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SCALABLE WATERMARKING FOR THE MEDIA CLOUD

Scalable watermarking has become increasingly important for the online distribution of digital content. It allows content to be scaled for a wide range of users and devices under dynamic network bandwidth. Scalable compression allows different display resolutions and requires different bandwidth. However, for low-end devices, the scaling process may alter the embedded digital watermark. In the proposed watermark-based scalable authentication, users can embed scalable watermarks into digital images and upload them to the cloud. When the user wants to download their multimedia data back to their own devices, they just need to know partial content of the scalable watermark image and make some comparison to make sure the images are not corrupted or modified.

THE DWT-BASED WATERMARKING TECHNIQUE

Discrete wavelets transform (DWT)-based watermarking is within the category of frequency domain watermarking techniques. The process of transforming the image into its transform domain varies; hence, the resulting coefficients are different. Generally, the watermarked data are embedded in a transformed image. In other words, the watermark is inserted into transformed coefficients of the input image. Finally, inverse transform is performed on the watermarked image. The watermark detection process is the inverse procedure of the watermark insertion process. A blind watermarking algorithm based on a qualified significant wavelet tree (QSWT) is proposed by Lin et al. In this method, the image is transformed into wavelet coefficients using three-level DWT, and the LH3 subband is considered to embed the watermark as it is more significant than the HL3, HH3, and LL3 subbands. This technique is mainly based on the significant difference of wavelet coefficient quantization in which every seven non-overlapping wavelet coefficients of the host image are grouped into a block.

THE BLIND WATERMARKING TECHNIQUE

Our proposed watermark embedding algorithm based on QSWT is described in Fig. 1.

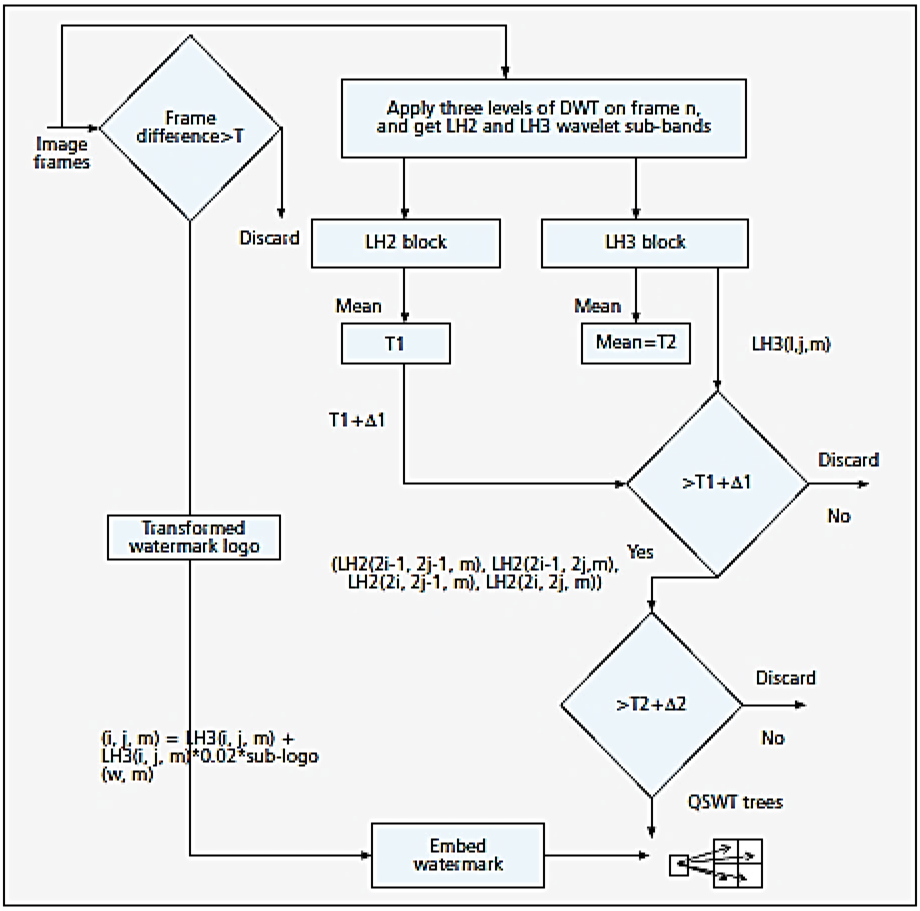

Fig. 1. The proposed watermark embedding algorithm

After a three-level DWT is applied in the input image frame n, wavelet subbands LH2 and LH3 are generated. The next step is to convert LH2 and LH3 to a set of smaller subblocks. T1 and T2 are acquired by calculating the mean of these subblocks in LH3 and LH2, respectively. For each coefficient at location LH3 (i, j, m) in subblock m, if it is greater than the threshold T1 (m) + D1, the system will check if at least three of its child coefficients (LH1 (2i – 1, 2j – 1, m), LH1 (2i – 1, 2j, m), LH2 (2i – 1, 2j – 1, m), and LH2 (2i, 2j, m) are greater than the threshold (T2 (m) + D2). If they are, LH3 (i, j) will be set as one of the QSWTs (m). The coefficient values of the parent and all its children are summed. Then QSWT (m) will be sorted in decreasing order, and these trees are output. All coefficients that do not meet these two adaptive thresholds are discarded. The original image is transformed using three-level DWT. From the 10 bands obtained, LH3 is used to embed the watermark. The watermark is embedded in the calculated QWST tree as described in [7].

JOINT DESIGN OF WATERMARK AUTHENTICATION AND ERROR CORRECTION CODES FOR MEDIA CLOUD

The number of parity/redundant symbols that must be added to the message is determined by the amount of required capability of error corrections. The parity symbols must contain enough information to detect the values of the erroneous information symbols. While there are several forward error correction (FEC) techniques available, Reed-Solomon (RS) codes provide powerful correction with high channel efficiency. With the advent of very large-scale integration (VLSI) techniques, RS codes can be useful in both high and low data rate systems at low cost. The efficiency of RS codes is almost as the same as that of Hamming codes, except that RS codes deal with multibit symbols rather than individual bits. The main idea behind this work is to detect and extract the watermark data in which the watermarked data is subjected to noise caused by transmission. These noises might result in failure to detect watermarked data from the media cloud. The joint design mechanism could also extract more watermarking bits (higher robustness) than the general extraction algorithm. In the design, RS code plays an important role, extracting the watermarked bits, due to its ability to correct errors. For the joint design of RS and watermarking, two approaches have been considered. In the first method, the full watermarked image is given as input to an RS encoder. In the second method, only the LH3 band is given as input to the RS encoder. After the process of detecting and correcting errors, we replace the LH3 obtained from the RS code in the original image, and apply inverse DWT to reconstruct the image. In this scheme, packets are discarded if they cannot be corrected due to the bit errors caused by the noise. There is a trade-off between the quality and RS code protection in general. For example, having more RS protection will improve the quality with increased redundancy.

Security protection between users and the mobile media cloud is critical for future multimedia applications. We present a joint design of watermarking technique based on the significant difference of wavelet quantization with the Reed-Solomon error correcting code. The watermarking technique authenticates multimedia data from the media cloud guarantees that data transmission is reliable for multimedia data between mobile users and the media cloud.

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