

From Depth to Local Depth : A Focus on Centrality

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Aiming at analysing multimodal or non-convexly supported distributions through data depth, we introduce a local extension of depth. Our construction is obtained by conditioning the distribution to appropriate depth-based neighborhoods, and has the advantages, among others, to maintain affine-invariance and to apply to all depths in a generic way. Most importantly, unlike their competitors, that (for extreme localization) rather measure probability mass, the resulting *local depths* focus on centrality and remain of a genuine depth nature at any locality level. We derive their main properties, establish consistency of their sample versions, and study their behavior under extreme localization. We present two applications of the proposed local depth (for classification and for symmetry testing), and we extend our construction to the regression and functional depth contexts. Throughout, we illustrate the results on some, artificial and real, univariate and multivariate data sets.

Key Words: Statistical depth functions, multimodality, non-convex support, symmetrization