Intrinsic Shape Analysis

Thomas Hotz

Institut für mathematische Stochastik
Georg-August-Universität Göttingen
e-mail: hotz@math.uni-goettingen.de

Two geometrical objects are said to have the same *shape* if they are identical up to a similarity transform. We are interested in statistically analysing shapes where we view the set of these equivalence classes as a metric space with a natural topology and metric. *Extrinsic* shape analysis applies classical multivariate analysis by a suitable embedding in a Euclidean space, often projecting to the tangent space at some *mean shape*. We will discuss the drawbacks of this approach if the statistical descriptors of the dataset cannot be well represented in a single tangent space. Recently, *intrinsic* methods have been developed which do not require such an embedding. We will present two such approaches: *prinicipal components geodesics* as an intrinsic generalisation of PCA, as well as *intrinsic MANOVA*. The difficulties faced by intrinsic analyses, and in fact by shape analysis in general, will be highlighted.