

# Audio Watermarking

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# 1. Application

- In the **ownership protection** applications, a watermark containing ownership information is embedded to the multimedia host signal. The watermark, known only to the copyright holder, is expected to be very robust and secure.

# 1. Application

- In the **content authentication** applications, a set of secondary data is embedded in the host multimedia signal and is later used to determine whether the host signal was tampered.

# 1. Application

- It is even more demanding to use watermarks not only in the identification of the copyright ownership, but as an actual proof of ownership. The problem arises when adversary uses editing software to replace the original copyright notice with his own one and then claims to own the copyright himself.

# 1. Application

- Additional data embedded by watermark in the fingerprinting applications are used to trace the originator or recipients of a particular copy of multimedia file.

## 2. Requirements

- Perceptual Transparency

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- Perceptual Transparency: In most of the applications, the watermarkembedding algorithm has to insert additional data without affecting the perceptual quality of the audio host signal.



## 2. Requirements

- Watermark Robustness: Robustness of the algorithm is defined as ability of the watermark detector to extract the embedded watermark after common signal processing manipulations.

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- Watermark Bit Rate: One of the most important properties of an audio watermarking system is watermarked bit rate, usually determined by specific demands of the application the system is designed for. Bit rate of the embedded watermark is number of embedded bits within a unit of time and is usually given in bits per second.

# 3. Algorithms

- Least Significant Bit Coding: The watermark encoder usually selects a subset of all available host audio samples chosen by a secret key. The substitution operation on the LSBs is performed on this subset. Extraction process simply retrieves the watermark by reading the value of these bits.

# 3. Algorithms

- Watermarking the Phase of the Host Signal: Algorithms that embed watermark into the phase of the host audio do not use masking properties of the HAS, but the fact that the human auditory system has a low sensitivity to relative phase change.

# 3. Algorithms

- Echo Hiding: Echo hiding schemes embed watermarks into a host signal by adding echoes to produce watermarked signal.

# 3. Algorithms

- Patchwork Method: the watermark embedding process uses a pseudorandom process to insert a certain statistic into host audio data set, which is extracted with the help of numerical indices describing the specific distribution.