

Research on adaptive noise filtering method in separating heart sounds and lung sounds

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Abstract: This study presents an adaptive noise filtering method for the separation of heart and lung sounds from single-channel auscultation recordings. The proposed approach addresses the challenge of spectral overlap between these two physiological signals, where conventional filtering often fails to preserve diagnostic information. A novel algorithm based on adaptive noise cancellation is developed, utilizing the quasi-periodic nature of heart sounds as a reference signal for the adaptive filter. The method dynamically adjusts filter coefficients to suppress heart sound interference while retaining the non-stationary characteristics of lung sounds. Performance evaluation using both simulated mixtures and real clinical recordings demonstrates that the proposed technique achieves significant noise reduction and signal fidelity, with an average improvement in signal-to-noise ratio of 8.5 dB compared to standard bandpass filtering. The results indicate that this adaptive approach effectively separates heart and lung sounds without requiring multi-channel acquisition, offering a practical solution for enhancing respiratory and cardiac auscultation analysis in resource-limited settings.

Keywords: adaptive filtering, heart sound separation, lung sound separation, noise reduction