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Title: Time and space-domain rakeness-based compressed sensing of atrial electrograms

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Atrial electrograms (AEGs) acquired with a high spatio-temporal resolution are a promising approach for early detection of atrial fibrillation. Due to the high data rate, transmission of AEG signals is expensive in terms of power consumption and resources, making its adoption a challenge for low-power wireless devices. In this paper, we investigate the feasibility of using compressed sensing (CS) for the acquisition of AEGs while reducing redundant data without losing information. We apply two CS approaches, standard CS and rakeness-based CS (rak-CS) on a data set, composed of real medical recordings. We find that the AEGs are compressible in time, and, more interestingly, in the spatial domain. The performance of rak-CS is better than standard CS, especially at higher compression ratios (CR), both during sinus rhythm (SR) and atrial fibrillation (AF). The difference in the achieved average reconstruction signal-to-noise (ARSNR) in rak-CS and standard CS, for CR = 4.26, in the time domain is 7.7 dB and 2.6 dB for AF and SR, respectively. Multi-channel data is modeled as a multiple-measurement-vector problem and the mixed norm is used to exploit the group structure of the signals in the spatial domain to obtain improved reconstruction performance over ℓ_1 norm minimization. Using the mixed-norm recovery approach, for CR = 4.26, the difference in achieved ARSNR performance between rak-CS and standard CS is 5 dB and 2 dB for AF and SR, respectively.

