miAnnotation: An Open Source Software Tool for Annotating Medical Images

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May 2010
Symptom

70 Years Old, Chest Pain

http://www.medicinenet.com/
Diagnosing Patients

http://www.medicinenet.com/
CT Angiography Images
Disease Detection

more objective and effective
The Question

- To improve diagnosis and treatment, images need to be properly annotated and important features need to be measured.
- The questions is: what is the best way to do that?

http://www.medicinenet.com/
Goal

Received a subcontract by Harvard Medical School funded through the NIH (ARRA Suplement to P41RR013218) to develop an annotation tool for medical images that is

- Free open source
- Platform independent
- Functionality similar to commercial systems
3D Slicer

- a multi-platform, free open source software for exploring novel **image analysis** and **visualization** techniques.
- consists of more than over a million lines of code, mostly **C++**, 250 active developer, 5K downloads in 2009.
- has extensive **algorithmic** and visualization functionality.
- a research platform and NOT FDA approved.
Slicer Features

- Visualization
- Filtering
- Registration
- Segmentation
- DTI
- Quantification
- Real-time Integration
Core Slicer Contributors

- Autism
- Brain Cancer
- Depression
- Head and Neck Cancer
- Huntington's Disease
- Lupus
- Schizophrenia
- Traumatic Brain Injury
- VCFS
- Neuroimage Analysis
- Lung Disease
- Atrial Fibrillation
- Cardiovascular Disease
- Liver Cancer
- Colon Cancer
- Prostate Cancer
- Orthopedic Injury
- Neuromuscular Dynamics
- Image Informatics
Development Environment

Web Page, Wiki & Mailing Lists

Training, Workshops & Tutorials

SVN, Cross Platform & Package Generation

Dashboard, Testing, & Nightly Builds
Informatics Implementation

- Remote I/O in MRML Lib
  - All Data is Loadable from URL
    - Models, Volumes, Transforms…
    - Scenes
  - All Storable Data can be Pushed to Web Services
    - XNAT, HTTP…
- FetchMI Module
  - Tagging, Searching
  - XNAT Web Services
- Created Under mBIRN, Clinically Applied via Harvard Catalyst CTSC
Medical Images
Medical Image Analysis - increase the efficiency and accuracy of radiologists and clinicians, thus improve healthcare

- Automated or Semi-automated analysis of n-dimensional medical images.
- Visualization, annotation, and interaction with n-dimensional medical images.
- Image Guided Diagnosis and Therapy.
Medical Image Annotation - Daily Clinical Practice

- to capture information latent in the scans.
- to support efficient storage in modern databases.
- to enhance communication between experts.
Medical Image Annotation - Biomedical Research

- to design ontology and semantic-based annotation techniques for information retrieval.
- To reduce the wealth of information latent in the scans to more explicit features useful in clinical decision-making.
Current Annotation Tools – Vendors Medical Scanners

- Only tuned to the specific medical imaging workstations.
- Not trivial to compare annotation by different workstations.
- Not simple to share the annotation.
Current Annotation Tools – Non Vendors Software

- provide more flexibility.
- the source code is not publicly available.
Current Annotation Tools – Open Source Software

- Limited to certain operation systems.
- Missing features often found in other commercial products.
Our Solution – miAnnotation Open Source Tool

- Is open source
- Supports multiple operating systems
- Has similar annotation functionalities to commercial systems
- Is integrated into 3D Slicer
- Is easy to be customized
Annotation Types

Overlay Text Annotations

Sticky Note
Measurement Annotations

Ruler

Angle

BiDimensional

16.36 mm

76.3 A

35 x 59.8
Fiducials (Seeds)
Region Of Interests (ROI) or Box Annotation
Spline Interpolator (Contour Annotation)
### miAnnotation – Kits

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miAnnotation – Software Development
miAnnotation – Design

GUI
- UserInput
- UpdateGUI
- SetMRMLNode

Logic
- ModifiedEvent

MRML Scene
- SetMRMLNode
- ModifiedEvent

Manager

Core Developers

Application Developers

3D/2D
- vtkWidget
miAnnotation – Design (MRML Structures)
miAnnotation – The User Interface
miAnnotation – Left Panel

- **Upper Panel – Create**
  - 8 different annotation types
  - Controls for mouse mode

- **Middle Panel – Edit**
  - A table contains all annotations
  - Edit annotation properties
  - Edit annotation table

- **Lower Panel - Save**
  - Save as text format
  - Save screen shot
  - Save entire MRML structure
  - Save report as HTML format
miAnnotation – Input/Output
Output – MRML Scene

![Save Scene and Unsaved Data](image)

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<th>Node Status</th>
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[Save Selected] [Cancel]
Output – Screen Shot
Output – Report in HTML

3D Slicer Report

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3D Slicer Report

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Screen Shots
Thank You

Software Demo...