

Identifying and characterizing complex dynamical regime transitions

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Complex systems often undergo abrupt or gradual transitions to dynamical regimes that can be safe or dangerous for the system functionality. Examples of dangerous transitions include desertification, population extinctions, financial crashes, cardiac arrhythmia, epileptic seizures, etc. A precise identification of such transitions is important for preventing harmful consequences, and a lot of efforts are nowadays focused on developing reliable diagnostic tools that can be applied to observed time-series.

Here I will show that complex network tools

The data analysis tools proposed here may be useful for the study of a broad range of real-world systems that display abrupt or gradual transitions to complex dynamical regimes.

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- [1] B. Luque, L. Lacasa, F. Ballesteros, and J. Luque, *Horizontal visibility graphs: Exact results for random time series*, Phys. Rev. E **80**, 046103 (2009).
 - [2] C. Bandt and B. Pompe, *Permutation entropy: a natural complexity measure for time series*, Phys. Rev. Lett. **88**, 174102 (2002).
 - [3] C. Masoller, Y. Hong, S. Ayad, F. Gustave, S. Barland, A. J. Pons, S. Gomez, and A. Arenas, *Quantifying sudden changes in dynamical systems using symbolic networks*, New J. of Phys. **17**, 023068 (2015).
 - [4] A. Aragonese, L. Carpi, N. Tarasov, D. V. Churkin, M. C. Torrent, C. Masoller, and S. K. Turitsyn, *Unveiling temporal correlations characteristic to phase transition in the intensity of fibre laser radiation*, Phys. Rev. Lett. **116**, 033902 (2016).
 - [5] C. Quintero-Quiroz, J. Tiana-Alsina, J. Roma, M. C. Torrent, and C. Masoller, *Characterizing how complex optical signals emerge from noisy intensity fluctuations*, Sci. Rep. **6**, 37510 (2016).
 - [6] A. Pikovsky, M. Rosenblum and J. Kurths, *Synchronization: A universal concept in nonlinear sciences*, Cambridge University Press (New York, 2001).
 - [7] <https://www.youtube.com/watch?v=nltBQG.IIWQ&feature=youtu.be>