AbstractID: 7262 Title: A method for defining segmentation surfaces using nonparallel contours

Purpose: Segmentation of anatomical structures from CT images for treatment planning has typically involved the process of manual delineation of contours on image slices. However, the original image slices are not always the best planes that allow accurate delineation of structures, and as a result, software tools that permit drawing of contours on oblique or even non-parallel planes are gradually becoming available. Unfortunately, what is missing still is the accompanying computational method for extracting surfaces from such contours. We investigate a novel approach for automatically generating a triangular surface mesh from contour lines defined on arbitrary, possibly intersecting planes.

Method and Materials: Using contour delineation programs, we first obtain the defining equations of each contour plane as well as contour line segments delineated on each plane. The contour planes partition the entire space into convex sub-spaces. We compute a surface mesh within each subspace by extending our previously developed method for surface extraction from contours defined on two parallel planes. The entire surface is then constructed by merging surfaces within each subspace. Finally, a normal smoothing step is employed to fair the appearance of the surface. This has been implemented in CERR.

Results: Testing the initial implementation on synthetic data reveals that our method is capable of extracting smooth, water-tight surface meshes from complex contour curves with arbitrary shape (e.g., either convex or non-convex) and arbitrary topology (e.g., consisting of either a single loop or multiple loops) that reside on arbitrarily oriented planes.

Conclusion: We have developed a novel computational approach for extracting surfaces from contours delineated on planes that may have non-uniform spacing and may have arbitrary orientations. Our method meets the critical need for segmentation of anatomical structures in treatment planning systems using contours delineated from oblique or non-parallel planes.