Multiscale Poincaré plot analysis of time series from laser speckle contrast imaging data

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Résumé en anglais	The monitoring of microvascular blood flow is of importance for research and clinical purposes because, for some pathologies as diabetes, the microcirculation may be affected long before organ dysfunctions are diagnosed. Laser speckle contrast imaging (LSCI) is gaining an increased interest to monitor microvascular blood flow (peripheral cardiovascular data). However, in spite of this and by opposition to central cardiovascular data as electrocardiograms, very few studies have been conducted on the analysis of LSCI through scales. We therefore propose to process LSCI data with a multiscale approach relying on Poincaré plots. For this purpose, we first study multiscale Poincaré (MSP) plots of simulated signals (synthetic white and 1/f noise time series). Then, MSP plots of LSCI time series recorded in 24 healthy volunteers are generated and analyzed. Furthermore, this analysis on real-life data is also conducted to study the role played by age on the results. Thus, the subjects were divided into two age groups: 13 young subjects (mean age = 23.8 ± 3.2 years old) and 11 elderly subjects (mean age = 56.9 ± 6.7 years old). Our results show properties that may reveal a weak fractal structure for LSCI data. Moreover, we find no statistical difference ($p \geq 0.05$) for the descriptors of MSP plots between the two age groups. MSP plots may become a simple-to-implement visualization tool to provide new insights into biomedical data across scales.
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