Online Tool for Dynamical Heart Rate Variability Analysis

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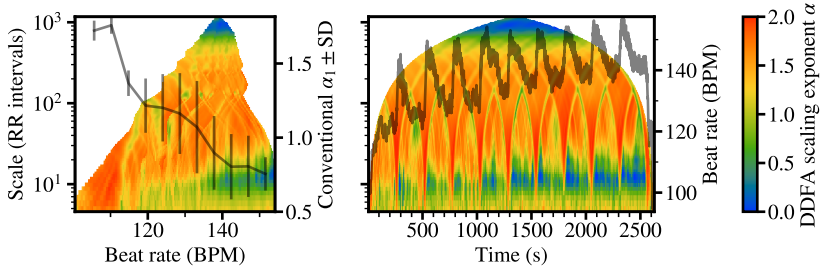
Aims: We present a straightforward yet versatile online tool for rapid heart rate variability (HRV) analysis utilizing state-of-the-art methods. The unique feature of the tool is the dynamical examination of accurate RR interval (RRI) correlations as a function of time.

Methods: In addition to extracting the time-dependence of all the common HRV measures, the highlight of the tool is the recently developed dynamical detrended fluctuation analysis (DDFA). This method addresses the inadequacy of the conventional short- and long-range scaling exponents by determining local scaling exponents continuous in both scale and time. Furthermore, these exponents are computed in a dynamic manner such that the statistical accuracy remains approximately constant across all the scales, resulting in higher temporal accuracy at the shorter scales. Therefore, the tool is particularly well-suited for studying HRV during highly non-stationary situations, such as physical exercise. Indeed, the tool readily integrates with sport watches from all the major manufacturers.

Results: The tool reveals complex correlations in the RRIs during physical exercise. Different sports at various intensities leave distinct fingerprints in the dynamic correlations that depend on, e.g., the heart rate, breathing, and running modalities. Another key advantage of the temporal fidelity is the possibility to study transient alterations in the HRV that could be indicative of various cardiac diseases.

Conclusions: We have implemented an accessible online tool for HRV analysis that is attractive to both researchers and enthusiasts alike. The tool could accelerate cardiac research by providing a quick visual overview of dynamic HRV measures, and permitting further custom analysis by downloadable raw data.



Examples of dynamic RRI correlations during indoor rowing exercise obtained with the tool. Stronger and stronger anticorrelations ($\alpha < 0.5$) appear at scales of roughly 10 RRIs as the exercise progresses.