Adaptive and wavelet filtering methods for improving accuracy of respiratory measurement

ID 70208
Author(s) Keenan, D Barry; Wilhelm, Frank H
Author(s) at UniBasel Wilhelm, Frank ;
Year 2005
Title Adaptive and wavelet filtering methods for improving accuracy of respiratory measurement
Journal Biomedical Sciences Instrumentation
Volume 41
Pages / **Article-Number** 37-42

Respiratory activity is commonly measured by chest and abdomen bands using respiratory inductive plethysmography (RIP) or similar techniques. Such respiratory signals pose special challenges to adequate processing since the range of natural breathing frequencies is wide, and movement artifacts are common during periods of physical activity and even during sleep. Presented are novel linear and nonlinear signal processing algorithms that enable the decomposition of the range of artifact generated by non-respiratory sensor movement, enabling the respiratory component to be retrieved. We evaluated the performance of these techniques for improved processing of human respiratory signals. We demonstrate that, in contrast to conventional low-pass filters that attenuated higher frequency breathing and swift respiratory events such as cough episodes, a soft thresholding technique applied to a set of wavelet filterbanks effectively denoised the signal without attenuating respiratory information. Another type of artifact, low frequency noise generated from walking or running motion, can appear as breathing at the pace frequency making it difficult to differentiate a breath from a heel strike. Since this artifact often resides in the respiratory frequency band it cannot be removed by classical or wavelet filtering methods. We introduce an adaptive filtering technique that uses an upward body acceleration signal as a reference to resolve the respiratory component. A real-life data set acquired with a novel ambulatory and sleep monitoring system (LifeShirt, VivoMetrics, Inc., Ventura, CA, USA) demonstrates the utility of these respiratory filtering approaches and indicates that accurate respiratory volume and timing information can be collected noninvasively in physically active subjects in- and outside the laboratory or clinic.

Publisher Instrument Society of America
ISSN/ISBN 0067-8856
edoc-URL http://edoc.unibas.ch/dok/A5250345
Full Text on edoc No;
PubMed ID http://www.ncbi.nlm.nih.gov/pubmed/15850079
ISI-Number BCI:BCI200600013621
Document type (ISI) Journal Article