Lost Data Channel Reconstruction in multichannel Biomedical Signals

Saulius Daukantas*, Vaidotas Marozas, Mantas Lukosevicius, Arunas Lukosevicius

Institute of Biomedical Engineering, Kaunas University of Technology, Kaunas, Lithuania

Multichannel biomedical data is frequently used in research and clinical practice: in sleep studies, surgery, rehabilitation, sports medicine. The probability of transient corruption or loss of one of channels in multichannel signal is increased. This problem of lost data is also common in real time wireless data transfer because of lost data packets. In this work, we proposed and compared two methods to reconstruct the lost data channel in multichannel biomedical signal. The first method makes use the cycle analysis of biomedical signals. Hilbert transform and cross-correlation function were used to estimate the peaks in the channels and phase differences among channels. The ensemble of 10 - 20 cycles from the history in lost data channel is used to calculate the median cycle. Intelligent resampling helped to adjust the lengths of median cycle to fit the time slots defined by peak indexes in context data channels. The adjusted in lengths and time shifted median cycles were combined to reconstruct the lost channel. The second method uses a recurrent neural network (echostate state network -ESN) and can be considered as more general method to reconstruct lost channel data than the first method. After teaching, ESN network was employed in time series prediction mode. Lost channel history data and context channels were used to teach the ESN network. The proposed methods were tested and compared using the subset of B dataset from Mind the gap challenge announced in www.physionet.org. The testing data comprised 21 signals having electrocardiogram channels corrupted. The following scores were obtained for both methods in this preliminary testing: a) Event 1 scores: the first method - mean 0.67 (std 0.17) and the second method - mean 0.34 (std 0.43); b) Event 2 scores: the first method - mean 0.83 (std 0.09), the second method - mean 0.86 (std 0.13).