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Quality Estimation of Image with Watermark

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Abstract: ***Quality estimation of image is very important. In applications involving all signal transmission are analyzed with quality metrics, the quality metrics are reduced, no reference &full reference. In this paper propose that quality estimation of image based on adaptive watermarking scheme. The proposed scheme the embedded watermark to estimate the quality by using DWT method & Set Partitioning in Hierarchical Trees (SPIHT).In SPHIT trees are decomposed in bit planes. To estimate the quality by using HVS masking and image complexity***

Keywords: DWT, Set Partitioning in Hierarchical Trees, HVS masking

1. Introduction

Image quality estimation is very important in today's video broadcasting, transmission control, and ecommerce because quality estimation is a key determinant of customer satisfaction and a key indicator of transmission conditions. But when we transmit a signal from sender to receiver The receiver can't identify whether it is original image or degraded(may be channel noise, packet loss, third party attack etc) image. There are 3 technologies currently used to identify the degradation.

1. Full Reference quality metrics.
2. No Reference quality metrics.
3. Reduced Reference quality metrics.

1) The Full Reference quality metrics estimate image quality by comparing the differences between the distorted image and the original image. The widely used quality metrics in this category are the PSNR, wPSNR, Watson ,JND, etc. The Full Reference quality metrics provide more accurate quality evaluation results comparing to the Reduced or No Reference quality metrics. However, the Full Reference quality metrics become less practical when the original image is not available.
2) The No Reference quality metrics estimate image quality without accessing the original image.
3) The Reduced Reference quality metrics evaluate the quality of a distorted image using partial information of the original image. Such partial information can be some features extracted from the original image . The Reduced Reference quality metrics do not require the presence of the original image for quality evaluation. However, the partial information of the original image need to be transmitted to the receiver side either through an ancillary channel or by embedding into the transmitted image.

In an image feature is depend on watermarking based quality evaluation scheme was proposed which attempts to achieve the quality estimation of the quality metrics. In the evaluation of watermark and original image is measured using the True Detection Rates (TDR) An iterative process is used to find the optimal watermark strength by experimentally testing the image degradation and extraction characteristics so that the quality estimation error can be minimized. And also analyzed with complexity of image and accuracy of the image to the quality estimation suitable for certain applications.

2. The Proposed Watermark Embedding Scheme

The proposed water embedding schema is shown in block diagram fig:1.The block diagram mainly include read original image ,read watermark, then to add redundancy , dwt, hvs masking block etc

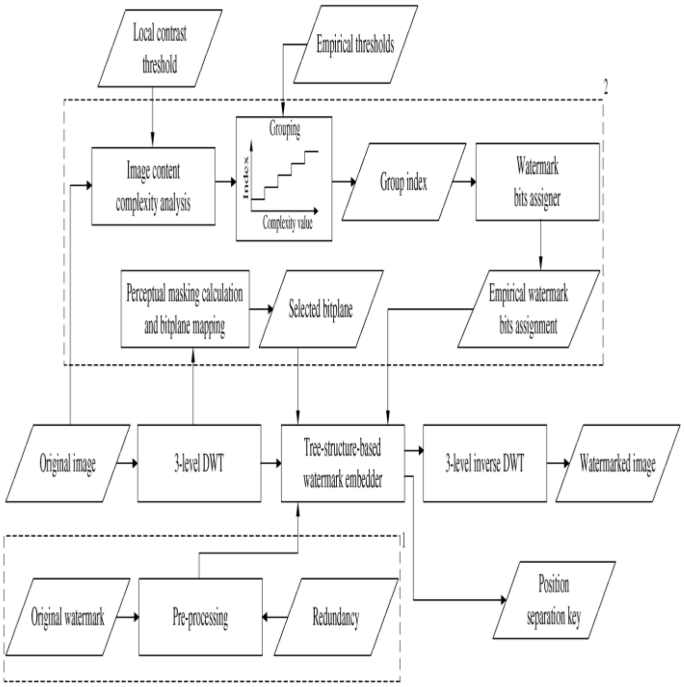

Figure 1: block diagram of proposed watermark embedding process

Embedding process consists of mainly including steps are:

1) Initially to read the original image
2) Then to read the secret image
3) Then to apply the embedding tools that are mainly include
   a) Then to add the redundancy (one or more)
   b) Apply wavelet decomposition
   c) Then to apply the image complexity by using mathematically, Complexity= $\sum(n*2^i)$
   n:no:of quad tree decomposition nodes,i:level of the decomposition

d)To apply the hvs masking and data embedding
4) Then to apply decryption tool
5) Analysis by using TDR

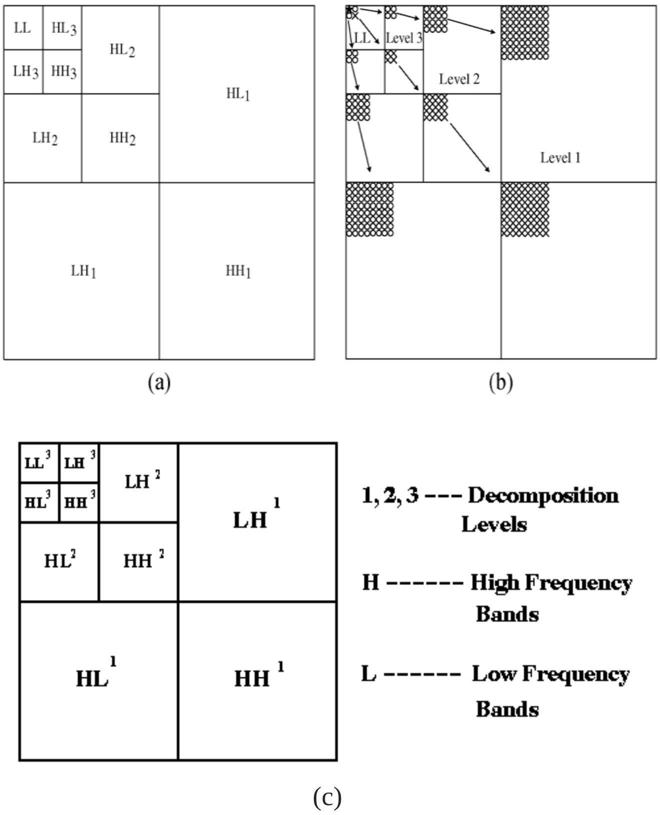

Figure 2: (a).Illustration of the 3-level DWT decomposed sub bands (b) and the formation of tree structure (c)DWT

Apply 3-level DWT to the cover image(original image) to obtain the DWT(Discrete Wavelet transform) decomposed image. Discrete Wavelet transform (DWT) shown in fig.2.(c) is a mathematical tool for hierarchically decomposing an image(signal ,image etc). It is useful for processing of non-stationary all signals The 3-level DWT decomposed sub bands are denoted as shown in Fig.2(a).These denotations for the 10 DWT decomposed sub bands will be used throughout the paper. Embed the watermark with adaptive embedding strength using the tree structure based watermark embedded. The result of the watermark embedder is the watermarked DWT image. Apply 3-level inverse DWT to the watermarked discrete wavelet image to obtain the watermarked image. The Formation of the Tree Structure :The tree structure is formed by categorizing the DWT coefficients with inherent Discrete Wavelet transform similarities across all the DWT sub bands. The correlated coefficients build up the parent-child relationship and form a tree shown in fig 2.b The Selection of Trees and DWT Coefficients: the applications of the watermarking based quality evaluation it is desirable to embed watermark throughout the original image so even the watermarked image is locally tampered, the extracted watermark can still reflect the quality degradation of the cover image. According to the length of the watermark sequence, the trees for watermark embedding are chosen using the position separation keys shown in fig 3

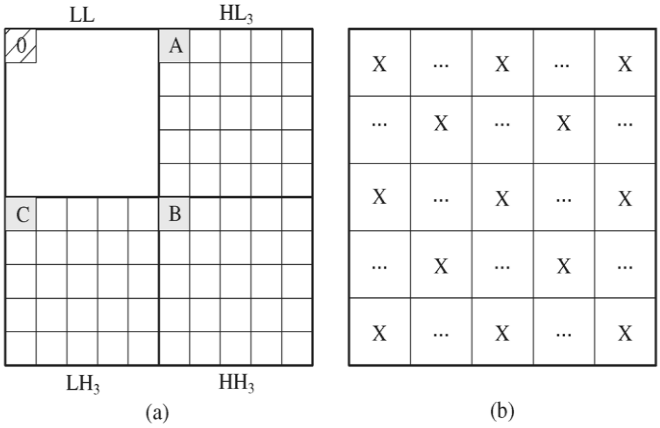

Figure 3: The tree selection strategy

The HVS masking:
The HVS masking is used in the proposed scheme to better balance the invisibility and the robustness of the embedded watermark. One HVS mask is generated for one DWT decomposed detail block. Totally, nine HVS masks are generated for one image in the Image quality evaluation using tree structure based watermarking embedding process. To accommodate the proposed tree structure based watermarking scheme, every HVS mask is mapped into bit plane indices referring to the distribution of the HVS mask. The mapping relationship between the coefficients of the HVS masks and the bit plane indices is defined based on experiments. Then, the binary watermark bits are embedded into the selected bit planes referring to the achieved bit plane indices. The luminance values of the DWT coefficients in the LL block are used in the HVS masking calculation. The HVS masking is used in the proposed scheme. As researched in four factors, as listed in the following, are greatly affecting the behavior of the HVS:

1.Band sensitivity or frequency masking: Intensity variations are less visible in high resolution sub bands and are also less visible in the diagonally decomposed blocks,
HHℓ. .
MF (ℓ, θ) = M1(θ) ·M2(*l*) *[2]*
2.Background luminance: Intensity variations are less visible over the brighter and
darker areas. The luminance masking is denoted as ML.
ML(ℓ, i, j) = 1 + I(ℓ, i, j)[2]
3.Spatial masking or edge proximity: The eyes are more sensitive to noise addition near edges or contours of images. This factor, ME, is evaluated using the
empirically scaled local energy of the DWT coefficients in all detail sub bands.
ME(ℓ, i, j) is formed on the basis of sigma(ϱ)[2]
where, ρ is a weighting parameter and the suggested value for ρ is 1/2
4.Texture sensitivity: Intensity variations in highly textured areas are less visible than those in the flat-filed areas of images. This masking factor, MT , is estimated using the local variance of the corresponding DWT coefficients in the LL sub band.
MT (ℓ, i, j) = var$\{ll(x+X), y+(Y)\}$ X and Y are derived in [2]
Therefore hvs masking is MHV S(ℓ, θ, i, j) = α ·MF (ℓ, θ) ·ML(ℓ, i, j) ·ME(ℓ, i, j)β ·MT (ℓ, i, j)γ

where MHV S denotes the coefficients in one HVS mask; α = 1
ϱ is a scaling parameter,
which implies that disturbs having values lower than half of MF · ML · ME^β · MT^ γ are assumed invisible. The suggested value for β and γ is 0.2 .
After hvs masking then decrypt the input image. Then, the extracted watermark is compared with the original watermark bit by bit and the True Detection Rates (TDR) is
TDR = Number of correctly detected watermark bits/Total number of watermark bits

3. Result Analysis

This paper implemented in MATLAB .The main advantage of this paper is to estimates the quality of image . Following screenshots represents the output of the work carried out on the project Quality Estimation Of Image With Watermark

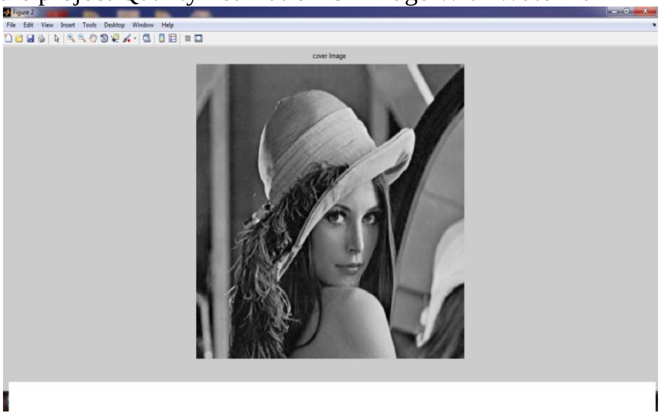

Figure 4: read cover image

Figure 5: read watermark data

Figure 6: redundancy added

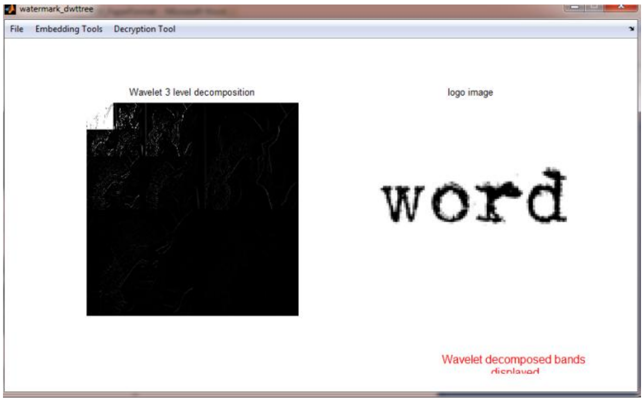

Figure 7: DWT decomposition

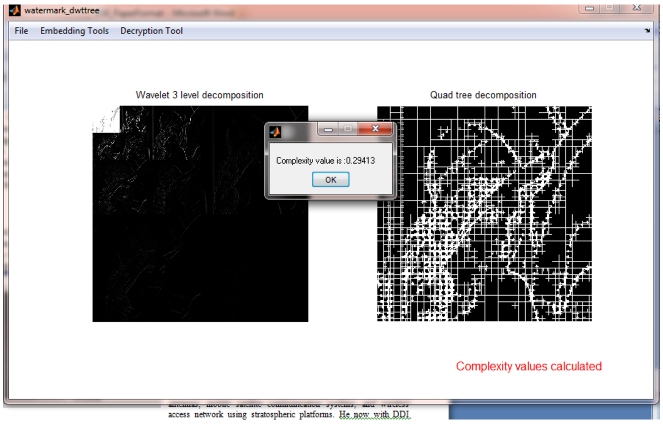

Figure 8: image complexity analysis

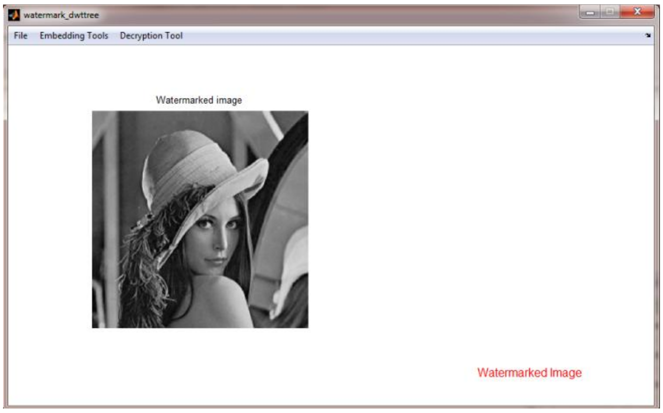

Figure 9: hvs masking and embedding data

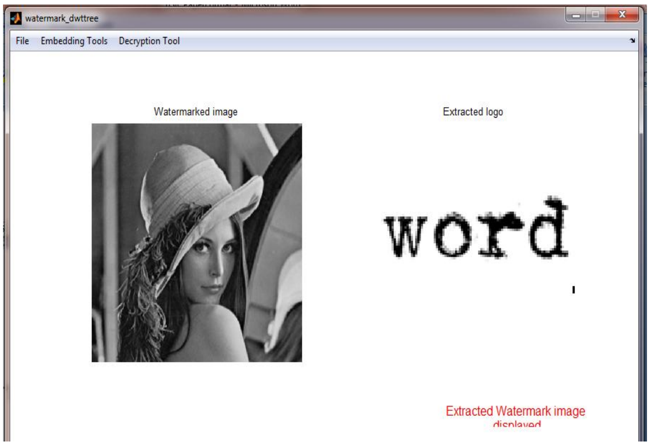

Figure 10: extracted watermark image

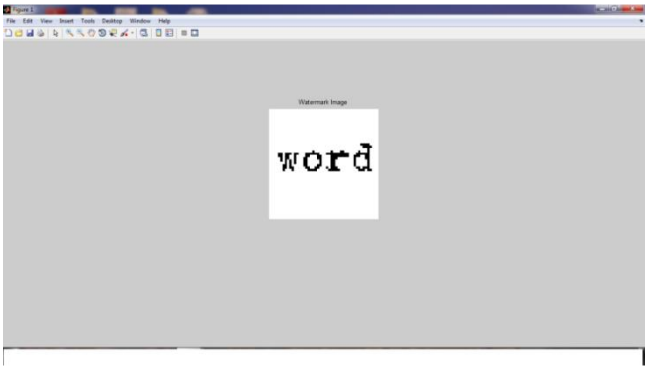

Figure 11: Analysis of the Image (Quality estimation of image)

The proposed scheme has good computational efficiency; it is useful to further develop the proposed scheme for video quality evaluation and estimation

4. Conclusion

In this paper, a watermarking based quality estimation or evaluation scheme is presented. The proposed scheme is designed to estimate and evaluate the image quality in terms of the existing Full-Reference quality metrics that are based on the tree structure, the binary watermark is embedded into the selected bit planes of the selected DWT coefficients with adaptive watermark embedding strength the watermark is not embedded in the approximation sub band, which reduces loss in image quality caused by embedding the watermark. The experimental results and output show that the proposed scheme works effectively and good

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