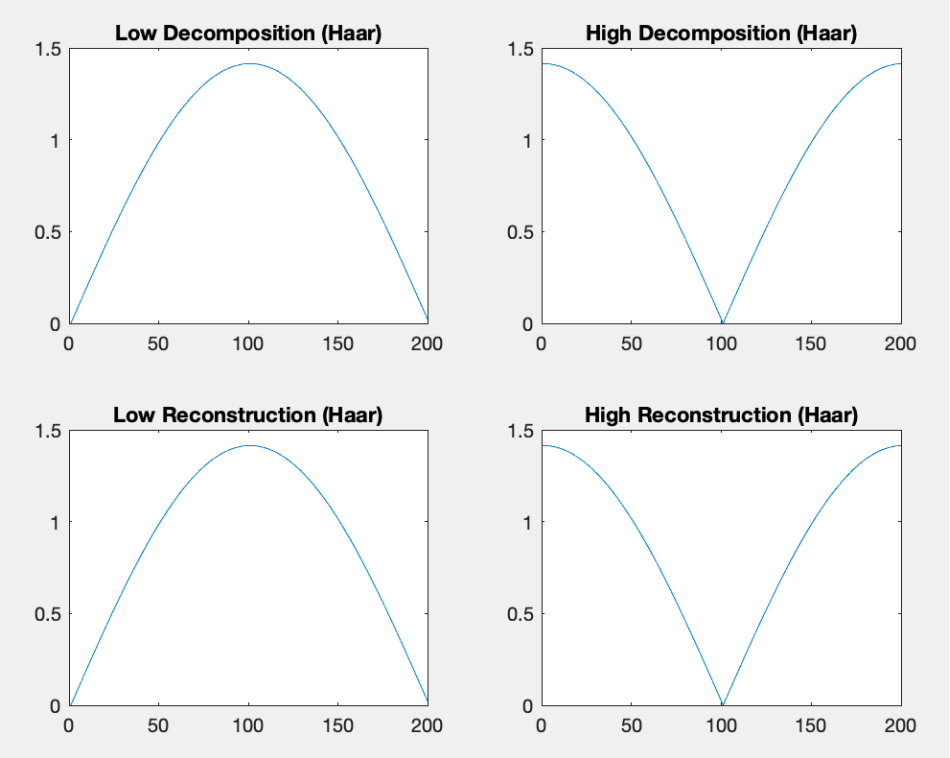

Figure 15: Filters associated with image for Haar wavelet filter

```
ans =

    '---------SSIM output of Regenerated image (512*512->128*128->512*512) and original-------------------------'


ans =

    'SSIM Output result for DB4 filter between Regenerated image and Original Image = 92.2495%'


ans =

    '---------SSIM output of Regenerated image (512*512->128*128->512*512) and original-------------------------'


ans =

    'SSIM Output result for Haar filter between Regenerated image and Original Image = 99.7954%'
```

Conclusion:

We can see that both the wavelet filters can decompose an image properly and can reconstruct it really well. when 512*512 image is decomposed in to 128*128 and reconstructed back to 512*512 image, In case of DB4 wavelet filter the reconstructed image has **92.24%** similarity than the Haar filter's **99.75%.**

Through this report we can understand the whole operations really well and underlying concept really well.