On data depth in infinite dimensional spaces

Anirvan Chakraborty · Probal Chaudhuri

Abstract The concept of data depth leads to a center-outward ordering of multivariate data, and it has been effectively used for developing various data analytic tools. While different notions of depth were originally developed for finite dimensional data, there have been some recent attempts to develop depth functions for data in infinite dimensional spaces. In this paper, we consider some notions of depth in infinite dimensional spaces and study their properties under various stochastic models. Our analysis shows that some of the depth functions available in the literature have degenerate behaviour for some commonly used probability distributions in infinite dimensional spaces of sequences and functions. As a consequence, they are not very useful for the analysis of data satisfying such infinite dimensional probability models. However, some modified versions of those depth functions as well as an infinite dimensional extension of the spatial depth do not suffer from such degeneracy and can be conveniently used for analyzing infinite dimensional data.