

# On Confidence Bands in Functional data - The Bootstrap or Gaussian Kinematic formula?

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In this talk we explain advantages and disadvantages of using the Gaussian Kinematic Formula (GKF) over some bootstrap methods for construction of simultaneous confidence bands (SCB) of the mean function in functional data. The GKF as introduced by Jonathan Taylor can be used to approximate the distribution of the maximum of Gaussian related processes for large thresholds. One of the main results of this talk will be an error bound on the asymptotical coverage rate of SCBs constructed using the GKF, which basically requires only a functional CLT for the estimator of the mean function and some regularity assumptions on the limiting process. We discuss how this ideas can be extended to discretely observed functional processes contaminated by observation noise. Here we build on ideas of Chaudhuri and Marron, who introduced Scale Spaces for curve estimation in the early 2000's.

The theoretical discussion will be accompanied by some simulation studies comparing SCBs from the GKF with methods from the literature and we will discuss, when to use the GKF and when to rely on the bootstrap from a practitioner point of view. An application to DTI fibers and future applications to fMRI, especially confidence bands for Signal to Noise Ratios, are presented as well.