CSSI Element: High-Performance Workflow Primitives for Image Registration and Segmentation

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Project goals: Provide sustainable software infrastructure for medical and biological research benefiting from high-performance image processing for ill-posed problems

- Development of high-performance libraries for image registration and segmentation algorithms (libkaze and Plastimatch)

Recent Accomplishments:

- Development of a general mathematical framework that accommodates *analytical regularizers*: diffusion, curvature, linear elastic, third-order, and total displacement
- Multi-core implementations of analytical regularizers
  - Up to two orders of magnitude speedup than central-differencing based numerical solutions
- Development of *multi-atlas segmentation pipeline*, building on Pastimatch's high-performance deformable registration libraries
  - Decide optimal registration and fusion strategies using multiple atlases
  - Segment the query image against the atlas, based on best registration strategy and the fusion parameters

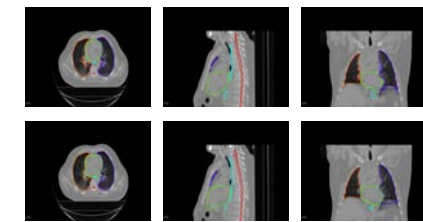**Plastimatch** is open source software for high-performance image computing

- B-spline method for deformable image registration (GPU and multicore accelerated) for CT, MRI, and PET
- Analytic regularization for B-spline registration
- Multi-atlas segmentation
- FDK cone-beam CT reconstruction (GPU and multicore accelerated)
- Plugin to 3D Slicer

Deformable registration

Reconstruction

Segmentation

www.plastimatch.org   www.libkaze.com