

## A CAVLC-BASED VIDEO WATERMARKING SCHEME FOR H.264/AVC CODEC

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**ABSTRACT.** *Forensics for digital data has become more and more important, especially for video surveillance systems. Recently, H.264/AVC CODEC has been widely applied to video surveillance systems. In this paper, therefore, a novel video watermarking scheme for H.264/AVC CODEC is proposed. It embeds a watermark bit by adaptively truncating the last nonzero quantized AC coefficients in a  $4 \times 4$  luminance block. The existence of truncated coefficient has least perceptual degradation and least influence on successive prediction coding. Thus, the scheme could constrain the perceptual degradation, which is caused by embedding watermark, within an ideal degree. Experimental results show that the proposed scheme does not increase but even reduces the bit rate after embedding watermarks in general cases. Besides, the accuracy of extracted watermark bits after the re-encoding attack could be maintained over 80%. Moreover, since the scheme is low-complexity and implemented in the encoder, it can be easily adopted by real-time video applications.*

**Keywords:** Video watermarking, H.264/AVC, Digital authentication

**1. Introduction.** H.264/AVC is the state-of-the-art video coding standard. This new standard provides a better coding efficiency than others. More and more digital video applications are adopting H.264/AVC codec, such as broadcast TV, video surveillance system, digital video camera and video conference. The same as digital data, H.264/AVC video sequence is prone to mass copy and tampering on the Internet. Therefore, copyright protection for it has become more and more important, especially for video surveillance systems.

Video watermarking is an adequate approach to achieve digital authentication and copyright protection for video data. Owing to the unique features of video coding, video watermarking is very different from image watermarking. The compressed video data have little capacity for data hiding in the code space. This is because video coding standards compress video sequences with much higher compression ratio than image compression techniques. On the other hand, the bit rate of video coding is very sensitive to the fluctuation between coefficients, especially in entropy coding. Therefore, the application of remarkable data hiding and image watermarking schemes [1-3] to video watermarking schemes would not be appropriate. In video encoder, if one bit is embedded in the frequency domain or motion field, the bit's increasing usually will not be only one bit. Because the embedded bit would increase the size of current code space, it must destroy the reconstructed data for successive coding. Therefore, the successive coding has to employ more bits to compensate for the distortion additionally. Furthermore, low-complexity and