

**University of California, Irvine
Statistics Seminar**

***Testing Homogeneity for Independent Functional Data: The
Trouble with Sparse Functional Data***

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Functional data are random functions on an interval, e.g. $[0, 1]$, hence they can be viewed as stochastic processes. They have become increasingly common due to advances in modern technology to collect and store such data. In reality these random functions can only be measured at discrete time grids and the measurement schedule may vary among subjects. Depending on the sampling frequency, functional data are collected either intensively or sparsely, which affects both methodology and theory. Furthermore, the data may contain noise, a.k.a. measurement errors. Among the various sampling plans, sparsely observed functional data that feature only a few measurements per subject are the most challenging to deal with, both in methodology and theory. Such sparsely observed functional data are ubiquitous in longitudinal studies and require special handling. Although the challenges for mean and covariance estimation and many regression settings have been overcome for such sparse functional data, testing the equality of distributions, a.k.a. homogeneity test, between two independent samples of functional data will be shown not to be feasible for sparse functional data. Instead, we demonstrate that a test of marginal homogeneity, i.e., that the marginal distributions are the same among the independent samples for all time points t , is attainable for sparse functional data. The pros and cons of this marginal approach will be discussed and also an interesting phenomenon associated with this approach. Both theory and numerical results will be presented.