ES 203: DIGITAL SYSTEMS

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Problem Statement

To verify the authenticity of one's digital watermarked property.

Project Description

Digital watermarking is an important branch of information hiding technology. First, we will read the image. Then, the process of embedding the watermark on the input image will be carried out. The reversible image watermarking algorithm based on discrete cosine transformation uses the DCT algorithm to embed the watermark. The watermarked image is added with filters that will tamper the originally obtained watermarked image. Finally, the filtered watermark is extracted and compared in terms of whether it is tampered or not using Structural Similarity Index Measure (SSIM).

Week One

Task: Reading and writing the input image

Breakdown:

1. To read the .bmp image in Verilog, the image must be converted from the .bmp format to the .txt format.
2. Read the .txt file and save the image data into an array.
3. Write the image data that is read to the original bitmap image for verification.

*The same process will read watermarks that have to be embedded.

Week Two

Task: Embedding the watermark onto the image

Breakdown:

1. Read the hexadecimal data of the grayscale image and binary watermark into arrays X and Y respectively.
2. The Direct Cosine Transformation (DCT) algorithm is applied to the array X. The resulting data is written into an array 'image_dct.'
3. Add each pixel value of array Y to the corresponding values in the image_dct array, thereby creating the 'embed' array.
4. The Inverse Direct Cosine Transformation (IDCT) algorithm is applied to the 'embed' array. The output array is written into a text file and converted to a bitmap image thereby obtaining the watermarked image.

Week Three

Task: Filtering the watermarked image and comparing it with the unfiltered one.

Breakdown:

1. Add Gaussian Filter to the watermarked image. (Image A)
2. Compare the watermarked image with the enhanced image A using PSNR.

Week Four

Task: Extraction of noised watermark; Comparing it with the original watermark.

Breakdown:

1. Extraction is the opposite process of embedding. Extract the noised watermark using the opposite method.
2. Build a Verilog module to calculate the Mean Squared Error (MSE) and Structural Similarity Index (SSIM) of the original watermark with respect to the noised one.

Overview