Mini Checkpoint

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Project 7

Semi-Automated Segmentation of MRI

Mentors:
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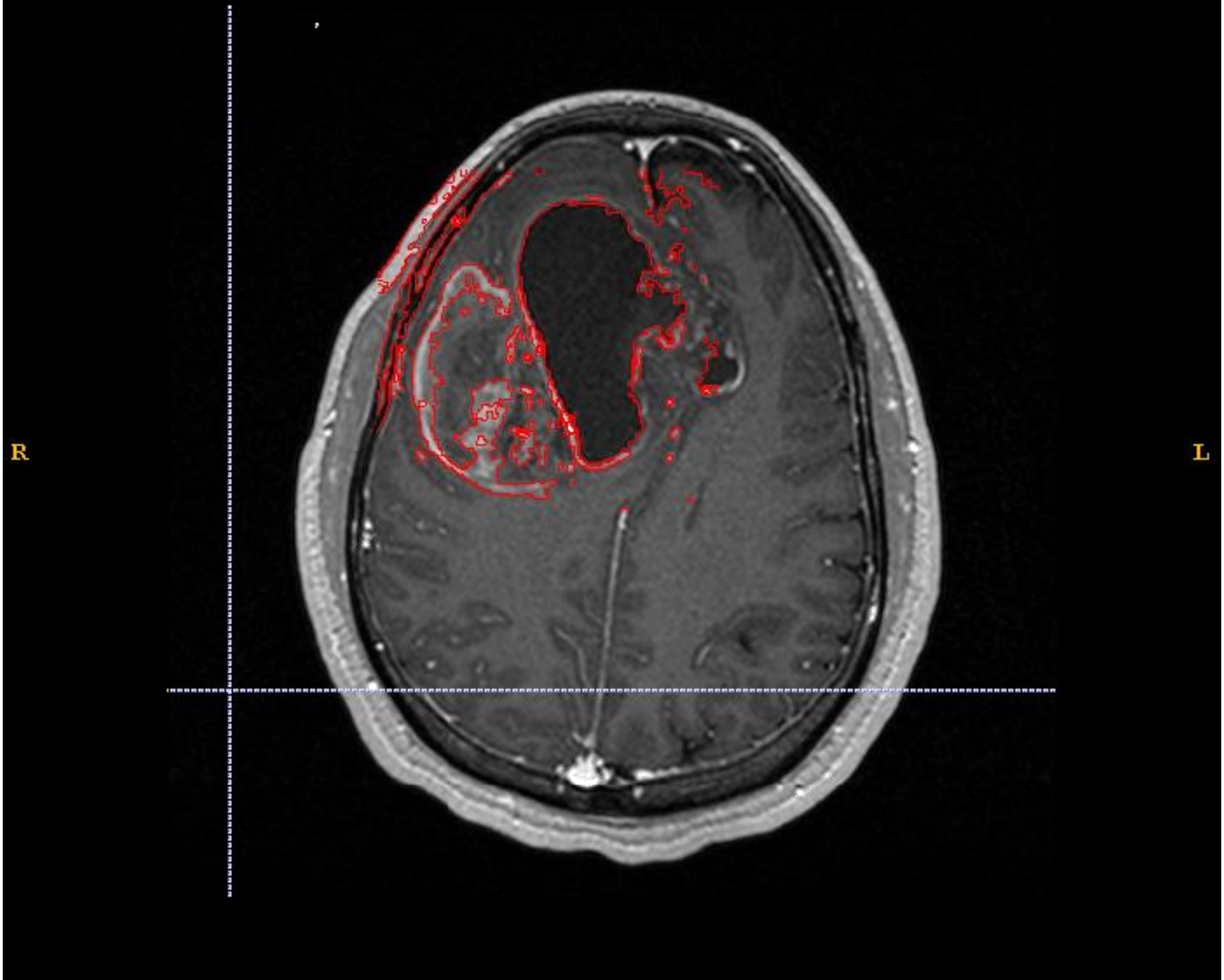
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The Viscous Watershed Transform

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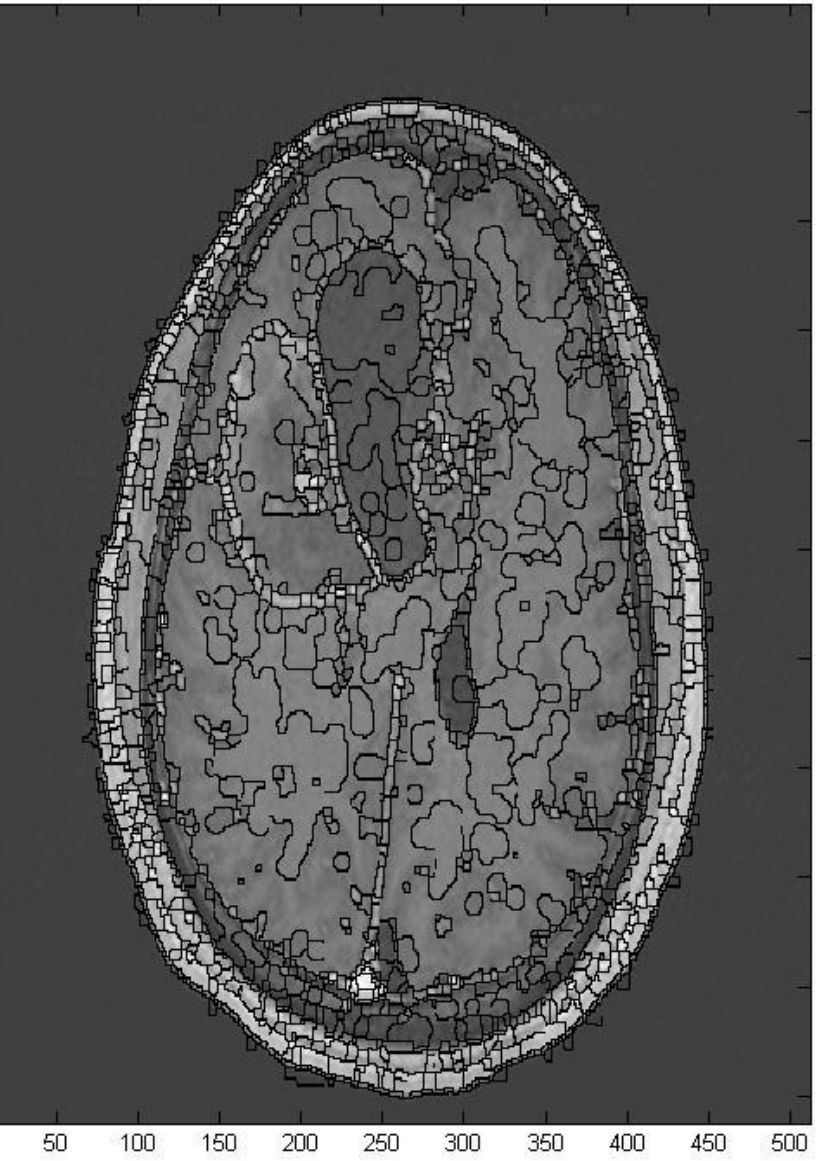
Abstract

The watershed transform is a fundamental operator developed by mathematical morphology for image segmentation. It is based on an analogy comparing images to topographic relief where contours are defined as the points of meeting of water in a scenario of flood of the relief. The watershed transform has some great qualities: first it is powerful in many applications ; second, it is nonparametric ; thirdly, it leads to a very efficient computation method. On the other hand of the nonparametric aspect, the transformation suffers from a low robustness what results in significant fluctuations of the segmentation when contours are blurred or noisy... In order to introduce geometrical constraints of regularization into algorithms of segmentation based on watershed, two options are possible. The first consists in simulating a viscous flood for the construction of the watershed line. The second consists in calculating the watershed on a regularized relief. In this article, the second alternative is selected. It is suggested to modify the relief so that its non viscous flood is equivalent to the viscous flood of the original relief. This choice makes it possible to separate clearly the smoothing procedure from the strict calculation of the watershed and thus to preserve the qualities and speed of the standard watershed transform. The results obtained by our regularization method are illustrated and discussed on very diverse examples.

Viscous Watershed

- Essentially generating borders using same gradient magnitude image
- Simulates viscous fluid flow instead of normal fluid flow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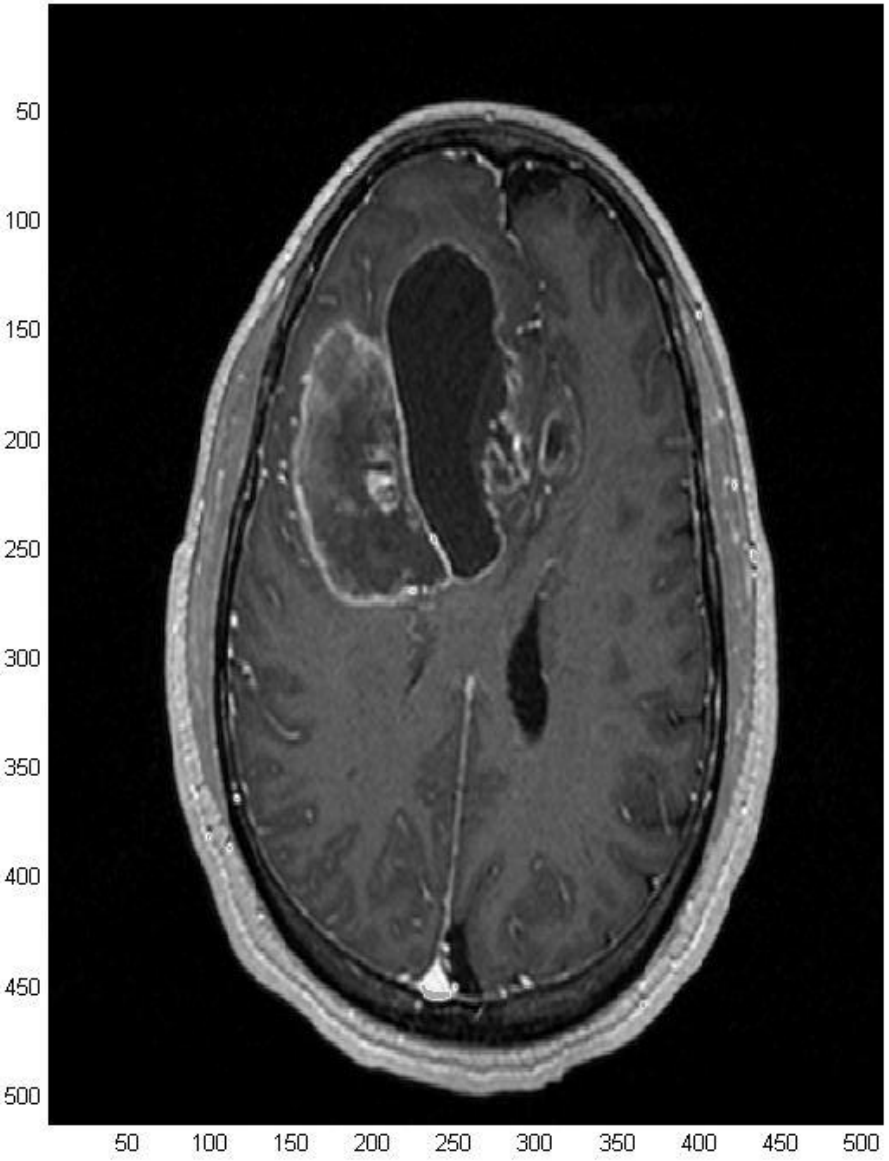
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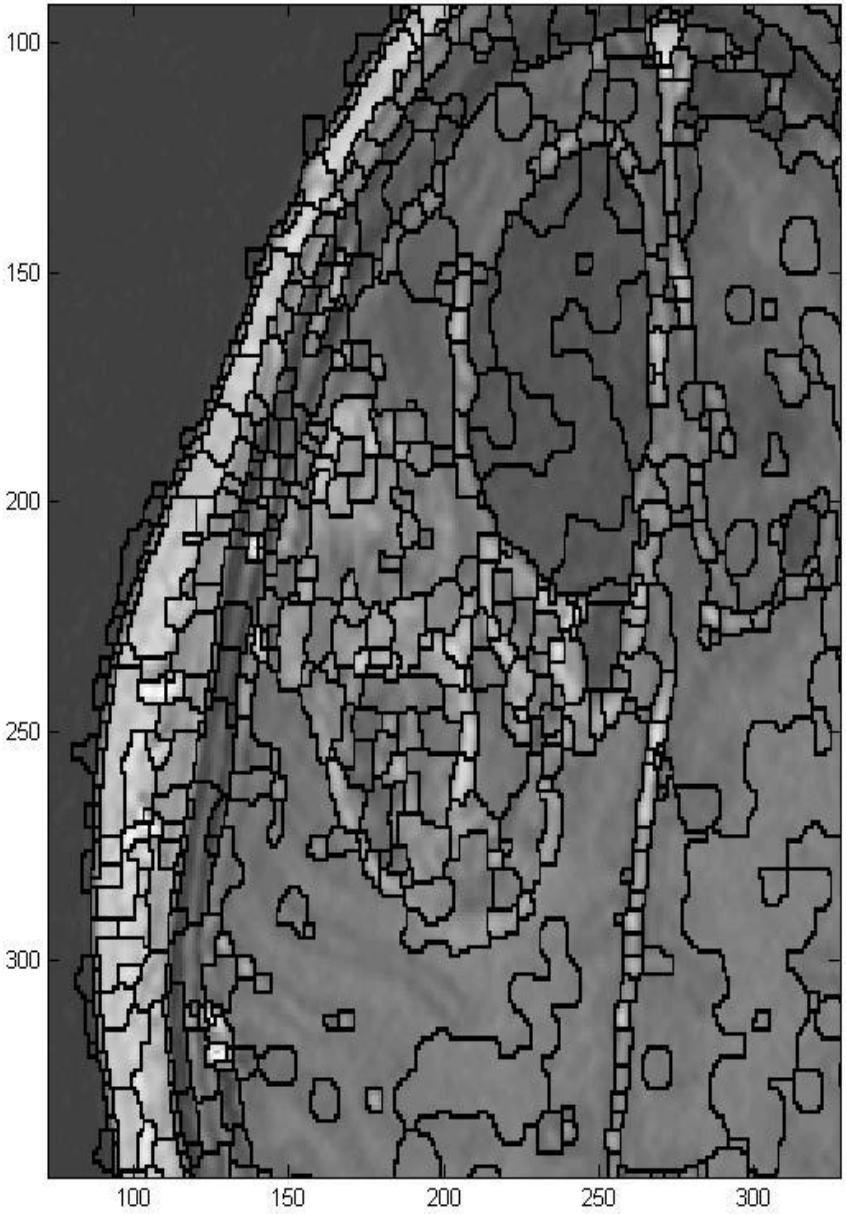
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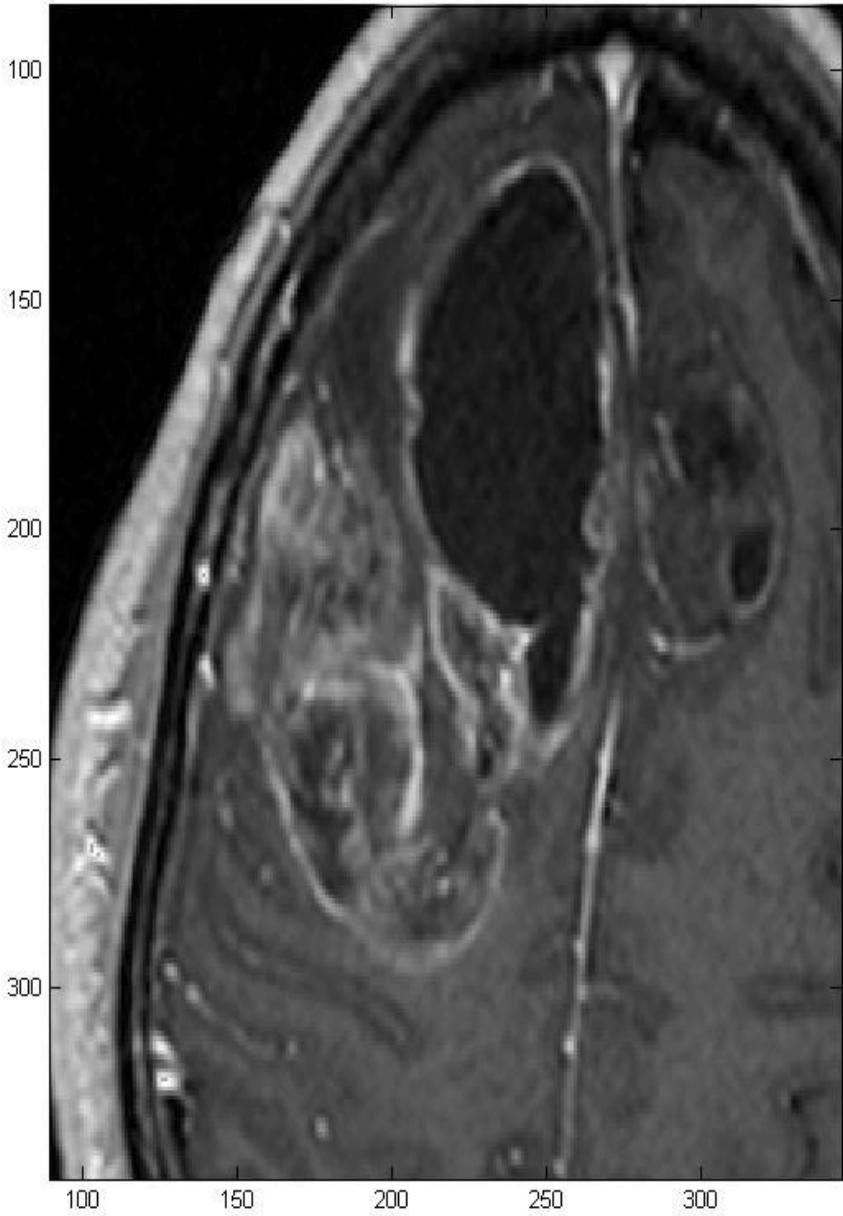
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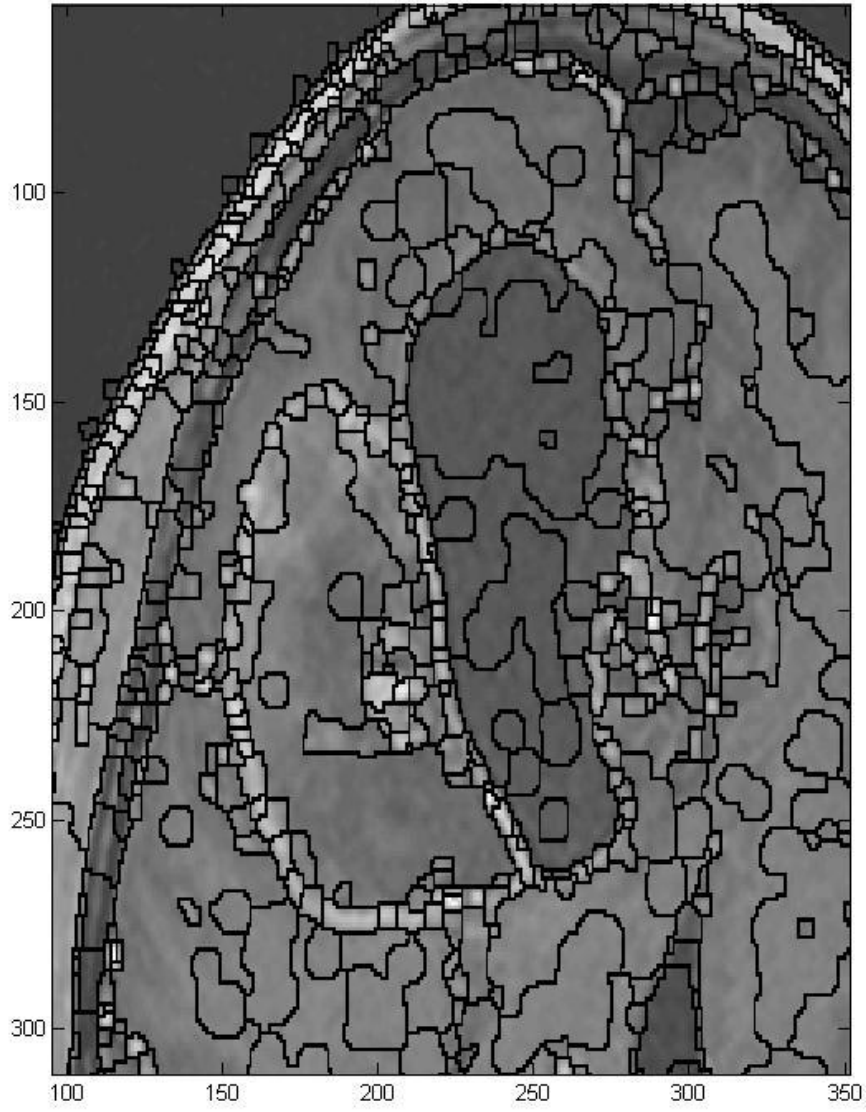
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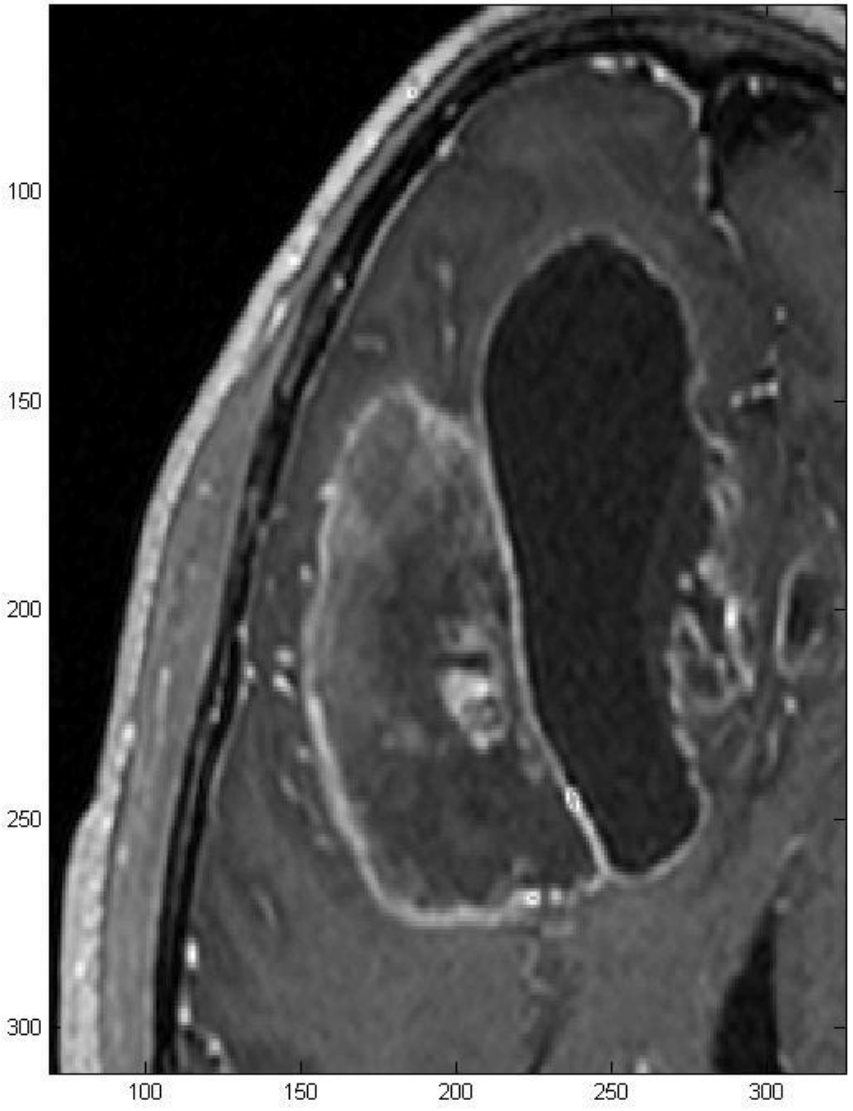
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Current Status

- Coding Progress
  - Currently implemented in MATLAB
  - A few bugs to work out in C++
- Main Differences
  - Problem of over-segmentation returns for borders
  - Possibly slower (in MATLAB)

Progress

- **Expected:**
  - Improved Watershed Implementation
  - Perform segmentations on simulated datasets
  - Algorithm Documentation

Progress

- **Maximum:**
  - Test variability and accuracy of the program
  - Investigate inter/intra-observer variability

New Deliverables

- Expected:
  - Investigate Effectiveness
    - Residents will segment on real datasets, count failures before/after viscous watershed
  - Complete C++ implementation
- Maximum:
  - Publish Implementation + Documentation (Insight Journal)