

Title: Audio Watermarking: A Comprehensive Review

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Abstract: —Audio watermarking has emerged as a potent technology for copyright protection, content authentication, content monitoring, and tracking in the digital age. This paper offers a comprehensive exploration of audio watermarking principles, techniques, applications, and challenges. Initially, it presents the fundamental concepts of digital watermarking, elucidating its key characteristics and functionalities. After that, different audio watermarking methods in both the time and transform domains are explained, such as feature-based, parametric, and spread spectrum methods, along with how they work, and their pros and cons. The paper further addresses critical challenges in maintaining key criteria such as imperceptibility, robustness, and payload capacity associated with audio watermarking. Additionally, it examines watermarking evaluation metrics, datasets, and performance findings under diverse signal-processing attacks. Finally, the review concludes by discussing future directions in audio watermarking research, emphasizing advancements in deep learning-based approaches and emerging applications..

Keywords: Audio watermarking; deep learning approach; spread-spectrum method; signal-processing attacks; time domain; transform domain

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