AbstractID: 6999 Title: Three Dimensional Vessel Centerline Reconstruction and Imaging System Calibration from a Single Vessel in Angiograms

Purpose
Three dimensional (3D) vessel reconstructions can be useful in assisting clinicians with diagnosing and treating vascular disease, providing information about vessel diameter, length, and tortuosity. Reconstruction of 3D vessels from two views requires knowledge or calibration of the geometry relating the two imaging systems. We introduce a geometry calibration technique that performs this calibration using only a single indicated vessel segment in the angiograms.

Methods
Vessel segments of interest were indicated in two angiographic views. The initial imaging geometry is estimated using each view's gantry information, and corresponding points along the vessels in both views are determined using epipolar constraints. The 3D position of the vessel is determined by triangulation of the found corresponding points. The geometry is corrected by varying nine of the imaging system's parameters using the Nelder-Mead Downhill Simplex Method, with an objective function that minimizes the distance between the reprojection of the reconstructed 3D vessel centerlines and the 2D indicated vessel centerlines in both views. Results were compared with the enhanced-Metz-Fencil (EMF) geometry correction technique, which requires identification of additional corresponding points in both views.

Results
Variations in the shapes obtained from our single vessel technique (SVT) and the EMF were comparable, median RMS of 0.47 and 0.34 mm, respectively, with magnification variations of 2.2% and 0.7%, respectively. Median errors in 2D reprojections of the 3D data for our technique and the EMF were both 0.12 mm, indicating very good agreement with the 2D indicated centerlines.

Conclusion
We have developed an imaging geometry correction technique for two views based on alignment of reprojected 3D data with its respective 2D image information using only a single indicated vessel segment. This technique is reliable and comparable to other geometry correction techniques requiring additional user input.

Supported by NIH grant #HL52567 and Toshiba Medical Systems Corporation