



Microsoft Research
FacultySummit

Inner Eye: Toward a Computational Platform for Imaging Metadata

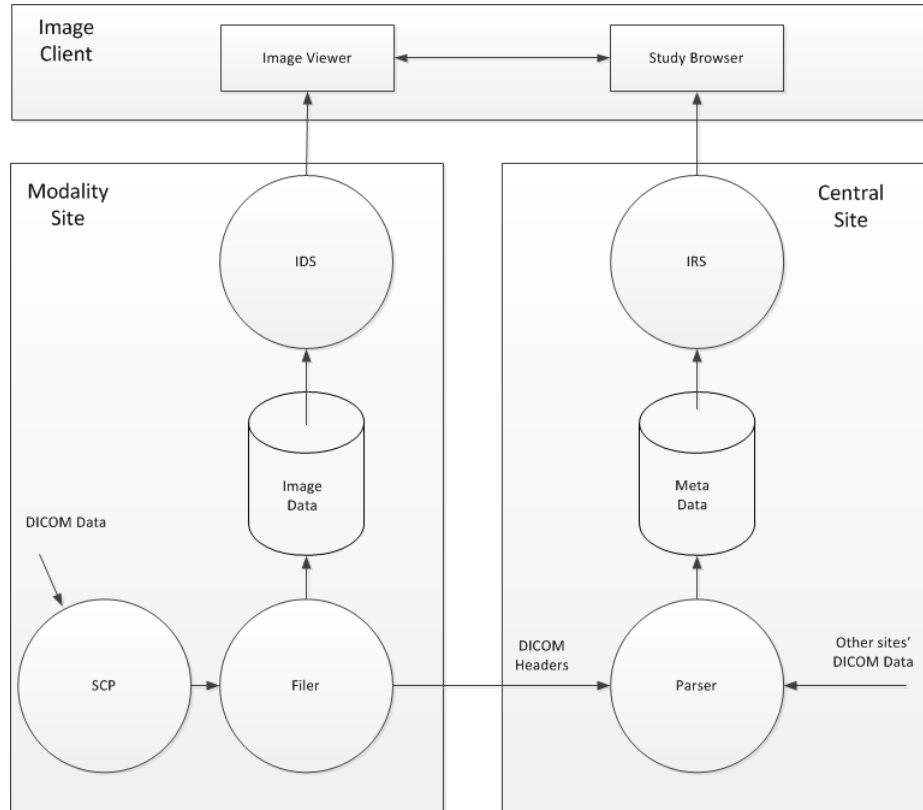
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Microsoft Corporation

Medical Images as Big Data

Big data poses unique challenges to MIS infrastructures

- Too big to move: 'play it where it lies'
- A 3-tier model presents itself
 - Pre-process: static/slow processing
 - Middle-tier: interactive, ad-hoc analysis & b/w compression
 - Client-side: scalable last mile

Amalga Imaging Server Topology



Inner Eye: Semantic tagging of Medical Images

Handling big data's opacity

- Another challenge posed by medical Images as Big Data is their 'opacity':
 - They are hard to find
 - They're hard to navigate (e.g. find organs in 1000-slice CT)
 - They're hard to compare
- Image Tagging as part of the Semantic Web
 - ...'a web of data that can be processed directly and indirectly by machines' (Tim Berners-Lee)

Inner Eye: Semantic tagging of Medical Images

Models of image tagging

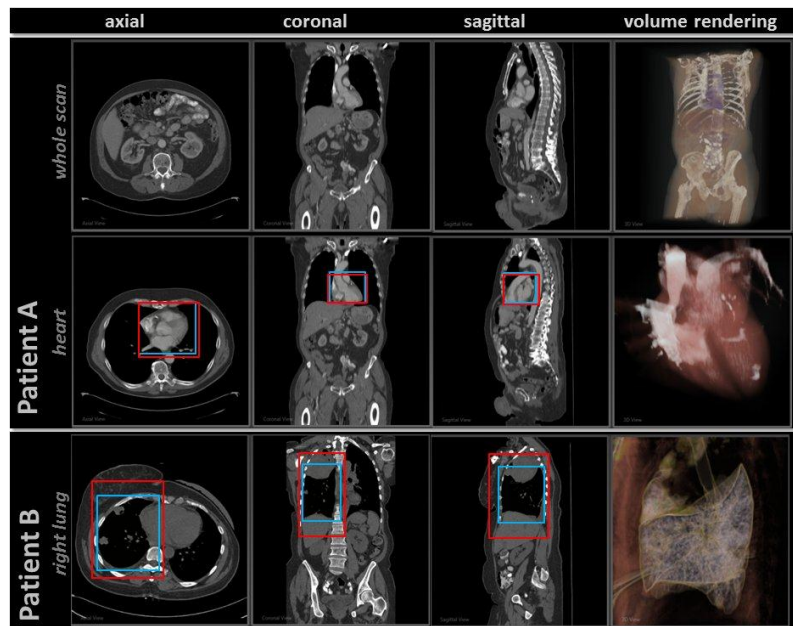
- Tagging models:
 - **Dense labeling**
 - **Segmentations**
 - Basic shapes
 - Bounding boxes



Inner Eye: Semantic tagging of Medical Images

Models of image tagging

- Tagging models:
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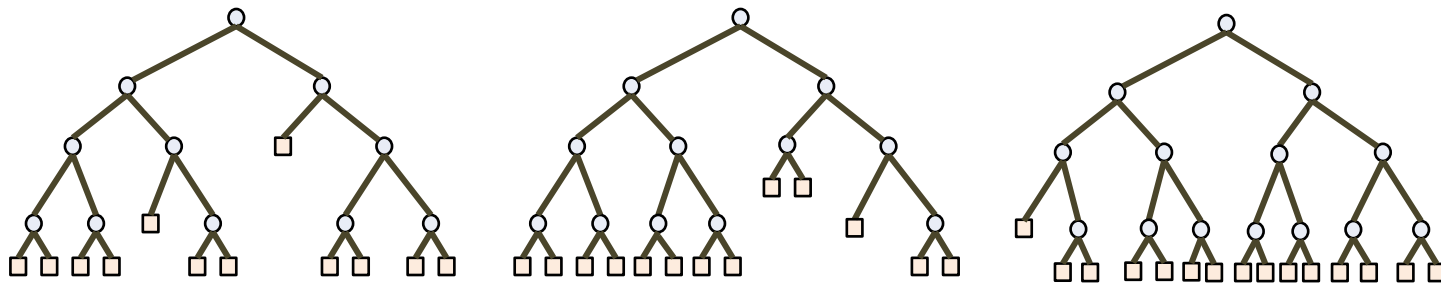


Inner Eye: Semantic tagging of Medical Images

Regression forests for localization

- Decision Forests
 - Categorization
 - Dense models
- Regression Forests
 - Localization
 - Sparse, compact models
- Pioneered by Antonio Criminisi's team at MSR-Cambridge

Regression Forests



Trees are all randomly, slightly different from one another

The forest output is the combination of all tree outputs



input



output

Inner Eye: Semantic tagging of Medical Images

Use cases of regression forest labeling

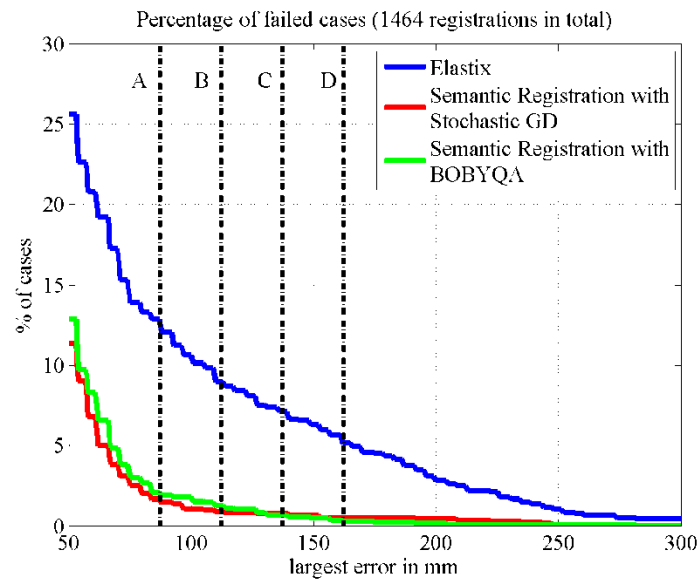
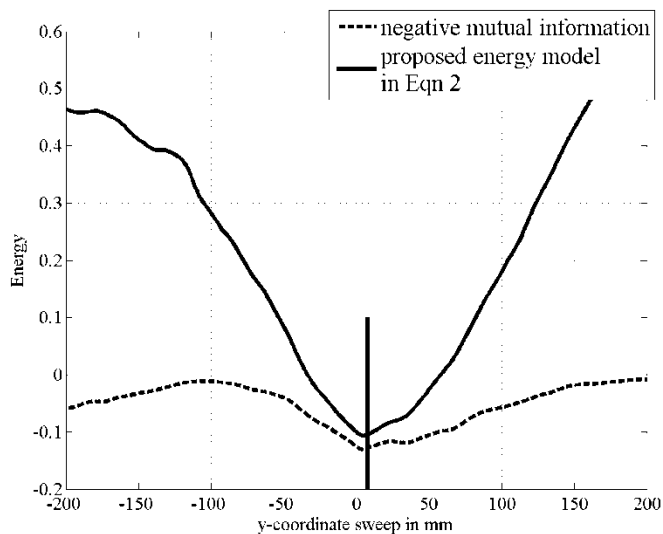
- Navigation
- Registration
 - Pre-register w/o using any image data (revisit tier diagram)
- Report linking
- Search...

Semantic Tagging and Big Data Architecture

Tying it together

- Tagging in the 3-tier world
 - Ingestion
 - Ad-hoc/on-demand processing
- Registration
 - Match tags first, then match the relevant data
 - Faster
 - Fewer local minima
 - Data reduction

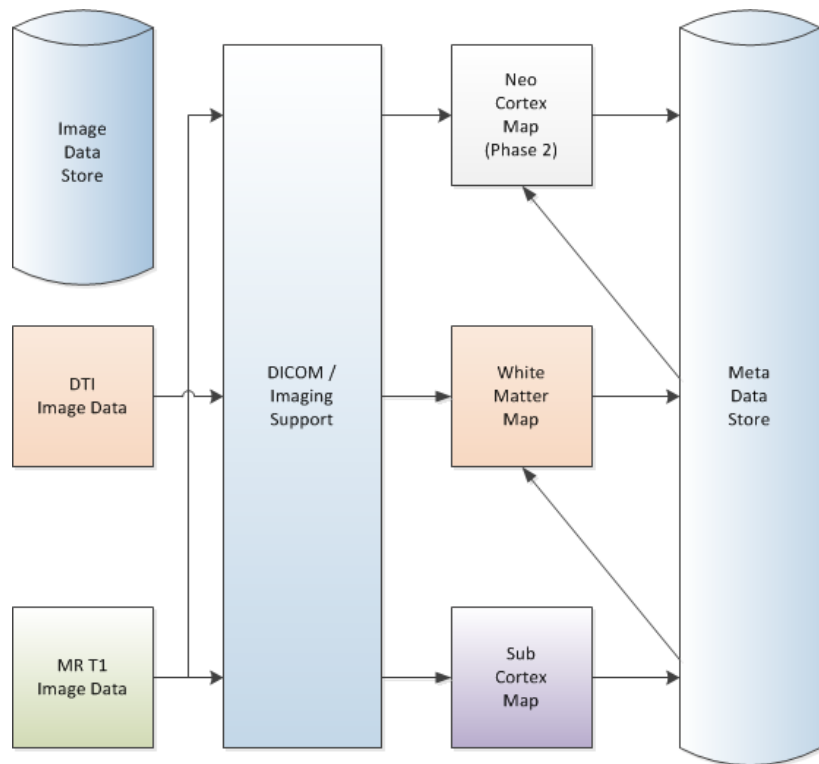
Regression-Based Registration



Semantic Tagging and Big Data Architecture

Hierarchical tagging models

- Example: The brain
 - Subcortical
 - White matter (DTI)
 - Cortical
- A pipeline model
- Ad-hoc analysis challenge





Regression Forests

Decision Forests with Long-Range Spatial Context for Organ Localization in CT Volumes

A. Criminisi, J. Shotton and S. Bucciarelli
Microsoft Research Ltd, Cambridge, UK

In Proc. MICCAI workshop on Probabilistic Models for Medical Image Analysis (PMMIA), London, 2009.

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