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BAYESIAN INFERENCE IN STOCHASTIC PROCESSES

Bayesian Inference for Dependent Species Sampling Processes

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In different areas of science there is a problem of making inferences from dependent species sampling processes. Species sampling problems naturally arise in ecology and biology, but also in other areas such as genetics, and have shown to be of central relevance in Bayesian nonparametrics. A wide literature has been developed on univariate, exchangeable species sampling models. Yet, in many problems one has multiple processes, for example, in species sampling in different areas or under different conditions, and inference should take into account the actual or probabilistic dependence across them.

Thus, it is of great interest to construct appropriate priors for Bayesian inference for dependent species sampling processes. A powerful way to construct a prior and establish dependence is to use a predictive approach. In this work we start by analysing the construction of dependent prediction rules that generate partially exchangeable processes, extending results of Kingman and Pitman.

However, in some real problems the assumption of partial exchangeability might be too restrictive. Conditional Identity in Distribution (CID) was recently introduced by Berti, Pratelli and Rigo (2004) as a new type of stochastic dependence which generalizes exchangeability. We propose a notion of partially-CID processes as a generalization of a partial exchangeability. The corresponding partially-CID species sampling processes are then analysed, and implications for the construction of priors for Bayesian inference are developed.

Keywords:
Species sampling processes; Bayesian nonparametrics; partial exchangeability; conditionally identically distributed processes.

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