

**Self-Synchronization and LUT based Client Side
Digital Audio Watermarking**

by

Jiang Jing-Jing

Master of Science in Software Engineering



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**Faculty of Science and Technology
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Approved by _____

Supervisor

Date _____

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Abstract

SELF-SYNCHRONIZATION AND LUT BASED CLIENT
SIDE DIGITAL AUDIO WATERMARKING

by Jiang Jing-Jing

Thesis Supervisor: Associate Professor Pun Chi-Man

Master of Science in Software Engineering

Three audio watermarking schemes were proposed in this thesis. First of all, *a novel self-synchronization based watermarking scheme*, where a special region centered at the feature point of the original audio signal was exploited to embed the watermark information. The feature point we chose can survive even after most kinds of attacks, thus the self-synchronization ability can be fulfilled through using such feature point as synchronization signal. Afterwards, *adaptive embed strength and secure client-side LUT-based watermarking scheme*, which divides the original audio signal into several non-overlapping segments and adaptively chooses an optimal embedding strength for individual segment according to the specific properties of each segment to embed the watermark, was presented. Secure client-side watermark is one of the possible solutions have been proposed for the copyright protection in large-scale content distribution system. *Self-synchronization and LUT based duplicated watermarking scheme*, which take advantage of steady and efficiency features derived from self-synchronization, duplicated watermarking and LUT-based method, reduces the

possibility of the embedded watermark being removed. Besides, in this scheme, a new embedding strategy namely client-side watermarking, which is totally different from the traditional watermark embedding schemes which mostly embed the watermark at the server side before the watermarked signal was transmitted to the client side, have been applied. The adoption of the client-side strategy makes full use of the advantages of broadband technique to increase the transmission efficiency since all the copies of signal being transmitted to different clients are a unique version.



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LIST OF ABBREVIATIONS

DWT: Discrete Wavelet Transform

DCT: Discrete Cosine Transform

PPE: Peak Point Extraction

LUT: Look-Up-Table

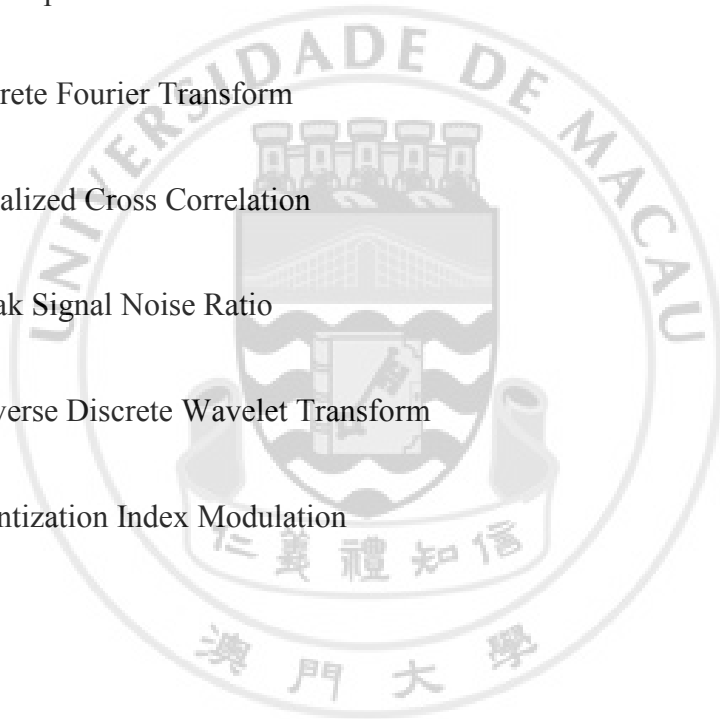
DFT: Discrete Fourier Transform

NC: Normalized Cross Correlation

PSNR: Peak Signal Noise Ratio

IDWT: Inverse Discrete Wavelet Transform

QIM: Quantization Index Modulation



PREFACE

In this thesis, most of the attentions have been focused on the self-synchronization and client-side embedding based digital audio watermarking scheme. As we known, it is inevitable that the audio file suffers from all kinds of synchronization attacks from time to time, like cropping attack to the audio signal. Synchronization attacks often caused losing of location information which tells where the watermarks have been placed, leading to the detection of watermark failed thoroughly. Besides, in recent years, we are experiencing a clear trend toward the distribution of large-scale multimedia content since sharing large-size multimedia content, such as high revolution videos, among the social network has become increasingly prevailing. To embed the watermark in the large-scale content by traditional way of watermarking, which embed the watermark on server side, burdens a lot of workload on the server side. How to deal with the problems mentioned above, and what kind of solution can solve that problems efficiently make it much more meaningful to explore and doing research on these kinds of topics.

Based on the existing methods, three audio watermarking schemes were proposed in this thesis. *A novel self-synchronization based watermarking scheme; adaptive embed strength and secure client-side LUT-based watermarking scheme; and self-synchronization and LUT based duplicated watermarking scheme.*

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