Statistical test for DCCA cross-correlation coefficient: Delta $\Delta \rho_{DCCA}$ case

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There are a great number of empirical results in many areas of knowledge that show cross-correlations between two non-stationary time series at different levels. However, it is important to have a robust and statistically well-tested tool to measure these cross-correlations, such as the detrended cross-correlation coefficient. Based on the null hypothesis of $\rho_{DCCA}$, a statistical test already exists in order to determine if there is significance in these cross-correlations [1].

Therefore, if we split these time series into two periods, called before/after, we can analyze the difference between the values of $\rho_{DCCA}$ (after-before) and thus measure this new coefficient, defined by $\Delta \rho_{DCCA}(n) = \rho_{DCCA}^{after}(n) - \rho_{DCCA}^{before}(n)$ [2]. But does result have statistical significance? In this work we proposed a statistical test to answer this question. Our test was based on the null hypothesis for $\Delta \rho_{DCCA}$, if the differences are statistically significant then the null hypothesis is rejected. For this test we analyzed simulated and real time series. The results show that the statistical significance of $\Delta \rho_{DCCA}$ depends on the size $N$ and the time scale $n$, and we define a critical value for this dependency $\Delta \rho_c$ at 90%, 95%, and 99% of confidence level. This test will be summarized in a Table, which contains $\Delta \rho_c$ for different $N$ and $n$.
