Semi-automatic Segmentation of MRI
Project Update

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Mentors:
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Goals

• Make tool for volumetric quantification of glioblastoma multiforme (GBM)
  – Must be fast and accurate before it will be adopted

• Validate tool on patient data
How does this help?

• More accurate variables to judge treatment efficacy

• Future Benefits
  – Volumetric progression tracking
  – Improved radiotherapy targeting and evaluation
  – Adaptable to similar segmentation problems
Interactive Watershed Transform

Edge Detector (Gradient/Sobel/...)

Watershed Transform

Region Merging

User Labeling
Interactive Watershed Transform

Region Merging

Merge neighbors with minimum mean difference
Interactive Watershed Transform

Region Merging

Merge neighbors with minimum mean difference
Interactive Watershed Transform

Stopping Criterion

• Don’t merge beyond a specified mean difference

• Potential Alternatives
  – Regional dynamics
  – Statistical hypothesis testing
    • Gaussian mixture to model object signal
Algorithm UI

• Point-to-click user interface
  – Minimal training; adaptable to touch interfaces
• ITK-Snap application framework
  – Simple user interface
  – Direct ITK integration
Interactive Watershed Transform

Demonstration
Current Prototype

• ITK filters written in C++
  – Complies with existing documentation
• Hacked into InsightSNAP
• Shortcomings
  – Gaps in the tumor boundary
  – No shape detection
    • A priori shape information may not be robust enough
Work In Progress

- Viscous Watershed
Work In Progress

• Viscous Watershed

Progress Update

• **Minimum:**
  – Implement a 2D watershed algorithm in ITK

• **Expected:**
  – Integrate algorithm into ITK-SNAP
  – Test variability and accuracy of the program
  – Perform segmentations on simulated datasets

• **Maximum:**
  – Implement 3D watershed algorithm in ITK
  – Test variability and accuracy of the program
  – Perform segmentations on simulated datasets
  – Investigate inter/intra-observer variability
Plan Updates

• Continue concurrent development
• Meetings as needed with Dr. Alfredo Quiñones-Hinojosa for consultation on software features and (retrospective) patient database access
Dependency Updates

• People
  – Neurosurgical residents for validation study
    • Have become familiar with user interface
    • Awaiting final algorithm
  – Dr. Hadie Adams
    • Weekly teleconference
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Progress Update

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

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