

Digital Watermarking

Course Project : ES203 Digital Systems

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Problem Statement

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

Abstract

Watermarks often reflect the identity of one's property. However, the practice of manipulating visible watermarks and claiming illegal rights over others' property has been incessant over years. To get over this, a majority have chosen to embed invisible watermarks. Nonetheless, if not manipulation, watermark tampering persisted. For the owners to keep up with consumer harmony, it becomes essential for them to verify the authenticity of their product's watermark.

Our project aims to recognize if the embedded watermark is tampered or if its originality is preserved.

Introduction

The digital watermarking technology uses the digital embedding method to hide the watermarking information into the digital products. The current algorithm uses DCT to embed and extract the watermark to verify the authenticity of a digitally watermarked image. The process is carried out in four major steps:

1. Embedding of watermark onto the image.
2. Adding filter to the watermarked image (Tampering of Image).
3. Extraction of watermark from the watermarked image with and without tampering.
4. Using SSIM to verify whether the watermark is tampered or not.

Test Images



Original Image

Size : 64x64



Original Watermark

Size : 64x64

Test Images



Original Image

Size : 64x64



Original Watermark

Size : 64x64

What is Digital Watermarking?

Digital watermarking technology is used to alter the multimedia data by inserting watermark information into the host to protect the copyright data. The system uses the host image as an input and embeds the watermark image onto it with the help of the any embedding algorithm.

What is Discrete Cosine Transformation (DCT) ?

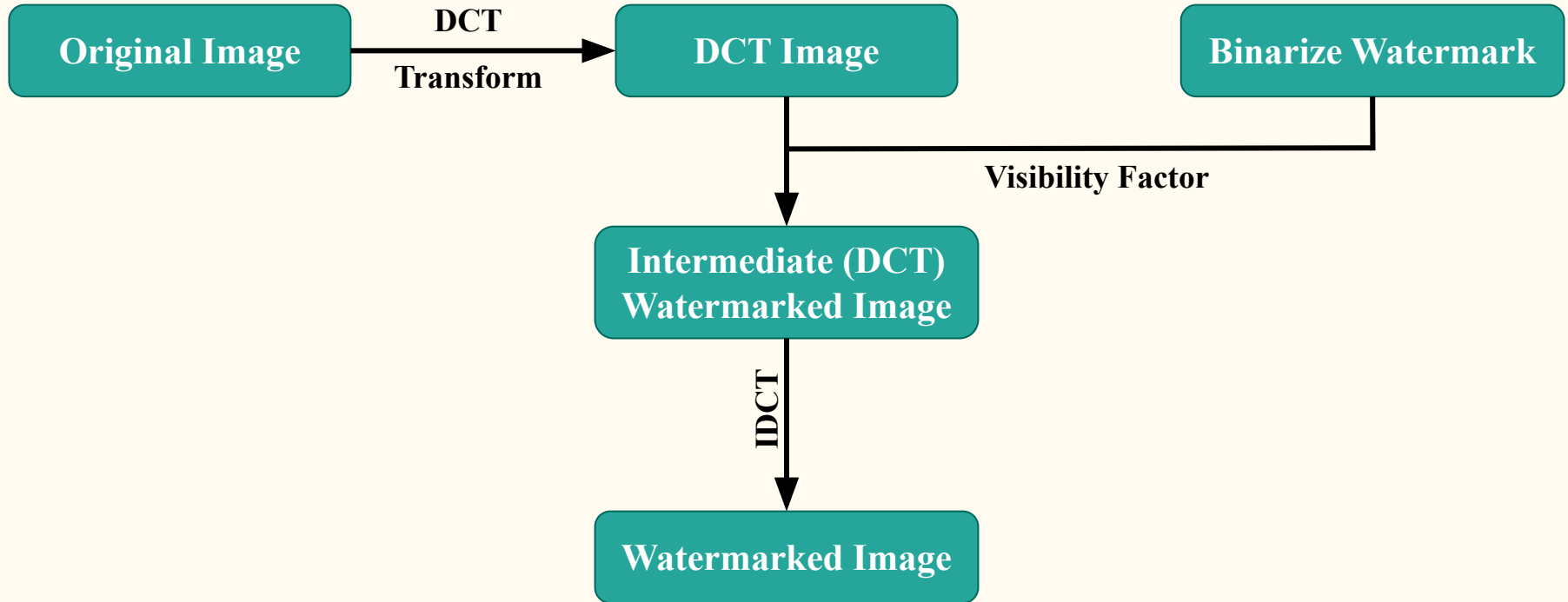
Discrete cosine transform expresses a finite sequence of pixel data values in terms of a sum of cos functions oscillating at various frequencies.

Watermarking using DCT is similar to spatial domain watermarking. Here, we alter the frequency coefficient instead of altering the image bit plane pixel LSB.

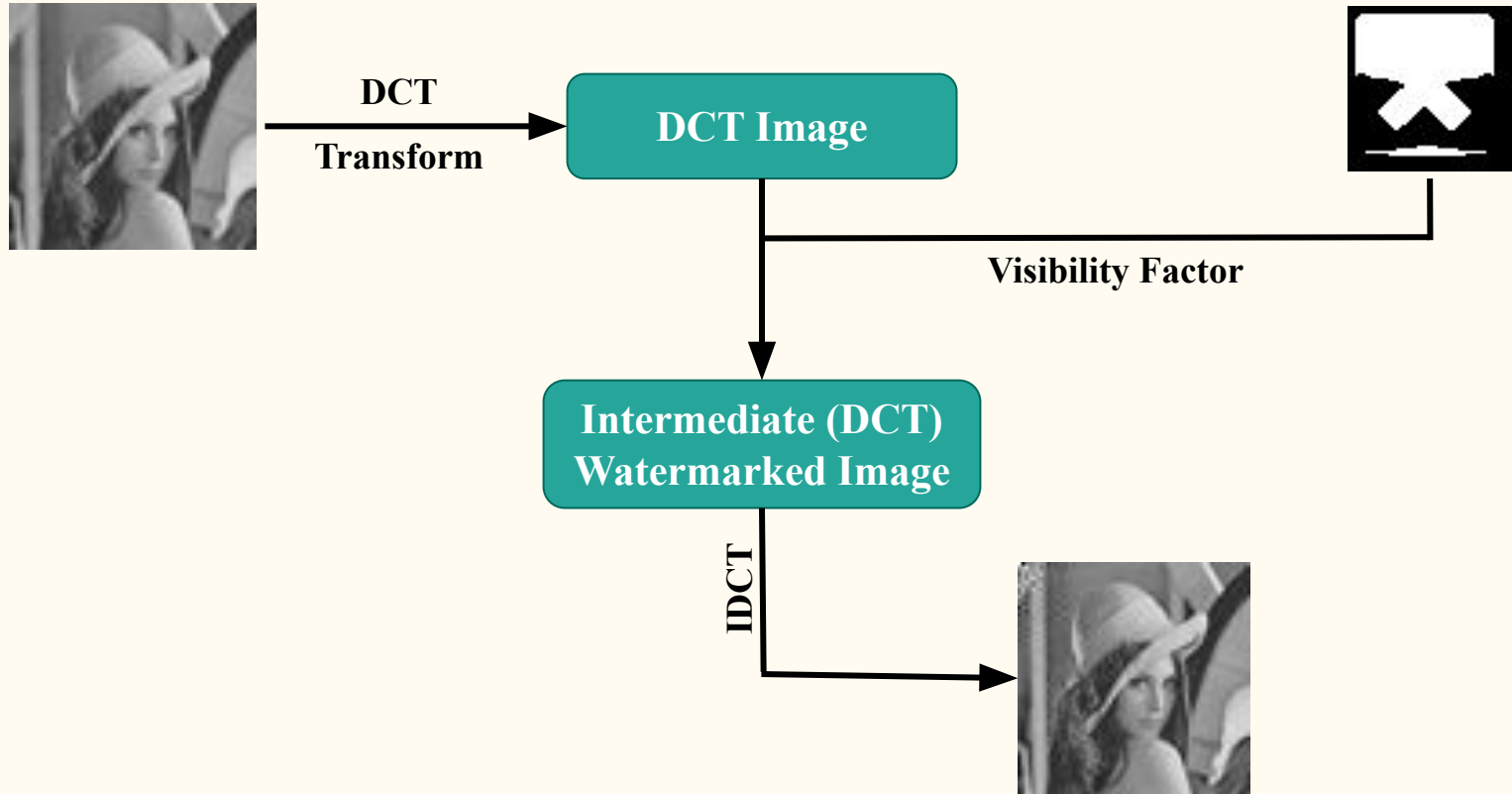
Why do we use DCT and IDCT for Digital Watermarking ?

DCT maps initial pixel values into frequency domain using cosine waveform. IDCT converts data in frequency domain to spatial domain. The frequency components of dynamic signals are used to reduce the storage size of digital image, reduce the timing of data transmission, and removal of unwanted information is carried out.

Embedding Flowchart



Embedding Flowchart



Process of Embedding

A watermark can be embedded to an image by using following steps :

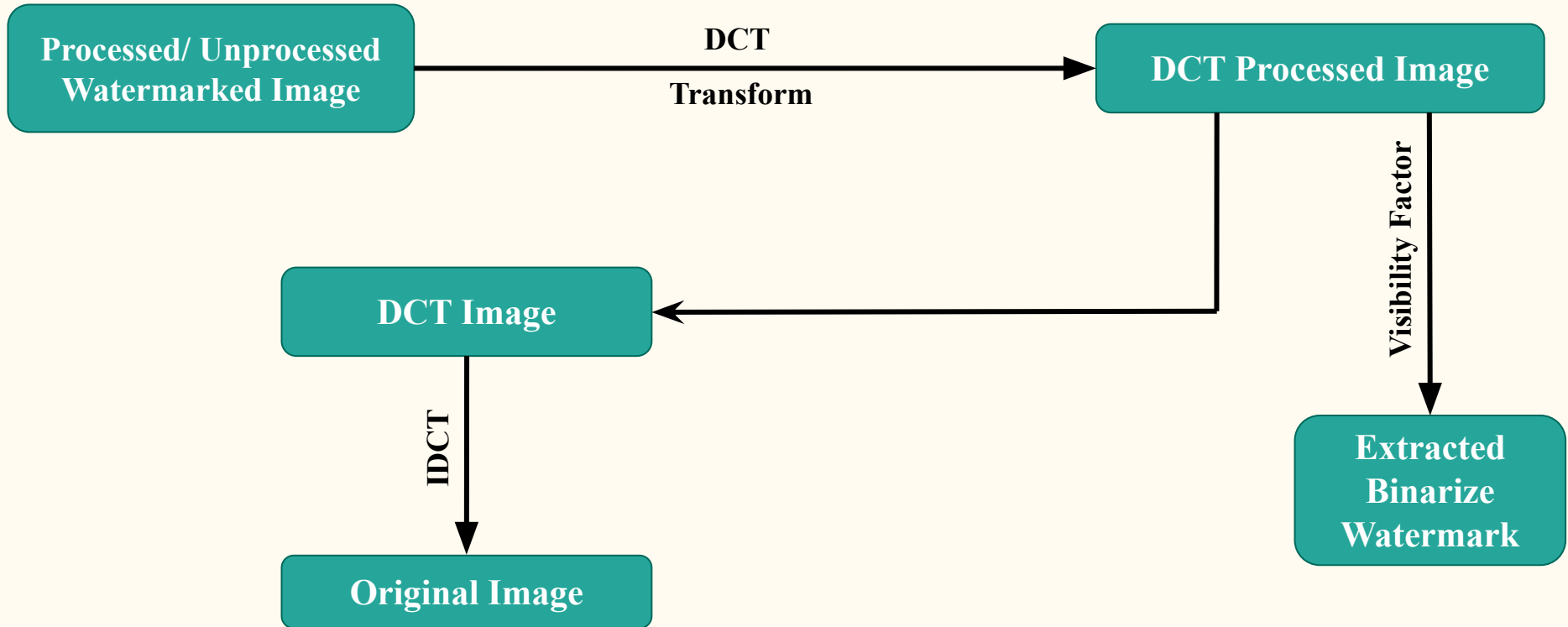
1. Apply DCT on text file of original Image.
 2. Multiply the pixels of binary watermark with visibility factor.
 3. Add the Arrays obtained in Step 1 and 2 and store data into Array_X.
 4. Apply IDCT on the Array_X.
 5. Convert it to image file.
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Filtering

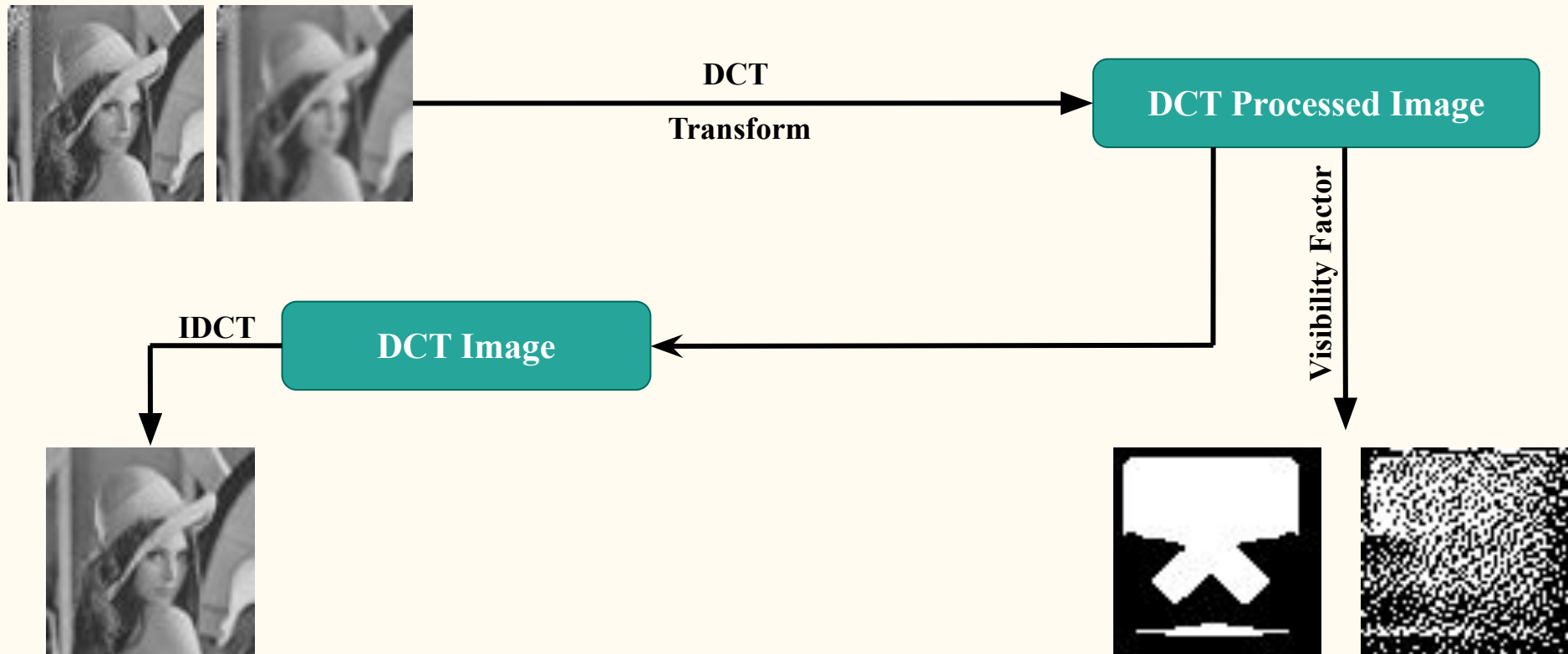
The filtering of an image can be done by using following steps :

1. Prepare a 2-D convolution operator.
 2. Prepare a kernel that represents the shape of a Gaussian hump.
 3. Apply the prepared gaussian mask to every 3x3 pixel matrix of the image.
 4. Resultant text file contains the pixel values of image with gaussian filter.
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Extraction Flowchart



Extraction Flowchart



Process of Extraction

The steps to extract a watermark from a watermarked image are given below :

1. Apply DCT on text file of watermarked Image.
 2. Subtract the array having DCT data of original image from the array obtained in step 1.
 3. Divide the result of previous step by visibility factor.
 4. The array obtained must contain the binary data of watermark.
 5. Convert it to image using MATLAB.
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