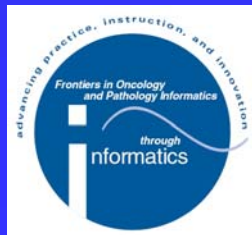


Whole Slide Image System Implementation

Jeffrey Fine MD
University of Pittsburgh

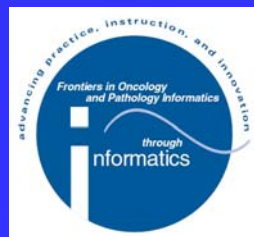
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Objectives

- Present rough framework for implementing whole slide image (WSI) technology
- Discuss examples of WSI implementation
- Discuss potential justifications or funding sources



Framework for Implementation

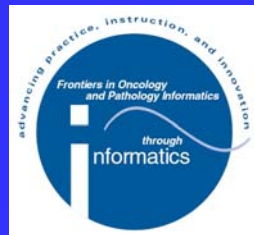
- What will virtual slides be used for?
- Who will use them?
- Is there a sound business case
 - If not, how will one justify the cost and effort?

Possible Applications

- Education
- Clinical Meetings
- Quality Assurance
 - Precious slides (cytopathology, frozen sections)
 - Proficiency testing
- Other Clinical Applications
 - Electronic distribution of stains
 - Consultation

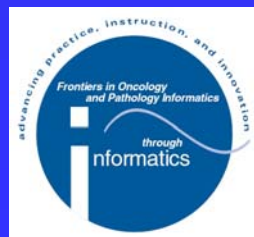
Classes of Users

- “Mission Critical”
 - Pathologists for patient care activities
 - Technical and/or administrative support for above
- Others (potential tier in no particular order)
 - Clinician colleagues
 - Researchers
 - Residents (educational not service)
 - Students



User Expectations

- Continuous availability no matter what
 - Technical support, recovery ability, etc.
- “Quick” performance no matter how many other users are present
- Security
- Good Workflow

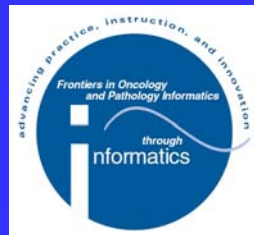


Implementation

- Needs drive system plans
 - Scan capacity (how many robots; how fast)
 - Storage capability and Network capacity
 - Ancillary systems (bar codes; slide quality, real APLIS integration)
- Fund or justify WSI system cost
 - (in a few minutes)

Challenges

- Current WSI implementations mostly limited to lowest tier
 - Education and research
- Cost
 - Not justified rigorously
 - Funded via research grants predominantly
- Not “mission critical”
 - No optimized workflow/integration
 - Support/availability not formally defined

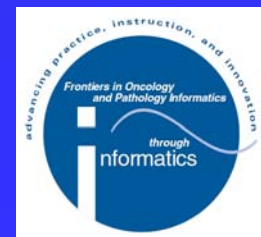


Example: UPMC

- Education
 - Several systems and thousands of WSI
- Research
 - QA, primary diagnosis, and IHC stain distribution
- Patient Care
 - Frozen Section QA Service (new)

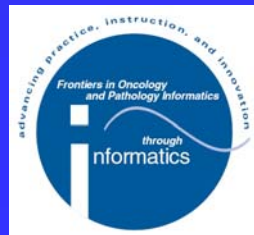
Frozen Section QA Service

- Purpose
 - Improve performance (error rate and deferral rate) both by UPMC faculty and by trainees in the future
- Initial application
 - Retrospective collection of cases with discrepant frozen sections (previous five years)
 - Distributions of WSI for formal review and for educational review
- Expansion
 - Ongoing review of frozen section slides



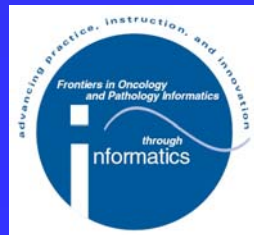
Users

- Pathologists (reviewers)
 - Workflow
 - Not yet well-supported by vendors
 - May evolve over time
 - Availability
 - Not “mission critical”; small user base
- Residents (educational)
 - Small volume and can use existing educational “workflow”



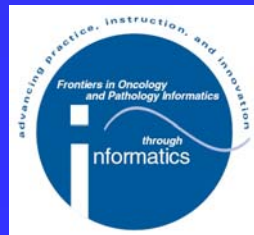
Justification

- QA is a high priority
 - Cost effectiveness poorly understood
- Equipment and personnel already in place
 - Eases funding transition from research to “operational”
- Low volume application



Other Benefits

- Digital archive of FS slides
 - Protects original slides from handling
 - Permits viewing by many simultaneously
- No transportation costs
- Slides widely available at all campuses for residents and faculty



WSI Example: US Labs

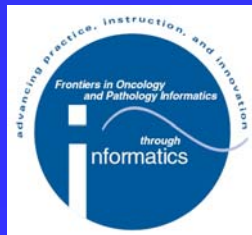
- WSI of slides by request
 - (200 images daily)
- Upcoming expansion to image all IHC slides (800 images daily)

Users

- Pathologists for patient care
 - “Mission critical”

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Justification

- Decreased turnaround time
 - WSI would be available hours earlier than conventionally shipped glass slides
- Decreased shipping cost
- Customer satisfaction
 - WSI are popular with several customers
 - Other customers could be accommodated as before with traditional shipping

Practical Details (US Labs)

- Images are stored for 30 days then purged
 - Customers receive glass slides for permanent record
 - Otherwise storage requirements would add more cost
- Slide throughput
 - Multiple high-speed scanning devices, in parallel
- Customers perform own validation using glass slides as gold standard

Future Expansion

- Utilization of WSI for image analysis service
 - Currently uses “static” images of glass slides since 1999

Discussion: Funding/Justification

- Research funds
 - Government entities (including the military)
 - Collaboration with vendors
- Departmental funds
 - Rigorous justification
 - Documentation
 - Were expected savings realized?
 - Was patient care enhanced?

Slide Archival

- Rapid review of prior pathology case
 - No time or courier costs for retrieval
 - Increased compliance with this basic QC procedure (enhanced patient care)
 - “Retention” of outside pathology material
- Archival of “precious” slides
 - Frozen sections, cytopathology slides, etc.
- Access for conferencing, education, research, or consultation

Electronic Slide Distribution

- US Labs example
- Decreased turn-around time and shipping costs
- Could be expanded to other modalities
 - Routine histology; special stains; FISH; etc.
- More efficient projection of service by pathology departments at large multi-campus healthcare organizations

Image Analysis

- Immunohistochemistry and FISH
 - WSI not required but could decrease manual labor associated with imaging step of image analysis
 - Potential revenue
- Other Computer-Assisted Diagnosis (CAD) activities

Revenue

- Direct justification for WSI service
- Possible revenue from newly billable activities involving image analysis
 - IHC analysis a potential “foot in the door” for digital pathology and WSI in particular

Unusual Funding Sources

- Clinical departments
 - Sub-specialty environment facilitates closer relationship with individual groups of clinicians
 - Justifications include conferencing, research, non-pathology resident education, QA, consultation, etc.
- Funded provision of telepathology services to underserved regions or countries

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- Anil Parwani
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