Methods and Applications of Recurrence Microstates Analysis

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'Recurrence plots (RPs) are graphical representations of data in a recurrence space. The numerical representation of this recurrence space can be obtained using a simple binary transformation based on Poincaré recurrence theorem, and it translate any data sequence into a matrix of zeros (non-recurrent) and ones (recurrent) states. These recurrence matrices contain many significant structures (motiffs) that can be quantified. The analysis of these motiffs and other properties from the recurrence matrix are the so called recurrence quantification analysis (RQAs). We have developed in 2018 [1] the so called recurrence microstates, that are squared motiffs from a recurrrence matrix and have calculated several quantifications about the statistics of these recurrence microstates probability. We improved the analysis [2] using the maximum entropy principle to turn the method almost free of parameter selection. Here we will present relevant results of this technique for chaotic, stochastic and real data analysis. Moreover, we show that new quantifiers can be obtained directly from the recurrence microstates. Finally, we present new applications using machine learning algorithms in classification and dimensionality reduction associated with the recurrence microstates technique.

References

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