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Motion Entropy Masking for Perceptually Tuned Robust Watermarking of H.264 Video over DAB IP Networks[1]

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Abstract

We present watermarking scheme for digital videos that are based on human visual system characteristics. In our scheme human visual system are used to determine image dependent upper bound values on watermark insertion. This allows us to insert maximal allowable transparent watermark which, in turn, is extremely hard to attack with common image processing, MPEG-4 AVC (H.264) compression. As the number of motion increases in a video signal, the human visual system decreases its sensitivity to motion. We model this decreased sensitivity to motion entropy masking. We used the motion entropy masking to increase the robustness of video watermarks. Our watermarking scheme inserts perceptually invisible watermark in discrete cosine transform (DCT) domain. We have shown that the proposed scheme provides betfer results than two other popular schemes both in transparency and robustness.

I. Introduction

A digital watermarking of electronic content is to insert some information into electronic contents such as images, audio and video fro copyright protection. Cox proposed a watermarking scheme that is based on the spread spectrum (SS) communication [1]. In this scheme, DCT is performed on a whole image and then the watermark is inserted (added) in a predetermined range of low frequency AC components. The inserted watermark signal consists of a sequence of real numbers that are normally distributed and it is scaled according to the signal strength of the frequency components. Podilchuk and Zeng (P& Z) have extended this scheme using Watson visual model to adapt the watermark to each image and they believed that it could provide a maximum length and maximum power watermark [2],[4]. We improved their scheme in two aspects. Firstly we incorporated excitatory-inhibitory interaction between human visual cells into our entropy-masking model in order maximize the watermark further. For video source, we extended our entropy model to cover motion entropy. Secondly, in P&Z's scheme, watermarked image sometimes shows image impairments because normal distributed watermark values will make the pixel values exceed the just noticeable difference (JND). We used bounded normal (BN) distribution which yield only the values between -1 and 1 to overcome the problem (drawback). Third, we designed a fast watermarking scheme using Hadamard transform (HT) instead of DCT because HT can be fully integer and implemented in bitwise operations. We also tested our watermarking scheme over H.264 video coding [9], which is widely used for low bit rate coding and high quality video coding. In this paper, we will introduce entropy masking concept in section 2, design considerations in section 3, implementation and simulation results in section 4, and conclude with future research directions.

II. Entropy Masking Model for Maximal Watermark

Our perceptual watermarking scheme inserts invisible watermark in the DCT domain and it can be used in the Motion Picture Experts Group (MPEG)

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