



Refined multiscale Hilbert-Huang spectral entropy and its application to central and peripheral cardiovascular data

Submitted by Anne Humeau-Heurtier on Fri, 02/19/2016 - 10:09

Titre	Refined multiscale Hilbert-Huang spectral entropy and its application to central and peripheral cardiovascular data
Type de publication	Article de revue
Auteur	Humeau-Heurtier, Anne [1], Wu, Chiu-Wen [2], Wu, Shuen-De [3], Mahé, Guillaume [4], Abraham, Pierre [5]
Pays	Etats-Unis
Editeur	Institute of Electrical and Electronics Engineers
Ville	New York
Type	Article scientifique dans une revue à comité de lecture
Année	2016
Langue	Anglais
Date	Nov. 2016
Numéro	11
Pagination	2405-2415
Volume	63
Titre de la revue	IEEE Transactions on Biomedical Engineering
ISSN	0018-9294
Mots-clés	entropy [6], Frequency-domain analysis [7], heart rate variability [8], Physiology [9], Time series analysis [10]
Résumé en anglais	<p>Objective: Spectral entropy has been applied in variety of fields. Multiscale spectral entropy (MSSE) has also recently been proposed to take into account structures on several scales. However, MSSE has some drawbacks, such as the coarse-graining procedure performed in the time domain. In this study, we propose a new framework to compute MSSE. This framework is also adapted for nonstationary data. Methods: Our work relies on processing steps performed directly in the frequency domain. For nonstationary signals, the evolution of entropy values with scales is observed along time. Our algorithm is herein evaluated both on synthetic time series (stationary and non-stationary signals) and on data from the cardiovascular system (CVS). For this purpose, heart rate variability (from the central CVS), laser Doppler flowmetry, and laser speckle contrast data (both from the peripheral CVS) are analyzed. Results: The results show that our framework has better performances than the existing algorithms to compute MSSE, both in terms of reliability and computational cost. Moreover, it is able to reveal repetitive patterns on central and peripheral CVS signals. These patterns may be linked to physiological activities. Furthermore, from the processing of microvascular data, it is able to distinguish young from elderly subjects. Conclusion: Our framework outperforms other algorithms to compute MSSE. It also has the advantage of revealing physiological information. Significance: By showing better performances than existing algorithms to compute MSSE, our work is a new and promising way to compute an entropy measure from the spectral domain. It also has the advantage of stressing physiologically linked phenomena.</p>

URL de la notice	http://okina.univ-angers.fr/publications/ua14453 [11]
DOI	10.1109/TBME.2016.2533665 [12]
Lien vers le document	http://ieeexplore.ieee.org/document/7419871/ [13]

Liens

- [1] <http://okina.univ-angers.fr/a.hum/publications>
- [2] [http://okina.univ-angers.fr/publications?f\[author\]=23885](http://okina.univ-angers.fr/publications?f[author]=23885)
- [3] [http://okina.univ-angers.fr/publications?f\[author\]=23886](http://okina.univ-angers.fr/publications?f[author]=23886)
- [4] [http://okina.univ-angers.fr/publications?f\[author\]=1153](http://okina.univ-angers.fr/publications?f[author]=1153)
- [5] <http://okina.univ-angers.fr/pierre.abraham/publications>
- [6] [http://okina.univ-angers.fr/publications?f\[keyword\]=3289](http://okina.univ-angers.fr/publications?f[keyword]=3289)
- [7] [http://okina.univ-angers.fr/publications?f\[keyword\]=21684](http://okina.univ-angers.fr/publications?f[keyword]=21684)
- [8] [http://okina.univ-angers.fr/publications?f\[keyword\]=6075](http://okina.univ-angers.fr/publications?f[keyword]=6075)
- [9] [http://okina.univ-angers.fr/publications?f\[keyword\]=3664](http://okina.univ-angers.fr/publications?f[keyword]=3664)
- [10] [http://okina.univ-angers.fr/publications?f\[keyword\]=5965](http://okina.univ-angers.fr/publications?f[keyword]=5965)
- [11] <http://okina.univ-angers.fr/publications/ua14453>
- [12] <http://dx.doi.org/10.1109/TBME.2016.2533665>
- [13] <http://ieeexplore.ieee.org/document/7419871/>

Publié sur *Okina* (<http://okina.univ-angers.fr>)