

Interactive Publications

Intramural research project

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December 2008



Demner-Fushman, Ford, Thoma, Chung, Antani



COMMUNICATIONS
ENGINEERING
BRANCH

Acrobat Reader - [2015-LindbergHumphreys.pdf]

File Edit Document View Window Help

157%

PERSPECTIVE

2015 — The Future of Medical Libraries

2015 — The Future of Medical Libraries

Donald A.B. Lindberg, M.D., and Betsy L. Humphreys, M.L.S.

The past 20 years have witnessed communications revolutions, rapid progress in genetics research, increasing public interest in health decisions, and corresponding expansion in the services provided by the National Library of Medicine. These concomitant and linked developments have upset the information marketplace and inspired policy debates about telecommunications, intellectual property, and access to the results of government-funded research. The Internet and the World Wide Web

people use electronic health records. Like basic researchers, clinical researchers depend on electronic data systems. When using such

medical libraries in the post-Google world?

Today, most medical libraries exist within hospitals or academic institutions, available to physicians, nurses, and public health

1 of 3 8.5 x 11 in

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

**“..paper as the core container for knowledge is dying..”
John Wilbanks, Science Commons Project
CNI Task Force Meeting, December 8, 2008**

Lindberg DAB and Humphreys BL. 2015 – The future of medical libraries. N.Engl. J. Med. (2005) 352; 11: 1067-70.

NLM's activities toward this future

- **Intramural R&D project: build tools**
- **Experiment with Elsevier and Student National Medical Association**
 - n **Make 12 science/clinical articles interactive**
 - n **Investigate improved learning for young medical students – “digital natives” (contrast with static articles)**
- **Experiment with Optical Society of America**
 - n **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**
 - n View text and multimedia objects – in context
 - n Link from one object to another
 - n Link to external resources
 - n Exercise control over objects
 - n 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

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

● ODA (Open Document Architecture)

- n 1999 ITU-T; ISO 8613
- n Encoding of multimedia in a document
- n No rules for use, packing or interactivity

● HyTime (Hypermedia/Time-based structuring language)

- n ISO/IEC 10744
- n Links to multimedia
- n Concepts later incorporated into HTML, XML
- n No applications beyond 1999

● SMIL (Synchronized Multimedia Integration Language)

- n W3C Recommendation
- n Applied in movie sub-titling, captioning, scrolling news
- n Cumbersome tools

● RTF (Rich Text Format)

- n MS proprietary
- n Multimedia supported through MS OLE technology

Two prototype IPs

● Prototype IP₁

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

● Prototype IP₂

- n Modified existing scanned article in *J. Ch. Ad. Psychopharm.*
- n Incorporated underlying research data corresponding to published tables and graphs

Tools

- ***Panorama*** for readers – visualization and analysis
- ***Forge*** for authors – to create IPs
- **Goals**
 - n **Distribute tools freely**
 - n **Allow plug-ins by developer community**
(~~ NIH's ImageJ)



The Elsevier Grand Challenge

Knowledge Enhancement in the Life Sciences

- 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


Stop Refresh

Default Layout


IP PDF View

2 of 8 75%

Screening
 Others: 65 yo WM here for enrollment into Virtual Colonoscopy protocol. Patient states doing well w/o change in BM, wt loss, blood in stool. Patient ave risk for colon cancer w/o FH of colonic polyps, colon ca or polyposis syndromes. Patient w/o positive stool guaiac test or h/o iron def anemia w/in past 6 months. Patient has had no prior evaluations for colon cancer screening including normal colonoscopies w/in 10 yrs, and normal ACBE w/in past 5 yrs. Patient w/o h/o adenomatous polyps, colorectal cancer, IBD, HNPCC or FAPS. No h/o rectal bleeding, hematochezia, or unintentional wt loss w/in past 12 months. Patient has no contraindications for colonoscopy in general or to fleets prep.



A 61 year old male presents with:
 ScreeningOthers: 61 yo WM here for enrollment into Virtual Colonoscopy protocol. Patient states doing well w/o change in BM, wt loss, blood in stool. Patient ave risk for colon cancer w/o FH of colonic polyps, colon ca or polyposis syndromes. Patient w/o positive stool guaiac test or h/o iron def anemia w/in past 6 months. Patient has had no prior evaluations for colon cancer screening including normal colonoscopies w/in 10 yrs, and normal ACBE w/in past 5 yrs. Patient w/o h/o adenomatous polyps, colorectal cancer, IBD, HNPCC or FAPS. No h/o rectal bleeding, hematochezia, or unintentional wt loss w/in past 12 months. Patient has no contraindications for colonoscopy in general or to fleets prep.



Examples of DICOM images are presented below.




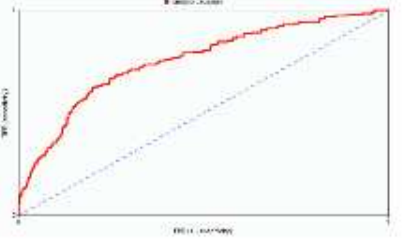
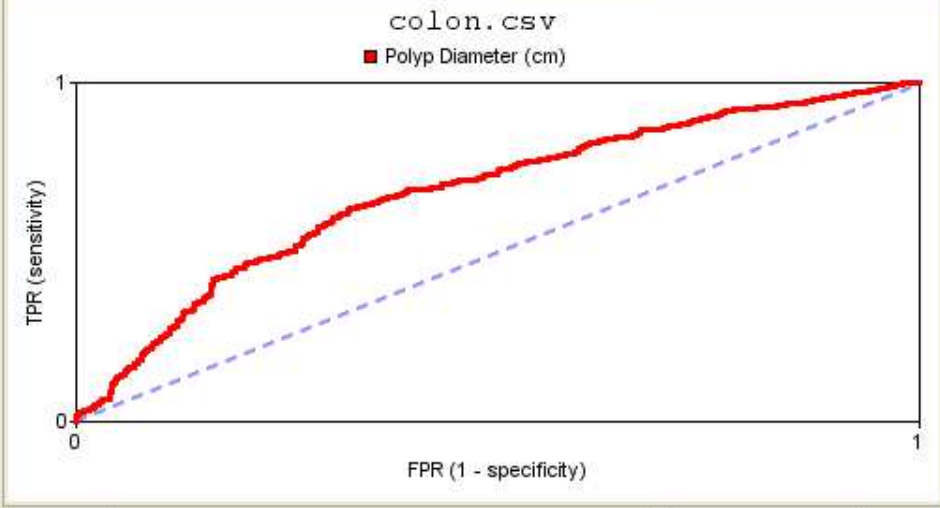





Chart Table Video Panorama ROC



Form Recent Views

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

- Data Sets
 - colon.csv
 - Analysis
 - Chart
 - Graph
 - ROC
 - Table

Standard 4-panel view

1

IP PDF View

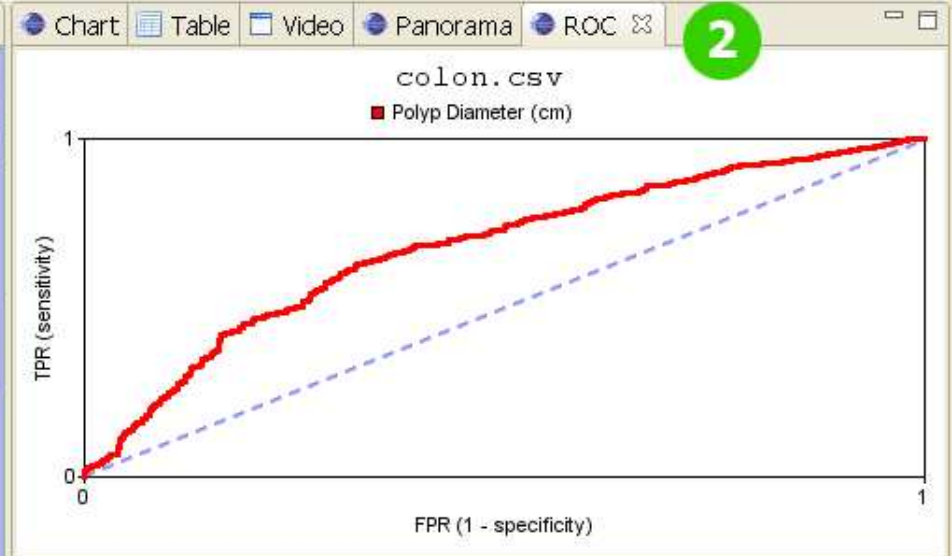
2 of 8 75%

Screening
Others: 65 yo WM here for enrollment into Virtual Colonoscopy protocol. Patient states doing well w/o change in BM, wt loss, blood in stool. Patient ave risk for colon cancer w/o FH of colonic polyps, colon ca or polyposis syndromes. Patient w/o positive stool guaiac test or h/o iron def anemia w/in past 6 months. Patient has had no prior evaluations for colon cancer screening including normal colonoscopies w/in 10 yrs, and normal ACBE w/in past 5 yrs. Patient w/o h/o adenomatous polyps, colorectal cancer, IBD, HNPCC or FAPS. No h/o rectal bleeding, hematochezia, or unintentional wt loss w/in past 12 months. Patient has no contraindications for colonoscopy in general or to fleets prep.

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ScreeningOthers: 61 yo WM here for enrollment into Virtual Colonoscopy protocol. Patient states doing well w/o change in BM, wt loss, blood in stool. Patient ave risk for colon cancer w/oFH of colonic polyps, colon ca or polyposis syndromes. Patient w/o positive stool guaiac test or h/o iron def anemia w/in past 6 months. Patient has had no prior evaluations for colon cancer screening including normal colonoscopies w/in 10 yrs, and normal ACBE w/in past 5 yrs. Patient w/o h/o adenomatous polyps, colorectal cancer, IBD, HNPCC or FAPS. No h/o rectal bleeding, hematochezia, or unintentional wt loss w/in past 12 months. Patient has no contraindications for colonoscopy in general or to fleets prep.

Examples of DICOM images are presented below.

CT Thorax with Contrast Echogram Magnetic Image Lumbar Spine



3

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

4

Recent Views

Data Sets

- colon.csv
 - Analysis
 - Chart
 - Graph
 - ROC
 - Table

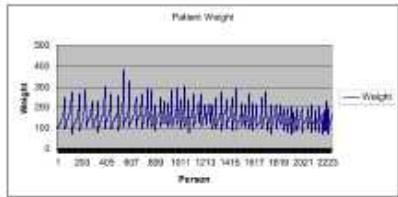
Table (original research data)

Stop Refresh

Four Dicom Screen Default Layout

IP PDF View

3 of 8



Graph 1: Patient Weight

Age	Average Weight	Average Height	Average Body Mass
30-39	105	63	27
40-49	100	63	28
50-59	101	63	28
60-69	100	62	28
70-79	105	62	27
80-89	104	61	26
90+	110	60	22

Table 1: MENNES data grouped by age

Script name	Project Label	Min Parameter	Max
1.1	1a	10	10
1.2	1a	10	10
1.3	1a	10	10
1.4	1a	10	10
1.5	1a	10	10
1.6	1a	10	10
1.7	1a	10	10
1.8	1a	10	10
1.9	1a	10	10
2.0	1a	10	10

Table 2: Concrete Parameters for body

1.1: The electronic reference system

	< Age(Screener)	> < Weight	< Height	< Body Mass	< HDL Data	< LDL Data
.....	41	.. 204.5	65.1	34	888	888
.....	40	.. 179.1	62.9	31.9	44	164
.....	34	.. 186.8	62.4	33.8	39	96
.....	56	.. 165.1	63.7	28.7	54	143
.....	63	.. 101.6	61.3	19	58	157
.....	31	.. 185.7	62.5	33.5	52	159
.....	50	.. 159.3	65.5	26.2	45	112
.....	37	.. 215.2	60.8	41	53	156
.....	33	.. 137.7	60.7	26.3	888	888
.....	68	.. 128.3	61.4	24	55	110
.....	31	.. 148	66.1	23.9	53	88
.....	31	.. 282.4	67.5	43.6	37	69
.....	60	.. 135.4	61.6	25.2	56	161
.....	30	.. 137.3	62.2	25	53	64
.....	38	.. 260.5	67.8	40	41	164
.....	31	.. 146.1	69	21.6	57	74
.....	33	.. 101.3	57.1	21.9	63	85

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)


All displayed rows

test2.csv


Analysis

Video


*Examples of cell development in the form of rings and ridges are presented below. This information was obtained from Dr. Alamy Khajouhi of the Weizmann Center.




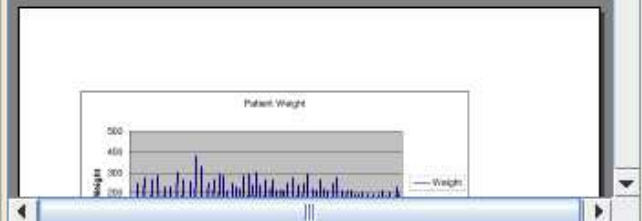
A 65 year old male presents with...
 Screening...
 Patient status...
 Patient has no contraindications for colonoscopy as present or to be done.



A 60 year old male presents with...
 Screening...
 Patient status...
 Patient has no contraindications for colonoscopy as present or to be done.



Examples of DICOM images are presented below:

Form

Video Options

Export Video Clip or Snapshot

Start Offset: 06:51:26
 End Time: 14:04:02

Start Position End Position
 Reset Export Clip

Recent Views

- Data Sets
 - C:\IP\Panorama I
 - DICOM
 - Volume
 - C:\IP\Panorama I
 - Video
 - colon.csv
 - Analysis
 - Chart

Video, in "chapters"

****Examples of col development in the form of images and video are presented below. This information was obtained from Dr. Alamy Khalafalla of the WakeForest Center.**

A 65 year old male presents with:
 Screening Colonoscopy
 Onset: 45 yo MM had his surveillance low Visual Colonoscopy previous. Patient states being well w/ no change in BM, wt loss, blood in stool. Patient was risk for colorectal cancer with 30% of colorectal polyps, colon as an adenoma syndrome. Patient was positive stool guaiac test for 4 months of 12 months, 10 years to months. Patient has had no prior evaluations for colorectal screening including normal colonoscopies in 10 yrs, and normal MRI in the past 5 yrs. Patient has no adenomatous polyps, colorectal cancer, IBD, HNPCC or FAP. No low normal bleeding, hematochezia, or unexplained wt loss in the past 12 months. Patient has no contraindications for colonoscopy in general or to this prep.

A 65 year old male presents with:
 Screening Colonoscopy
 Onset: 51 yo MM had his surveillance low Visual Colonoscopy previous. Patient complaining with w/ no change in BM, wt loss, blood in stool. Patient was risk for colorectal cancer with 40% of colorectal polyps, colon as an adenoma syndrome. Patient was positive stool guaiac test for 4 months of 12 months, 10 years to months. Patient has had no prior evaluations for colorectal screening including normal colonoscopies in 10 yrs, and normal MRI in the past 5 yrs. Patient has no adenomatous polyps, colorectal cancer, IBD, HNPCC or FAP. No low normal bleeding, hematochezia, or unexplained wt loss in the past 12 months. Patient has no contraindications for colonoscopy in general or to this prep.

Examples of DICOM images are presented below:

CT Colon with Contrast Echogram Magnetic Resonance Lesion Spine



- Discovery of Lesion
- Biopsy of Lesion
- Vascular Markings
- Introduction of Snare
- Second Biopsy
- Second Lesion Discovered
- Side by Side Lesion Possible
- Biopsy of Second Discovery
- Retroflexed Scope

Video Options

Export Video Clip or Snapshot

Start Offset: 06:51:26
 End Time: 14:04:02

Start Position End Position
 Reset Export Clin

Data Sets

- C:\IP\Panorama I
 - DICOM
 - Volume
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 - Analysis
 - Chart

Clinical DICOM images (e.g., from CT study)

DICOM Information

DICOM Panel Information

Check a box to turn on/off the

- Display Header Info
- Display Contrast Info
- Display Mouse Info

DICOM Header Primary

Tag Name	Tag Value
Modality	CT
Station Name	ctnav519
Image Number	1
Slice Thickness	1
kVp	120

DICOM Header Information

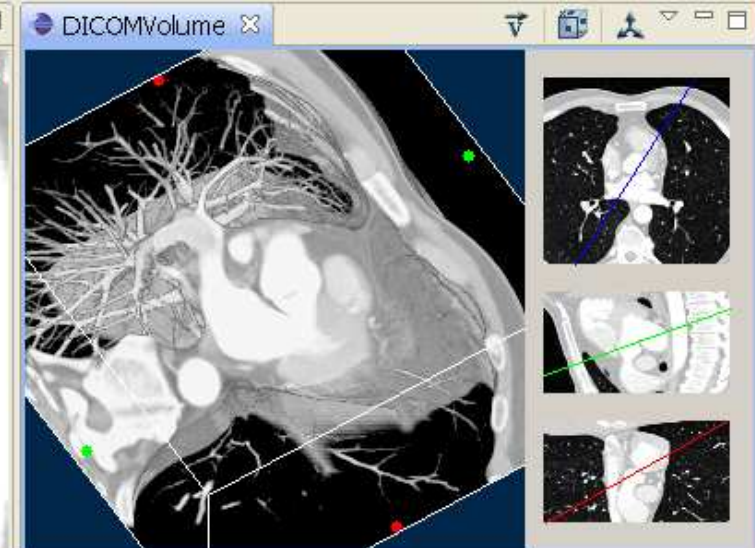
Volume Setting

Volume Parameters Setting



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

Stop Refresh

Four Dicom Screen Default Layout

IP PDF View

2 of 8 75%

Screening Others: 65 yo WM here for enrollment into Virtual Colonoscopy protocol. Patient states doing well w/o change in BM, wt loss, blood in stool. Patient ave risk for colon cancer w/o FH of colonic polyps, colon ca or polyposis syndromes. Patient w/o positive stool guiac test or h/o iron def anemia w/in past 6 months. Patient has had no prior evaluations for colon cancer screening including normal colonoscopies w/in 10 yrs, and normal ACBE w/in past 5 yrs. Patient w/o h/o adenomatous polyps, colorectal cancer, IBD, HNPCC or FAPS. No h/o rectal bleeding, hematochezia, or unintentional wt loss w/in past 12 months. Patient has no contraindications for colonoscopy in general or to fleets prep.



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Examples of DICOM images are presented below.



CT Thorax with Contrast



Echogram



Magnetic Image Lumbar Spine

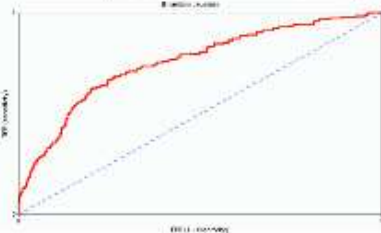
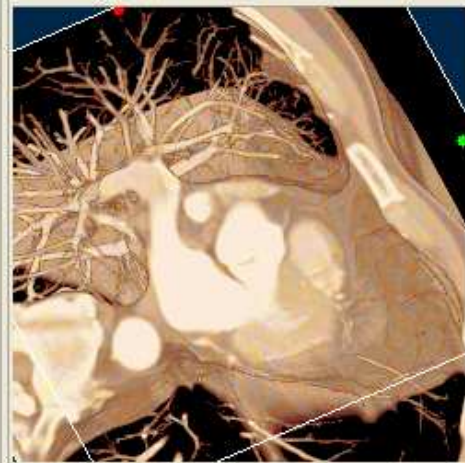


Chart Table Video Pan... ROC DIC... DIC...



Form

Slider for setting the parameters

Zoom: [Slider] Zoom Value: 0.5445

Distance: [Slider] Distance: 0

Depth: [Slider] Depth value: 6

Recent Views

- Data Sets
 - C:\IP\Panorar
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