Beta-product dependent Pitman-Yor process prior for Bayesian inference

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Time series data may exhibit clustering over time and, in a multiple time series context, the clustering behavior may differ across the series. This paper is motivated by the Bayesian non-parametric modeling of the dependence between the clustering structures and the distributions of different time series. We follow a Dirichlet process mixture approach and introduce a new class of multivariate dependent Pitman-Yor processes (DPY). The proposed DPY are represented in terms of vector of stick-breaking processes with dependent weights. The weights are beta random vectors that determine different and dependent clustering effects along the dimension of the DPY vector. We discuss some theoretical properties and provide an efficient Monte Carlo Markov Chain algorithm for posterior computation. The effectiveness of the method is illustrated with a simulation study and an application to the United States and the European Union industrial production indexes.

Keywords:
Bayesian non--parametrics; Dirichlet process; Pitman-Yor process;
Stick-breaking Autoregressive process; Time-series nonparametrics.

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