Nonparametric inference on shape spaces

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Abstract: The statistical analysis of shape distributions based on random samples is important in many areas such as morphometry, medical diagnostics, and machine vision. To measure the shape of an object, one may pick a suitable ordered set of k points or landmarks called k-ad on a two or three dimensional image of the object under consideration. The equivalence class of the k-ad identified modulo size and Euclidean motions of translation and rotation is called its similarity shape. This shape space can be given a metric tensor and hence a geodesic distance making it a Riemannian manifold. Thus, statistical analysis tools developed on general manifolds can be applied to estimate shape parameters and compare different shape distributions. Another notion of shape is the projective shape of a k-ad which is particularly appropriate in machine vision. This shape space consists of equivalence classes of k-ads invariant under all projective transformations. In this poster, I present certain recent methodologies and some new results for the statistical analysis of probability distributions on manifolds and apply them to the shape spaces.