BAYESIAN FLEXIBLE MODELING FOR FAMILIES OF RANDOM DENSITIES

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Abstract

In this talk, we discuss inference for families of random densities by combining concepts and methods from bayesian nonparametrics and functional data analysis. We start by fitting a Bayesian nonparametric version of a model by Kneip and Utikal, where the curves of interest are themselves densities, and the Karhunen–Loève decomposition is used to link all members of a family of densities $\{f_k\}_{k=1}^K$ through principal components. The main motivation for using Bayesian nonparametric inference here goes beyond the standard argument of modeling flexibility and robustness against misspecification. Indeed, as posed by one of the discussants

"*The covariance method for estimating the spectrum of the covariance operator is naturally motivated when the observed densities are considered to be a sample of random functions. This motivation is lost in the nonrandom situation considered by Kneip and Utikal*" - Chiou and Müller.

However, since on the Bayesian nonparametric setting densities are themselves random, such conceptual concern disappears. Simulations and application to Galton's data will be shown.

Throughout the talk, we will also explore a second advantage to regarding random densities as functional data analysis objects, and we advocate that functional box plots are natural for visualizing and summarizing posterior densities trajectories, as an alternative–or at lest as a companion–to mainstream credible band plots.

References

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