

Statistical causality and separability of stochastic processes in continuous time

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Abstract. In this paper we consider the statistical concept of causality for continuous-time stochastic processes. This concept unifies the nonlinear Granger causality with some of the related concepts (see [1–3]). This concept of causality is shown to be closely related to the notion of the extremality of measures and the martingale problem (see [4, 5]).

The idea of separability is to make a countable set of time points serve to determine the properties of the process. Sufficient conditions for a stochastic process to be separable are not easily formulated. What we can easily do is to go from one process, which may or may not be separable, to a separable process with the same finite-dimensional distributions.

The main results of this investigation show that separability is directly related to causality concepts. More precisely, we provide necessary conditions, in term of statistical causality, for the σ -algebra and the space $L^p(\Omega, \mathcal{G}_\infty, P)$ to be separable (see [6]). The concept of statistical causality is related to the notion of separability of stochastic processes, especially martingales.

Keywords: Stochastic process; causality; extremal measure; separability.

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