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# A Zero-Watermarking Algorithm for Privacy Protection in Biomedical Signals

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## Abstract

Confidentiality of health information is indispensable to protect privacy of an individual. However, recent advances in electronic healthcare systems allow transmission of sensitive information through the Internet, which is prone to various vulnerabilities, attacks and may leads to unauthorized disclosure. Such situations may not only create adverse effects for individuals but may also cause severe consequences such as hefty regulatory fines, bad publicity, legal fees, and forensics. To avoid such predicaments, a privacy protected healthcare system is proposed in this study that protects the identity of an individual as well as detects vocal fold disorders. The privacy of the developed healthcare system is based on the proposed zero-watermarking algorithm, which embeds a watermark in a secret key instead of the signals to avoid the distortion in an audio sample. The identity is protected by the generation of its secret shares through visual cryptography. The generated shares are embedded by finding the patterns into the audio with the application of one-dimensional local binary pattern. The proposed zero-watermarking algorithm is evaluated by using audio samples taken from the Massachusetts Eye and Ear Infirmary voice disorder database. Experimental results demonstrate that the proposed algorithm achieves imperceptibility and is reliable in its extraction of identity. In addition, the proposed algorithm does not affect the results of disorder detection and it is robust against noise attacks of various signal-to-noise ratios.

*Keywords:* E-Healthcare, privacy protection; zero-watermarking; visual cryptography; local binary pattern; MFCC; SVM

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