

Reconstruction of Missing Cardiovascular Signals using Adaptive Filtering

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This work is addressed to The PhysioNet/Computing in Cardiology Challenge 2010: Mind the Gap. The aim of the challenge is to develop robust methods for filling in gaps in multiparameter physiologic data. Our approach to identify the 30 seconds of missing ICU data (target signal) was a gray-box technique. Using the signals' history we identified the connection in form of a Multi-Input/Single-Output (MISO) system, where the output is the prior of the target signal, the inputs are all the other signals. Assuming that the connection is time-invariant, we were able to make a prediction of the target by using the identified filter on the available parallel measured signals. Third order Infinite Impulse Response (IIR) filters were used in the model, the filtered signals were summarized in a linear model. The filter coefficients were estimated using a genetic algorithm with a fitness function containing both Mean Squared Error (MSE) and correlation coefficient to the target prior. This was found to maximize both Q1 and Q2 scores. Since the above assumption only holds for short time period, we restricted the identification of the transfer function to 2s, 10s and 30s of prior, and chose the best fit. Our current results show promise on the datasets where the reconstructions can be tested: Q1=64.045, Q2=79.7993, Q1=64.9604, Q2=77.8366 of 100 attempts on each A and B datasets respectively. The algorithm converged in every case to a stable filter, a good fit to the prior ensured good identifiability. We conclude that this approach can be efficient in reconstructing lost cardiovascular signal waveforms. As next step we will consider further analysis of the found transfer functions.