

Chapter 42

Application of Error Control Coding for Multimedia Watermarking Technologies

Mehul S. Raval
DA-IICT, India

ABSTRACT

Intellectual property right, copyright, trade mark, digital rights management (DRM) are buzz words heard more often in era of Internet. Along with the uncountable advantages Internet has also brought certain evils. These evils have social, technological, economical and legal impact on our society in general. One of the issues concerning the “content creators” is mass violations of copyrights for their work through illegal distribution via “darknet”. Watermarking is seen as one of the component for DRM systems that can act as a deterrent to content flowing into the darknet. The performance of watermarking schemes can be improved if channel codes are used for encoding the hidden message. The chapter targets applications of Error Control Coding (ECC) to watermarking namely: copyright protection, authentication, forensics and stego watermarking techniques including active steganography. This chapter aims at studying various properties of watermarking systems (depending on application), looking into their specific requirements and then try to search for suitable error control code. This will boost the over all performance of watermarking techniques. This chapter also intends to discuss the state of art research in this direction and then presents a watermarking method based on facts covered in chapter.

INTRODUCTION

The watermarking has seen a sudden spurt in activities and interest after 1995. This is an era when internet started penetrating globe connectivity. This brought several worrying points includ-

ing the rising concerns for copyright violations. Watermarking is seen as one of the potential means for preventing content flowing into the darknet. The watermarking has been included as technology into future DRM standards. The goal of the *watermarking* is to protect the copyright and prove ownership of digital content. There are

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several applications of watermarking apart from copyright protection. The Table 1 associates the type of watermark with their application and its desirable properties (Ingemar, 2008; Wenjun, 2006). It is presumed that readers are very clear about the basics of each one of these applications and hence they have been described very briefly in Table 1.

Summarizing issues that can be handled well by the ECC for watermarking are:

- Providing reliable transmission of watermark through communication channel (Ingemar Cox, 2008)
- Improving the payload of watermark by using codes operating near Shannon's limit (A. Bastug, 2004).
- Providing authentication and traitor tracing (Kaushal, 2004).
- Providing the covert and secure communication (Kaushal, 2007).
- Providing the unauthorized access protection (M. C. Davey, 2001).

However we have to always consider the fact when ECC is applied to watermarking is that, every type of code will perform error correction to its capacity only above minimum SNR level in communication channel. Below this level some of the codes instead of providing a "gain" will introduce a "loss" in terms of increased BER. This increased BER can also attributed be type of decoder and characteristics of errors. If we can keep check on channel input BER than we can use any type of ECC provided output BER drops.

BACKGROUND

Watermarking as a Communication Problem Perspective

Channel coding has been classically seen as a mean for increasing reliability during transfer of content. Importance of coding theory has been realized and it has been applied to different communication scenario. Errors occur due to intentional or unintentional manipulations that are applied to the "watermarked" data as it travels through communication channel. Thus watermarking can also be seen as a communication problem (M. Barni, 1998; J.R.Herandez, 2000).

The block diagram in Figure 1 represents this model. The watermark is "message" which is to be sent from transmitter to receiver. There is a notion of communication channel and insertion of noise into the transmitted message. This noise is due to intentional or unintentional manipulations that may occur during its journey. The noise is presumed to be independent of the message being transmitted. There are multiple ways in which this can be handled and in one of the scenario the cover object or container itself is treated as a noise (Is it like an ordinary noise superimposed in channel?).

This model allows one to use conventional wisdom of information and communication theory and apply it to domain of digital watermarking. One of them is application of "channel coding" to improve the performance in terms of Bit Error Rate (BER) reduction. Statistical formulation and analysis of the spread spectrum water-

Table 1. Associating watermarking with applications and their desirable properties

Type	Application	Desirable property
Robust watermark	Copyright protection/Ownership identification	Robustness (Ability to survive)/Security
Fragile watermark	Authentication/Integrity of the content	Sensitivity to changes / Fragility
Forensic	Finger printing/ Traitor tracing	Detection of tampering/ Localization of changes/ Possible revival of content.
Active steganography	Covert and secure communication	Security / Undetectability / Capacity

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