AbstractID: 3874 Title: On constructing priors and likelihoods for deformable shape models

Purpose: Explicit deformable shape models (DSMs) can be used in a Bayesian statistical framework to provide *a priori* information for posterior optimization to match the DSM against a target image for automatic segmentation. In this approach a DSM is initialized in the target image and undergoes a series of deformations to closely match the target object. Deformation is driven by optimizing an objective function with terms for geometric typicality (prior) and model-to-image match (likelihood). The purpose of this work was to develop strategy, methodology, and tools for constructing the geometric prior and intensity likelihood for a particular form of DSM called m-reps.

Method and Materials: Geometric truth is defined for an object of interest by a statistically significant collection of expert human segmentations of training images. M-reps are fit to the human drawn contours by minimizing the distance between the surfaces of the m-rep and the contours under added conditions that lead to positional correspondence across training cases. The geometry of the resulting set of training m-reps is analyzed in non-Euclidean space using an approach called principal geodesic analysis (PGA) to yield a set of eigenmodes that define the geometric prior. The intensity likelihood is constructed by registering each training m-rep with the corresponding gray scale image and collecting regional intensity information that is statistically characterized over all training cases. The intensity information can be in several forms including linear profiles and regional histograms.

Results: PGA produces modes that include natural deformations such as local twisting, bending, bulging, and constricting. Unlike analysis in Euclidean space, improper shapes are avoided. The form of the intensity prior can be customized to each object of interest for optimal performance.

Conclusion: These methods are powerful, robust and generalizable to other DSMs.

Conflict of Interest: **The presenting author has a financial interest in Morphormics, Inc.**