

# Digital Watermarking In Images

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## **Introduction:**

Embedding a hidden stream of bits in a file is called Digital Watermarking. The file could be an image, audio, video or text. Nowadays, digital watermarking has many applications such as broadcast monitoring, owner identification, proof of ownership, transaction tracking, content authentication, copy control, device control, and file reconstruction. The main specifications of a watermarking system are: Robustness (Against intentional attacks or unintentional ones such as compression), Imperceptibility, and Capacity. Importance of each depends on the application.

Watermark can be implemented on the images with three following techniques as following:

1. Watermarking in Spatial domain
2. Watermarking in Frequency domain
3. Watermarking in Hybrid domain

## **Watermarking in Spatial domain:**

We can divide pixels of any image(say Grayscale) into bits. The MSB bits contribute maximally to the image as seen in the image while having the least contribution from the LSB bits. We can use these LSB bits for watermarking. If your image is for example in gray scale, you can make changes to the value of the LSB without any perceptible distortion for the human user therefore you can think of taking the LSB of an image (the cover image) and change its value in every pixel with the MSB of another image, that we would like to embed in a secret/non perceptible way in the cover image).

## **Watermarking in Frequency domain:**

There are several transforms that brings an image into frequency domain. Most common among those are Discrete Cosines Transform (DCT) and Fast Fourier Transform. In frequency domain, coefficients are slightly modified. This will make some unnoticeable changes in the whole image and makes it more robust to attack compared to what we have in spatial methods.

## **Watermarking in Hybrid Domain:**

Watermarking in hybrid domain means modifying the image regarding both spatial and spectral specifications. One popular algorithm in this domain is performing the previous method in small blocks of the image.