

Digital Circuits Lab Project

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Image Compression using 2D DWT

Introduction

Image compression is done using 2D discrete wavelet transform (DWT). DWT is one of the matrix based image transforms used for time frequency localization. DWT finds wide variety of applications like JPEG image compression, noise removal etc... It can be implemented simply using Haar wavelet basis function. The input image in 2D matrix form is first processed row wise and then processed column wise to obtain four subbands each corresponding to different image features. One of the subbands contains the compressed version of the input image.

The input image is first preprocessed using MATLAB and Python to convert the image into pixels and arrange them in the block format. Then the implementation is done in HDL and obtained the result hex file for postprocessing in MATLAB and Python.

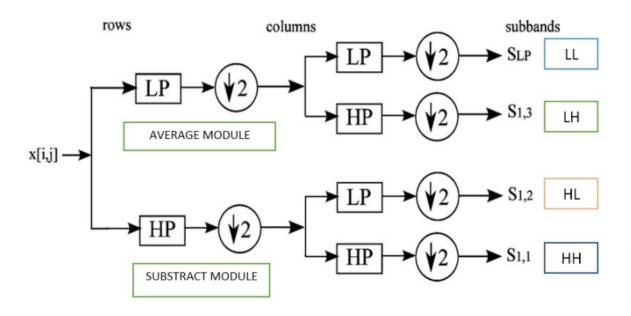
DWT using Haar wavelet basis function can be simply implemented using two approaches. The two implementation techniques are completely different from each other. They are

- Matrix based implementation
- Filter bank implementation

Matrix based approach requires more hardware and is more expensive while filter bank approach uses basic logic elements and a simpler approach compared to matrix based approach.

Filter bank implementation requires the following modules to implement DWT

- Averaging module (acts as low pass filter to obtain the smoothening coefficients)
- Subtraction module (acts as high pass filter to obtain the detailing coefficients)
- 1D wavelet module (for row wise processing)
- 2D wavelet module (for column wise processing)
- 2D DWT module (integration of all sub modules to form the final filter bank architecture)



Filter Bank Architecture

Weekly Milestones

- 1st Week
 - 1. Image Preprocessing
 - 2. HDL Implementation of Averaging and Subtraction module
 - 3. Implementation of 1D wavelet and 2D wavelet module

• 2nd Week

- 1. Implementation of DWT module and Modelsim Simulation
- 2. Separation of Image sub-bands and Postprocessing
- 3. Using Platform Designer and its testing

• 3rd Week

- 1. Using Platform Designer and its testing
- 2. Implementation on Xen10 FPGA board and Docklight terminal
- 3. Image quality analysis and documentation

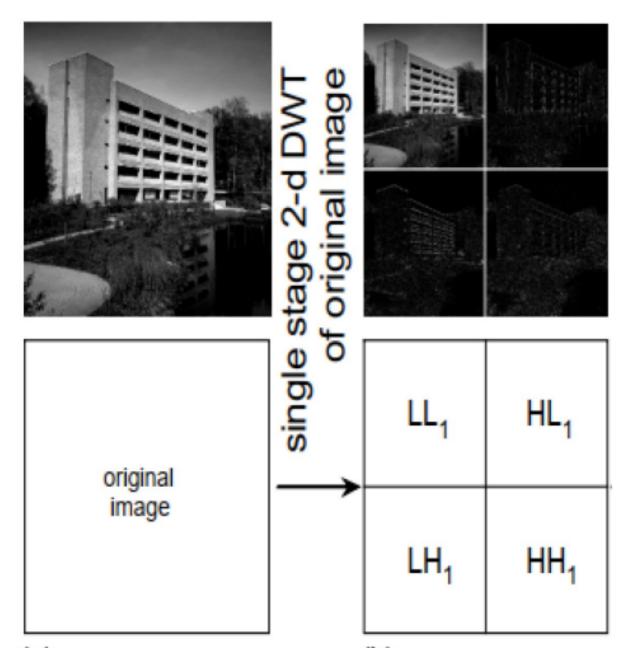


Image Compression

References

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