Dimensional causality

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Causality is one, if not the most fundamental pillars of science. This lecture presents a new method, the Dimensional Causality (DC) method, devised to detect and quantify the probability of four types of causal relationships between two or more time series: independence, direct or circular causal connection, as well as the existence of a hidden common cause. This novel method is based on intrinsic dimension estimates of the joint and separate time delay embeddings of the time series. We validated our method on simulated examples and demonstrate its capabilities on human neuro-electrophysiological measurements. The beautiful information reduction method encapsulates two computational beasts. Data, the sample size is small relative to the dimension. Typical dimensions are 6-10 which would need at least 10^6-10^{10} data points which is in scarcity in practice. The parameter space is also a nightmare, there are five parameters for the method but almost no preliminary information how to choose them.