AbstractID: 4348 Title: A Fast Pseudo-1D Active Contour for Medical Image Segmentation

Purpose:
A snake (active contour) is a deformable curve used in medical image processing to localize region boundaries. The time required for snake convergence to a solution is lengthened by increased data set size and complex external energy field computations. A new gradient vector flow (GVF) snake algorithm was developed to increase the convergence speed of the conventional GVF snake algorithm.

Method and Materials:
The new algorithm reformulates a 2D closed curve to a pseudo-1D open curve. This transformation reduces the solution search space and the area for external energy field computation. Further, curve deformations are restricted to one dimension, thus reducing the complexity for both deformation and external field computation. A binary 512x512 test image was created and the algorithms were run using each of three initializations. Additionally, both algorithms were applied to a 512x512 thoracic CT section.

Results:
The new algorithm, on average, converged to a solution for the binary image in 11.1s compared with 14.6s for the conventional algorithm (24% improvement). The greatest gains were seen in the GVF calculation where the mean reduction in time for GVF calculation alone was 2.9s (32% improvement). The time for contour fitting was also consistently decreased, with a mean reduction for fitting of 0.6s (11% improvement). The new algorithm on average converged to a solution for the CT section in 4.01s compared with 7.15s for the conventional algorithm (44% improvement). Area-of-overlap measures for the contours generated by both algorithms exceeded 0.97 for both binary and CT test images.

Conclusion:
A new active contour algorithm was developed, and a consistent speed improvement over the conventional algorithm was measured. This new algorithm is compatible with other optimization techniques and shows potential for processing large medical image data sets.

Conflict of Interest (only if applicable):
S.G.A shareholder R2 Technology, Inc.