

Statistical Properties and Memory of Excursions in Heartbeat Intervals

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We study the statistics of excursions, defined as the number of beats to return to a local mean value, in heartbeat interval time series from healthy subjects and patients with congestive heart failure (CHF). We find that the cumulative distributions of excursions are consistent with a stretched exponential function of the form $G(t) \exp(a * t^b)$ with $a=1.09 \pm 0.15$ (mean value \pm SD) and $b=0.91 \pm 0.11$ for healthy subjects and $a=1.31 \pm 0.23$ and $b=0.77 \pm 0.13$ for CHF patients. Besides, we study the statistics of return intervals between long excursions above certain threshold Q for both groups to explore the possibility of memory in the time organization of the extreme-size excursions. We find important differences in return intervals for both groups. We also apply the detrended fluctuations method (DFA) to excursions sequences to confirm the presence of correlations in healthy data while for CHF records the scaling exponent is characterized by a crossover, indicating that for short scales the sequences resemble uncorrelated noise.