Minimax properties of Fréchet means in deformable models for curve registration and image warping

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In this talk, we propose to study the problem of estimating a mean pattern from a set of similar curves or images. In the setting where the variability in the data is due to random deformations in space and additive noise, this problem requires to define non-Euclidean distances by using the action of a Lie group on an infinite dimensional space of curves or images. This approach leads to the construction of estimators based on the notion of Fréchet mean which is a generalization of the standard notion of barycenter to non-Euclidean spaces. A recent research direction in nonparametric statistics is the study of the properties of the Fréchet mean in deformable models, and the development of consistent estimators of a mean shape. Using such models, we propose to show the links that exist between minimax theory in nonparametric statistics, inverse problems and the analysis of high-dimensional data for the purpose of estimating a mean pattern from a sequence of curves or images. We will also highlight the connection between our approach and the well know problems of curve registration and image warping.