

AbstractID: 1758 Title: Statistical Properties of MIP Images Generated from MRA Images Processed with Vessel Enhancement Filters

Multi-scale 3D vessel enhancement filtering using the Hessian matrix may improve visualization of vessels in the MIP images. The eigenvalues of the matrix can be used to describe the magnitude and anisotropic characteristics of the curvature, thus potentially differentiating vessel from background. Using 14 3D TOF MRA images, we evaluated the MIP characteristics of two multi-scale Hessian based filters as well as the performance of the unfiltered images. Images were convolved with kernels generated from zero, first, and second order derivatives of Gaussians at increasing scales. The eigenvalues of the Hessian matrix were computed at each point for each scale. An operator classified 490,256 voxels throughout the volumes as large, medium or small vessel; aneurysm; and background. Filter values were computed using the sampled eigenvalues and the maximum value across the scales was selected at each voxel. MIP images were simulated by repeatedly selecting random samples of different sizes (different projection thickness) and then selecting the maximum value. Performance was assessed based on the SDNR and contrast in the MIP images. The MIP SDNR and contrast versus projection thickness behaved differently for the filtered and unfiltered data. Large and medium vessel SDNR leveled off for the original but peaked at small thickness for the filtered data. Small vessel SDNR decreased with thickness for filtered and original data. SDNR enhancement was most noticeable for small vessels. Contrast decreased steadily with thickness for all data. For typical axial projection thicknesses, the filters provide MIP vessel contrast enhancement.