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SPECIAL ISSUE: BAYESIAN INFERENCE AND STOCHASTIC COMPUTATION

Bayesian nonparametric modeling for functional analysis of variance

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Abstract Analysis of variance is a standard statistical modeling approach for comparing populations. The functional analysis setting envisions that mean functions are associated with the populations, customarily modeled using basis representations, and seeks to compare them. Here, we adopt the modeling approach of functions as realizations of stochastic processes. We extend the Gaussian process version to allow nonparametric specifications using Dirichlet process mixing. Several metrics are introduced for comparison of populations. Then we introduce a hierarchical Dirichlet process model which enables comparison of the population *distributions*, either directly or through functionals of interest using the foregoing metrics. The modeling is extended to allow us to switch the sampling scheme. There are still population level distributions but now we sample at levels of the functions, obtaining observations from potentially different individuals at different levels. We illustrate with both simulated data and a dataset of temperature versus depth measurements at different locations in the Atlantic Ocean.

Keywords Dirichlet processes · Gaussian processes · Global and local clustering · Hierarchical models · Random distributions