



# Statistics of Object Shape and Their Use in Segmentation and Registration

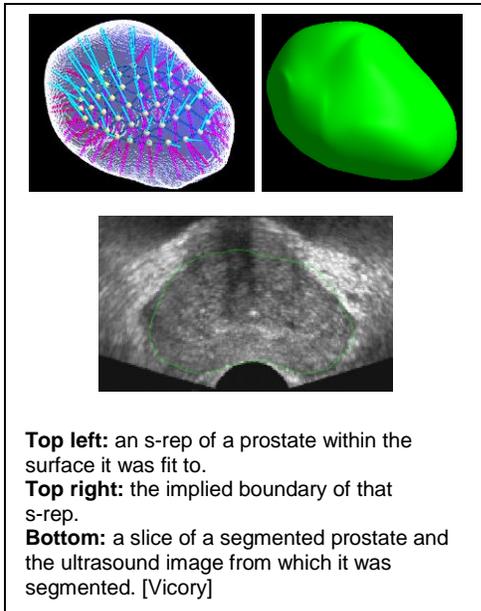
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## S-rep Fitting and Statistics

- Production and open web distribution of i) software to fit the powerful skeletal object representation called *s-reps* to data on object descriptions from medical image; ii) statistics software to generate probability distributions from *s-reps*, train and execute classification between 2 classes of *s-reps*, and do hypothesis testing on geometric differences between 2 classes of *s-reps*.



**Top left:** an *s-rep* of a prostate within the surface it was fit to.  
**Top right:** the implied boundary of that *s-rep*.  
**Bottom:** a slice of a segmented prostate and the ultrasound image from which it was segmented. [Vicory]

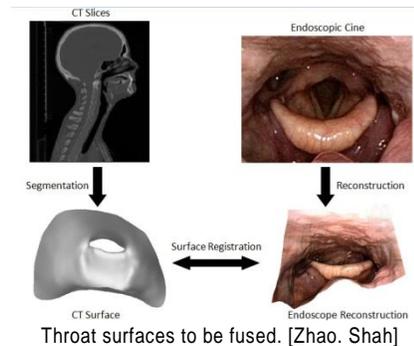
- Classification of schizophrenic vs. normal hippocampi based on shape.
- Comparisons of statistics on *s-reps* to statistics on alternative object representations.
- Development of methods to statistically characterize the shape of an object in the context of neighboring objects.
- Comparison of an individual's manual segmentation with those of others, for training.
- Improving interior point correspondence across a family of *s-reps*.
- Producing smooth manual segmentations from sparse slice contours.

## Segmentation

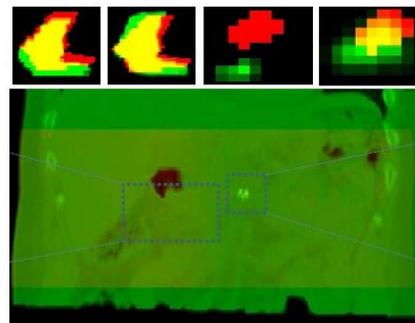
Segmentation of the prostate from trans-rectal 3D ultrasound, given that prostate's shape in MRI. This research involves shape spaces on *s-rep* differences, appearance models based on regional texture, and geometry-to-image match measures based on each voxel's probability of being inside the object.

## Registration

- Fusion of throat tumor image information from endoscopic cines and CT.



- 3D registration of 2D projection snapshots during respiration with 3D planning images. Applications in radiographs vs. CT of the abdomen and of the lung; in MRI projections vs. MRI in the abdomen.



Top left 2: Duodenum slice pre and post registration. Top right 2: same for a fiducial marker injected in the pancreas. Bottom: abdominal CT slice with yellow showing regions of good registration and red and green showing unregistered places. [Zhao]

**Participating Departments:** Computer Science, Biomedical Engineering, Statistics, Mathematics, Radiation Oncology, Neuroscience

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