Interactive Publications
Intramural research project

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“…rich interconnections among genetics research data, aggregated clinical and public health data, published literature, and high quality health information…”

John Wilbanks, Science Commons Project
CNI Task Force Meeting, December 8, 2008

“..paper as the core container for knowledge is dying..”

NLM’s activities toward this future

- Intramural R&D project: build tools
- Experiment with Elsevier and Student National Medical Association
  - Make 12 science/clinical articles interactive
  - Investigate improved learning for young medical students – “digital natives” (contrast with static articles)
- Experiment with Optical Society of America
  - OSA special issues (10 articles with multimedia in each)
IP as a research tool – attributes

- Online access
- Self-contained (text, multimedia objects)
- Document integrity (retain all parts)

Reader able to
  - View text and multimedia objects – in context
  - Link from one object to another
  - Link to external resources
  - Exercise control over objects
  - Reuse the media content (for analysis)
Our approach

- Investigate standards (formats, descriptive languages)
- Acquire biomedical media objects
- Create prototype IPs
- Record IP creation procedures
- Develop tools for authoring and visualization/analysis
Standards

**ODA** *(Open Document Architecture)*
- 1999 ITU-T; ISO 8613
- Encoding of multimedia in a document
- No rules for use, packing or interactivity

**HyTime** *(Hypermedia/Time-based structuring language)*
- ISO/IEC 10744
- Links to multimedia
- Concepts later incorporated into HTML, XML
- No applications beyond 1999

**SMIL** *(Synchronized Multimedia Integration Language)*
- W3C Recommendation
- Applied in movie sub-titling, captioning, scrolling news
- Cumbersome tools

**RTF** *(Rich Text Format)*
- MS proprietary
- Multimedia supported through MS OLE technology

*PDF
*Use Adobe and MS tools
*Eclipse framework, Java
*Inhouse and open source viewers (e.g., ImageJ)
Two prototype IPs

Prototype IP$_1$
- Modified existing PDF article in *Proc. SPIE Med Imag*
- Incorporated: cell evolution video, DICOM images (CT, MRI, ultrasound), Flash anatomy, NHANES spinal x-rays....

Prototype IP$_2$
- Modified existing scanned article in *J. Ch. Ad. Psychopharm.*
- Incorporated underlying research data corresponding to published tables and graphs
Tools

- **Panorama** for readers – visualization and analysis
- **Forge** for authors – to create IPs

Goals

- Distribute tools freely
- Allow plug-ins by developer community
  (~ NIH’s ImageJ)
A contest to improve the way scientific information is communicated and used

Invitation to prototype tools to “improve the interpretation and identification of meaning” in online journals in the life sciences

NLM’s *Panorama* selected as one of 10 semi-finalists out of 70 entries
Standard 4-panel view
Standard 4-panel view

1. IP PDF View
2. Chart
3. ROC Analysis Options
4. Recent Views

- **Colon csv**
- Polyp Diameter (cm)

**ROC Analysis Options**

- **Classifier Settings**
  - Perform receiver operating characteristic analysis.
  - Please select a pattern variable and a variable to represent the truth value (score) of the pattern.

- **Pattern:** Polyp Diameter (cm)
- **Score:** Colon Cancer
Table (original research data)

Panorama supports:
* Row/column selection, subset selection, sorting, filtering
* Common statistical calculations
* ROC, Logistic, Linear and Polynomial regression analysis
* Data export to sophisticated applications (R, SAS)
Video, in “chapters”
Clinical DICOM images (e.g., from CT study)

21 free DICOM viewers listed by W. Liao, T.M. Deserno, K. Spitzer
Aachen University of Technology, Aachen, Germany

“ImageJ is the most popular software tool for viewing DICOM data for Windows, Linux and MacOS.”
3D reconstruction