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Improving joint recovery of multi-channel ECG signals in compressed sensing-based telemonitoring systems through multiscale weighting

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Computational complexity and power consumption are prominent issues in wireless telemonitoring applications involving physiological signals. Compressed sensing (CS) has emerged as a promising framework to address these challenges because of its energy-efficient data reduction procedure. In this work, a CS-based approach is studied for joint compression/reconstruction of multichannel electrocardiogram (MECG) signals. Weighted mixed-norm minimization (WMNM)-based joint sparse recovery algorithm is proposed, which can successfully recover the signals from all the channels simultaneously by exploiting the inter-channel correlations. The proposed algorithm is based on a multi-scale weighting approach, which utilizes multi-scale signal information. Under this strategy, weights are designed based on the diagnostic information contents of each wavelet sub-band/scale. Such a weighting approach emphasizes wavelet sub-bands having high diagnostic importance during joint CS reconstruction. Coefficients in non-diagnostic sub-bands are deemphasized simultaneously, resulting in a sparser solution. The proposed method helps achieve superior reconstruction quality with a lower number of measurements. Reduction in the required number of measurements directly translates into higher compression efficiency, resulting in low energy consumption in CS-based remote ECG monitoring systems.

Biography

Anurag Singh is currently a PhD Research Scholar in the Department of Electronics and Electrical Engineering, IIT Guwahati, India. He has received his BTech (2009) from IET Rohilkhand University, Bareilly and MTech (Dec 2011) from Indian Institute of Information Technology, Design & Manufacturing Jabalpur in Electronics and Communication Engineering. His research interests include biomedical signal processing, multirate signal processing, compressed sensing and sparse representation.

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