Nonparametric Inference for Spaces of Shapes

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Abstract: Given a finite number k of landmarks or positions on an object, the so-called k-ads, one may record the shape or image of an object whether the object is viewed in a two-dimensional section or projection, or in $3D$. The equivalence class of a k-ad invariant under translation and rigid body rotation is its size and shape, and when size is also scaled out, one obtains the shape of the k-ad. The space of k-ads is then a (Riemannian) manifold on which one can measure appropriate distances, etc. We consider nonparametric statistical inference for discriminating among different shape distributions for purposes of medical diagnostics, morphometrics, etc. Ideas on multivariate analysis and time series analysis on such non-Euclidean spaces are also presented. For $3D$ similarity (or, reflection-) shapes of k-ads, a recent methodology is presented.

A second topic for statistical inference we consider involves another notion of shape for k-ads, namely, projective shape, which is particularly appropriate in machine vision.

This talk is based on joint work with Vic Patrangenaru and Abhishek Bhattacharya.