

Clustering dynamics in a class of normalised generalised gamma dependent priors

Matteo Ruggiero^{1,2} · Matteo Sordello³

Received: 27 November 2015 / Revised: 2 August 2016 / Published online: 20 October 2016
© The Institute of Statistical Mathematics, Tokyo 2016

Abstract Normalised generalised gamma processes are random probability measures that induce nonparametric prior distributions widely used in Bayesian statistics, particularly for mixture modelling. We construct a class of dependent normalised generalised gamma priors induced by a stationary population model of Moran type, which exploits a generalised Pólya urn scheme associated with the prior. We study the asymptotic scaling for the dynamics of the number of clusters in the sample, which in turn provides a dynamic measure of diversity in the underlying population. The limit is formalised to be a positive non-stationary diffusion process which falls outside well-known families, with unbounded drift and an entrance boundary at the origin. We also introduce a new class of stationary positive diffusions, whose invariant measures are explicit and have power law tails, which approximate weakly the scaling limit.

Keywords Alpha diversity · Bayesian nonparametrics · Dependent process · Diffusion process · Generalised Pólya urn · Moran model · Scaling limit

The first author is supported by the European Research Council (ERC) through StG “N-BNP” 306406.

✉ Matteo Ruggiero
matteo.ruggiero@unito.it

Matteo Sordello
sordello@wharton.upenn.edu

¹ University of Torino, Corso Unione Sovietica 218/bis, 10134 Torino, Italy

² Collegio Carlo Alberto, Via Real Collegio 30, 10024 Moncalieri, TO, Italy

³ The Wharton School, University of Pennsylvania, 3730 Walnut St, Philadelphia, PA 19104, USA