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典型应用

使用时频盲源分离和小波包去噪的胎儿心电信号提取

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摘要: 提出一种使用时频盲源分离(TFBSS)和小波包去噪的胎儿心电信号提取新方法。首先通过重排时频谱时频盲源分离方法进行胎儿心电信号的初次提取, 并将初次提取得到的母体心电信号和噪声对应的各路分量置零, 其余分量由混合矩阵进行重构; 然后再利用重排时频谱的时频盲源分离方法对重构信号进行胎儿心电信号的二次提取, 得到含噪声的胎儿心电信号; 最后通过小波包去噪抑制胎儿心电信号中的基线漂移和噪声。在胎儿心电信号和母体心电信号的QRS波无重叠、部分重叠或完全重叠的情况下, 通过该方法能有效抑制母体心电信号和噪声的干扰, 提取胎儿心电信号。实验结果表明该方法能提取清晰的胎儿心电信号。

关键词: 胎儿心电信号 时频盲源分离 小波包去噪 母体心电信号 重排时频谱

Extraction of fetal electrocardiogram signal utilizing blind source separation based on time-frequency distributions and wavelet packet denoising

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Abstract: A new method utilizing Blind Source Separation based on Time-Frequency distributions (TFBSS) and wavelet packet denoising was proposed to extract the Fetal ElectroCardioGram (FECG) signal. The original eight ElectroCardioGram (ECG) signals obtained from the

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thoracic and abdominal area of the pregnant woman were firstly processed to eight components by utilizing rearrangement TFBSS. Then the Maternal ECG (MECG) signal and noise components in eight components were set by zero and the rest components were reconstructed by using the mixing matrix. The FECG with noise could be extracted by separating the reconstructed result by using rearrangement TFBSS. Finally, the baseline shift and noise in FECG were suppressed by wavelet packet denoising technique. The FECG could be extracted even under the condition of the fetal QRS wave being partly and entirely overlapped with the maternal QRS wave in the abdominal composite signal. The experimental results show that the clear FECG can be extracted by utilizing the proposed method.

Keywords: Fetal ElectroCardioGram (FECG) Blind Source Separation based on Time-Frequency distributions (TFBSS) wavelet packet denoising Maternal ElectroCardioGram (MECG) rearrangement time-frequency distributions