Summary:

Measurement of stenosis from magnetic resonance angiography using vessel skeletons

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Stenosis, or narrowing of the lumen of the carotid artery is correlated with the risk of stroke and is used clinically for therapy planning. Measurement of stenosis from magnetic resonance angiography (MRA) are made based on retrospective projection images. However, such measurements do not take full advantage of the three dimensional nature of the MRA. We present a deformable model for reconstructing the surface of the carotid artery from contrast-enhanced MRA. The model, which is based on an initial estimate of the medial axis of the vessel, has no bias towards producing either smaller or larger-diameter vessels. Thus, it is appropriate for the measurement of stenosis.

The deformable model is based on a cylindrical coordinate system of a curvilinear axes. In this coordinate system, the location of each point on the surface of the deformable model is described by its axial, circumferential and radial position. The points on the surface deform in the radial direction so as to minimize discontinuity in radial position between adjacent points while maximizing the proximity of the surface to local edges in the image. Axes of the vessels are indicated manually or determined by axes detection methods.

We suggest alternative methods of evaluating vessel shape based on the surface reconstruction including the application to computational fluid dynamics.