Medical Image Segmentation and its Applications

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Background and Aim :Magnetic Resonance Angiography (MRA) is increasingly used to provide volumetric information of vascular system. Accurate assessment of MRA images requires that the vessel structures be extracted from MRA data sets. Patient specific computerized 3D model of vascular has important applications in augmented realty based navigation for intervention and biopsy. While evolutionary schemes based on the level set theory have proved to be effective tools for vessel segmentation [1] in high field MRA images, with current developments of lower field interventional MR scanners, they need to be robust in the presence of higher noise levels. One typical observation in level set based methods concerns with damaged intensity information of thin vessels that causes the evolution to stop before extracting the whole vessel. Targeted at such applications, in this paper, based on the natural continuity of vessel we introduce a shape prior which can be useful for vessel segmentation and can produce elongated structures. In fact, as the evolution may stop to maturely extract the vessel, segmented structures will have some elongations. We use this "shape-induced" directional information to propagate the surface. In that case our prior model will force the surface to expand anisotropicaly so that it can pass over small noise speckles.
Methods For a hypothetical evolving implicit surface, a new local shape measure is introduced, that is minimized whenever the implicit surface resembles a cylinder locally. Using this shape prior we define a new functional, which its minimization yields an anisotropic propagation term toward surface features.
Results: Our method combines geometrical and image content information. The geometry is captured using the signed distance transform of the evolving surface and is useful to improve the continuity of vessels. Though accurate comparison with other segmentation methods requires access to the same data sets, initial results are very encouraging. Validation using images obtained from higher field MR scanners stays as our future research plan.