Re-Imagining the Microscope to Facilitate Collaboration and Integration of Big Data in Medicine

Bruce Levy, M.D., C.P.E.
Associate Chief Health Informatics Officer
Program Director, Clinical Informatics Fellowship
Geisinger Health System

Disclosure of Relevant Financial Relationships
USCAP requires that all planners (Education Committee) in a position to influence or control the content of CME disclose any relevant financial relationship WITH COMMERCIAL INTERESTS which they or their spouse/partner have, or have had, within the past 12 months, which relates to the content of this educational activity and creates a conflict of interest.

Dr. Levy declares he has no conflict(s) of interest to disclose.

Outline
• Define Big Data and its relationship to health care in the 21st Century
• Describe the drive for collaboration in medicine and how the Scalable Adaptive Graphics Environment (SAGE) can meet that need
• Explore the case scenarios for utilizing SAGE to share big data, including Whole-Slide Images
• Future of data visualization

How do we achieve intelligence?
Got Intelligence?

A concept is the representation of an idea.

Expression of ideas in healthcare requires detail.

Got Intelligence?

Data are facts used as a basis for reasoning, discussion or calculation.

Examples of health data:
- Patient demographics
- Clinical signs and symptoms
- Medical, family and social histories
- Tests ordered and their results
- Problems and diagnoses
- Treatments provided
- Results of treatments
- Provider data

Got Intelligence?

Information is data that are interpreted, organized and structured.

Got Intelligence?

Knowledge is information that has been synthesized so that interrelationships are identified and formalized.

Health Care is BIG Data

- Big Data is...
  - High Volume
  - High Velocity
  - High Variety
  - High Veracity
Types of Data
- Structured
- Unstructured
- Image
- Recorded
- Genomic

- Clinical
- Demographic
- Financial
- Knowledge
- Populations

The V’s of Big Data
- Volume
- Velocity
- Variety
- Veracity
- Variability
- Visualization
- Value

Workflows, information systems, and optimization
Current systems adequate?

Data Quality
Early

Just getting started
Elusive to date

Health Care is a Team Sport
Communication and collaboration within and between teams is challenging

Traditional Microscopy
- Thin sections of tissue are stained and viewed through a microscope
- Pathologist renders a diagnosis

Collaboration – Pathology Style

Digital Pathology
Whole slide scanners can scan microscopic slides to produce a digital image
Issues with WSI

- Not like radiology – still make slides
- Expensive (money, people, space, time)
- Regulatory
- We are still using these digital images as we would use glass slides

How Can We Enhance Collaboration in Medicine?

Scalable Adaptive Graphics Environment

- Developed at UIC’s EVL
- Graphics streaming architecture
- Access, display and share
  - Data-intensive information
  - Variety of resolutions and formats
  - Multiple sources
- Open source

Data Objects in SAGE

- Digital cinema animations
- High-resolution images
- High-definition videoconferencing
- Presentation slides
- Documents
- Spreadsheets
- Desktop screens

Using Objects in SAGE

- Each object is in a window that can be moved and resized at will
  - Pointer and/or touch
  - Objects can be internally manipulated

SAGE is designed for collaboration
SAGE is not limited to large multi-tiled displays

SAGE enables

• Lightning collaboration
• Rapid sharing of content
• Fast transitions between presenters

SAGE enables

• Lightning collaboration
• Parallel investigation workflow
  • Solving problems through sharing different domain expertise side-by-side

SAGE enables

• Lightning collaboration
• Parallel investigation workflow
• Single-driver, multiple-navigators
  • Driver shares interactive items, and
  • Navigators ask questions…
  • Leads to driver making changes in real time

SAGE enables

• Lightning collaboration
• Parallel investigation workflow
• Single-driver, multiple-navigators
• Remote gigabit data streams
  • Ability to easily share with other SAGE installations

What is the potential for this technology in medicine?

How can superior collaboration impact patient care, research and education?
We started exploring SAGE…

…and imagined a WSI viewer.

Meanwhile EVL was working on SAGE2

- Interactive applications with simultaneous multiple user input
- Enhanced real time communication
- Lower barrier to entry
- Leverage cloud based and web browser technologies

We developed a WSI viewer in SAGE

- Multiple WSI can be viewed side-by-side
- Each WSI can be:
  - Panned and zoomed
  - Pointed to and annotated
  - Viewed and manipulated from anywhere

You can open a WSI through the user interface on a device connected to the internet, or by using the on-screen menu.
Re-Imagining the Microscope

1. Create annotation
2. Gross image
3. Open menu for choosing a document

Potential Applications

Medical Education

Resident Education

Tele-Pathology Consultation
Multidisciplinary Case Conference

- Link together 15 sites across U.S.
- One site "leads" the session
- Other sites can interact with session
- Recorded for future learning

Virtual Case Conference

Moving Forward

Display Technology is Evolving

3D Virtual Reality

Pathologist Cockpit
- Multiscreen cockpit
- SAGE cockpit
**Where do we go from here?**

- Improve capabilities
- Response time
- Unique annotations
- Linking images
- 3-D histology

**Important Information Regarding CME/SAMs**

The Online CME/Evaluations/SAMs claiming process will only be available on the USCAP website until September 30, 2017.

No claims can be processed after that date!

After September 30, 2017 you will NOT be able to obtain any CME or SAMs credits for attending this meeting.

**THANK YOU**