

# Implementation of Quantization based Image Watermarking

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**Abstract** – Stealing of images happens rampantly in this world of internet, wherein the imagecreator always stands to lose. To try and curb this loss of intellectual property of, there are many schools of thought as to how and what methodology to adopt when watermarking an image. Here in this paper we propose the DWT method with absolute angle quantization index modulation (AAQIM) combined with an invisible watermark. This is quantization based watermarking.

**Keyword** – Discrete Wavelet Transform, Absolute Angle Quantization Transform, Watermarks.

## I. INTRODUCTION

The internet allows us to download data, images and videos freely. Due to this open environment, the problem arises regarding security and illegal distribution of images because of which financial as well as compromise of privacy issues arise. One solution to show the ownership of the images is watermarks'. Watermarking is a technique to insert information regarding the creator or owner of the image into the image. Watermarking should have following properties:

- “FREEWARE” software standard with essential certifications.
- The most important feature should be a fair degree of robustness against cracking or hacking.
- An invisible watermark should not be easily detectable.
- Only authorised person/user should be able to detect it with specialised tools and knowhow i.e. security is an essential part of watermarks.

## II. DISCRETE WAVELET TRANSFORM

DWT is widely used in many applications such as science, engineering, mathematics and computer science. The main advantage of DWT over other transforms is that 2D-DWT works in totality as compared to other transforms. The decomposition into sub bands gives higher flexibility in terms of scalability in resolution and distortion.

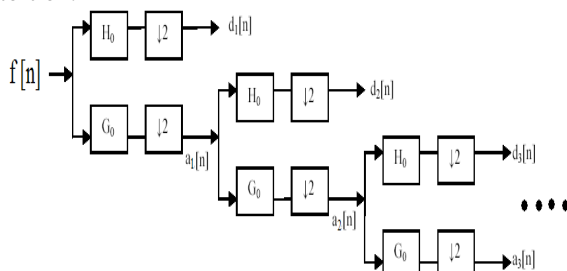


Fig.1. 2-D 4-band filter bank

The DWT involves two filters, a scaling filter or low pass filter and other a wavelet filter or high pass filter. Output of these two filters when combined is a filtering operation and sub sampling operation.

## III. ABSOLUTE ANGLE QUANTIZATION INDEX MODULATION

Angle quantization index modulation has advantages over Quantization index modulation. Quantization index modulation achieves high rate distortion robustness but it is fragile to amplitude scaling attacks. But AQIM angle has discontinuity problem. To solve this problem instead of quantizing the angle, its absolute value is quantized in the interval [ ] [0, ].[1] The absolute angle quantization function is defined as:

$$Q(|\theta|) = \begin{cases} 0, & \text{if } \lfloor \frac{|\theta|}{\Delta} \rfloor \text{ is even} \\ 1, & \text{if } \lfloor \frac{|\theta|}{\Delta} \rfloor \text{ is odd} \end{cases}$$

To calculate watermarked angle following rules are used:

$$|\theta^w| = \begin{cases} \lfloor \frac{|\theta|}{\Delta} \rfloor - \frac{\Delta}{2} & \text{if } Q(|\theta|) = w \\ \lfloor \frac{|\theta|}{\Delta} \rfloor + \frac{\Delta}{2} & \text{if } Q(|\theta|) \neq w \\ \text{and } \{ \lfloor \frac{|\theta|}{\Delta} \rfloor - \frac{\Delta}{2}, -\frac{\Delta}{2} \\ \text{Or } \lfloor \frac{|\theta|}{\Delta} \rfloor + \frac{\Delta}{2} \} \\ \lfloor \frac{|\theta|}{\Delta} \rfloor - \frac{\Delta}{2} & \text{if } Q(|\theta|) = w \text{ and} \\ \{ \frac{\Delta}{2}, \lfloor \frac{|\theta|}{\Delta} \rfloor - \frac{\Delta}{2} \text{ or } \lfloor \frac{|\theta|}{\Delta} \rfloor + \frac{\Delta}{2} \} \end{cases}$$

## IV. PROPOSED WATERMARK SYSTEM

There are two different approaches for watermarking [2]: spread spectrum (SS) based watermarking [3] [4] and quantization based watermarking. [5]-[7] SS based watermarking has less capacity of watermarking. Quantization based watermarking are fragile to amplitude scaling factor. It increases bit error rate (BER).

This paper proposes watermark using uniform quantization of the direction of the significant gradient vectors obtained at multiple wavelet scales. We use DWT to estimate gradient vectors at different scales. Absolute angle quantization index modulation is used to quantize gradient direction. Angle quantization index modulation is proposed because quantization index modulation is sensitive to additive white gaussian noise, uniform distribution noise and JPEG compression.

As shown in fig (2) Partition the gradient field into non-overlapping blocks. Arrange one watermark bit for one block which is found by DWT coefficients. The bit is inserted into the most significant gradient. But there are two problems which arise which are summarised as given :

- The bits which have no significant vectors are less robust to attacks.

b) Most significant vectors in some blocks have nearly equal magnitudes.

The solution to the above mentioned problems is same as proposed in [2].

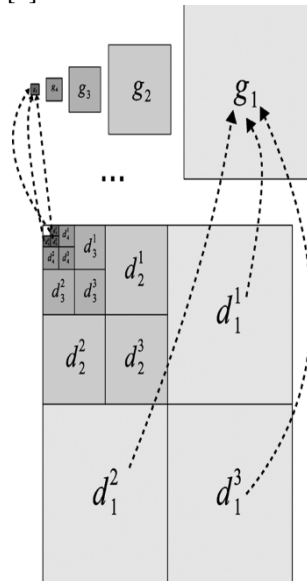


Fig.2. Illustration of five level gradient field, obtained from five level wavelet decomposition.

To overcome these problems scramble the locations of all gradient vectors uniformly. It reduces the probability of having two vectors with similar magnitude.

Fig (3) shows block diagram

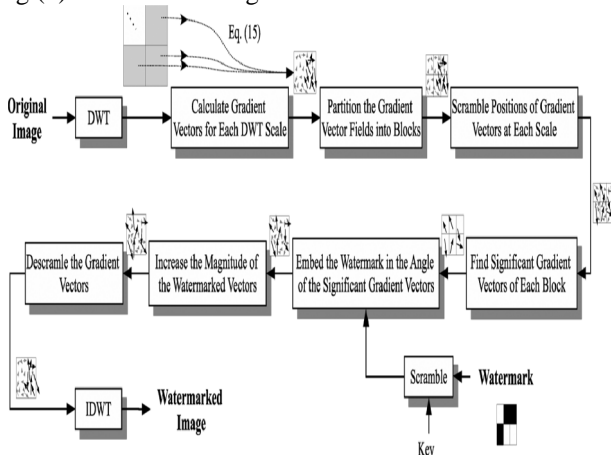


Fig.3. Block diagram of proposed watermark embedding scheme

2D DWT is applied to image. Obtain the gradient vectors corresponds to DWT coefficients. Assign the vectors in descending order of their magnitude and descending order of their magnitude and scramble them.

HVS (Hue, Value, Saturation) model is used to improve robustness. By using this method Just Noticeable Difference can be obtained and is less sensitive to distortions at edges and borders. So edges, borders and significant gradient vectors are good parameters to embed in the gradient direction.

## V. MULTI SCALE GRADIENT

We proposed multi scale gradient in this paper to increase the watermark capacity. Single scale gradient and multi scale gradient methods gives imperceptible watermarks. But compared to single scale gradient, multi scale gradient gives better image quality, robustness and capacity. We can embed 128, 64, and 64 bits at wavelet levels 3,4 and 5 respectively.

## VI. CONCLUSION

The absolute angle quantization index modulation is proposed to embed the watermark in each gradient angle. Following are the advantages of DWT with absolute angle QIM over other methods. It is robust to many attacks such as JPEG compression, Gaussian noise. It increases the imperceptibility and also increases capacity of watermarking. This quantization based watermarking needs lot of calculation and it is a complex method.

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