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Statistical Frameworks for Variable Selection with 3D Shapes and High-Resolution Imaging

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ABSTRACT

The recent curation of large-scale databases with 3D surface scans of shapes has motivated the development of tools that better detect global patterns in morphological variation. Studies which focus on identifying differences between shapes have been limited to simple pairwise comparisons and rely on pre-specified landmarks (that are often known). In this talk, we present SINATRA: a statistical pipeline for analyzing collections of shapes without requiring any correspondences. Our method takes in two classes of shapes and highlights the physical features that best describe the variation between them. We develop a rigorous simulation framework to assess our approach, which themselves are a novel contribution to 3D image and shape analyses. Lastly, as case studies, we use SINATRA to (1) analyze mandibular molars from four different suborders of primates and (2) facilitate the visual identification of biophysical signatures differentiating between two protein structure ensembles derived from molecular dynamics simulations.

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