Whole Slide Image System Implementation

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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”
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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