IMAGE MANIPULATION FOR THE RADIOLOGIST

Carl Kalbhen, MD

IMAGE MANIPULATION FOR THE RADIOLOGIST

Special thanks to Paul Chang, MD,
for valuable lessons provided in 2005

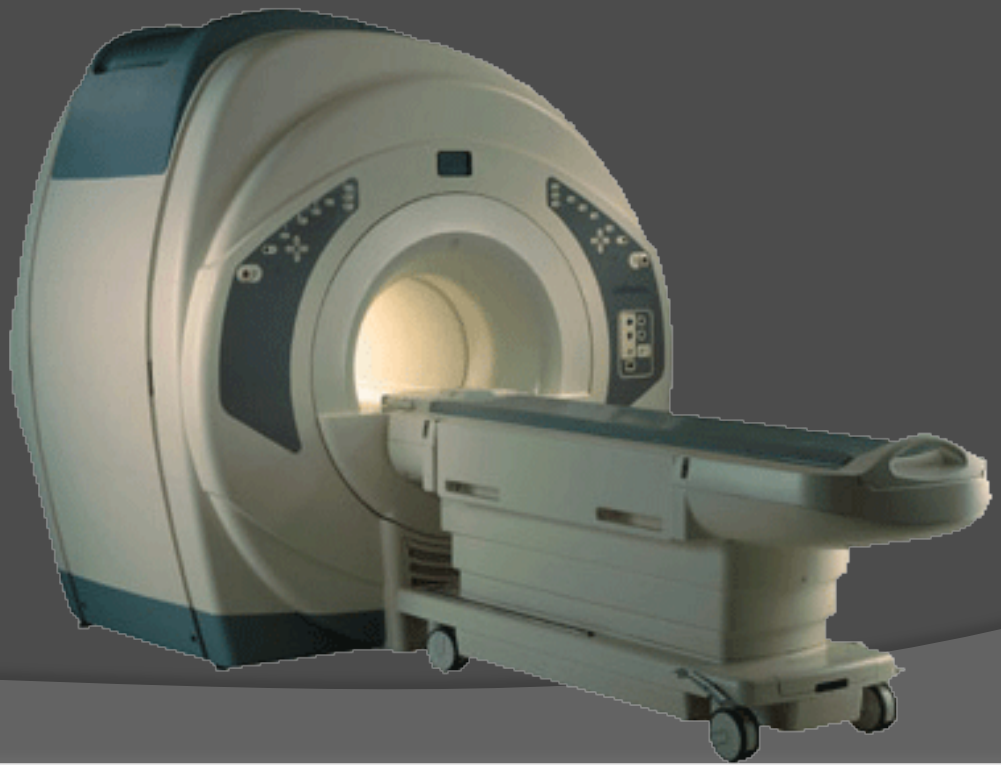
PowerRAD: Introduction to Personal Image Management and Presentation

Paul J. Chang, M.D.

Division of Radiology Informatics
University of Pittsburgh School of Medicine
UPMC Health System

Why

Radiologists in many ways act as photographers and image editors…..albeit with unique and uber expensive cameras



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Why

- Photography principles in day-to-day radiology
  - Exposure
    - Technique
  - Contrast
    - Media
    - Window/level
  - Framing/cropping
    - Field-of-view
  - Viewpoint
    - Cross-sectional plane
    - Planar angle

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Why

- Quality
  - Radiologist control
    - Fluoroscopy
  - Technologist control
    - Technique
  - Patient/no control
    - Body habitus
    - Motion

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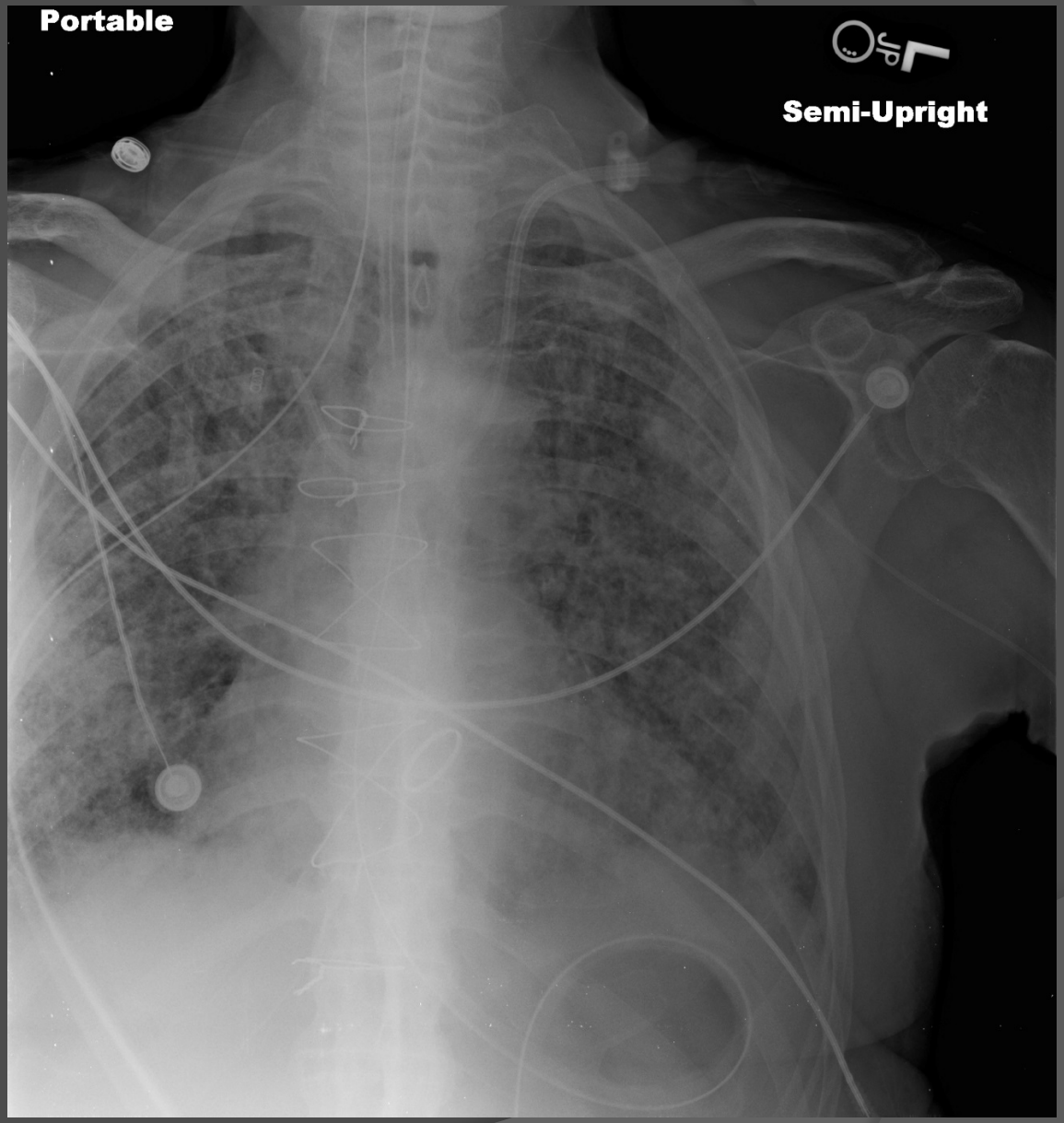
Why

Crappy images



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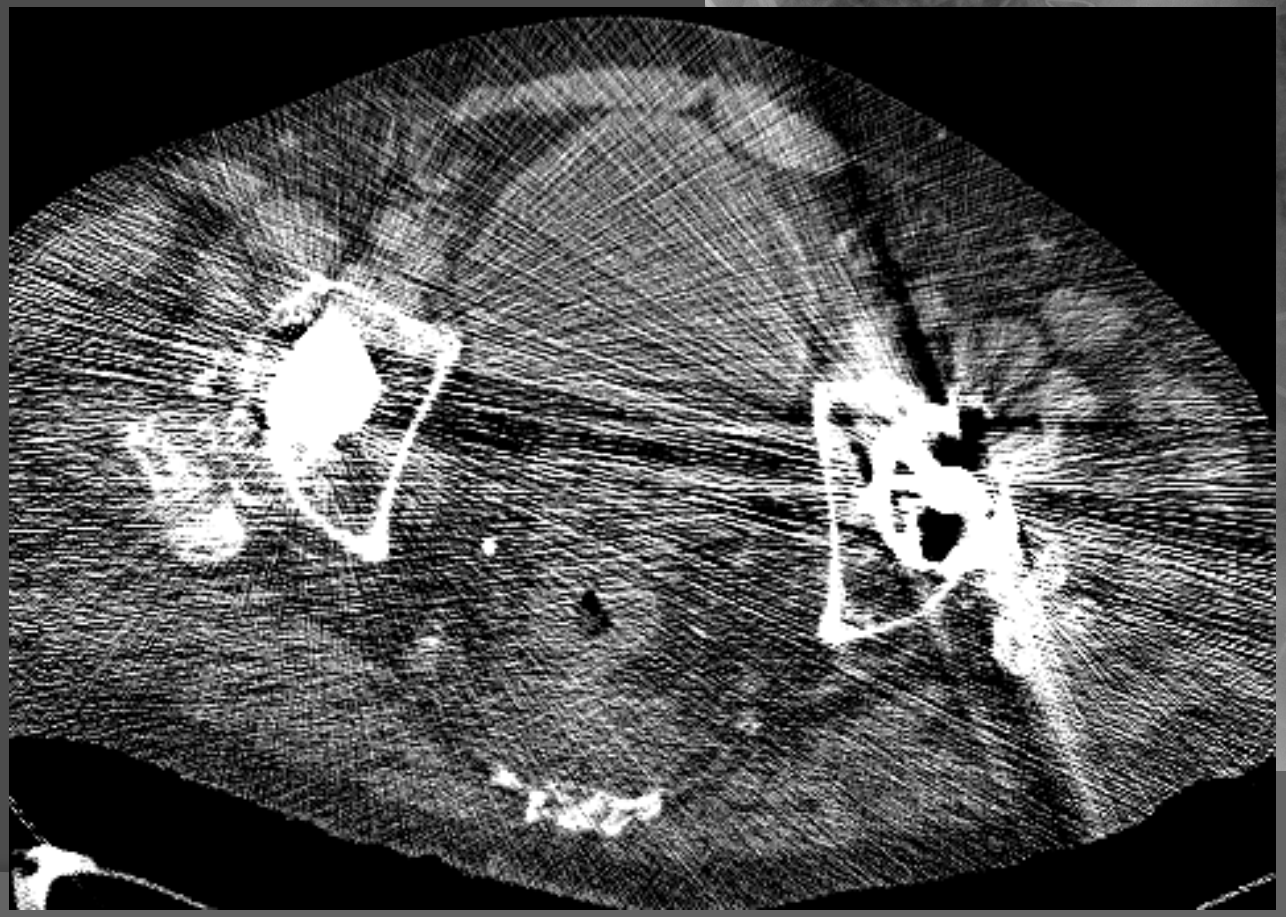
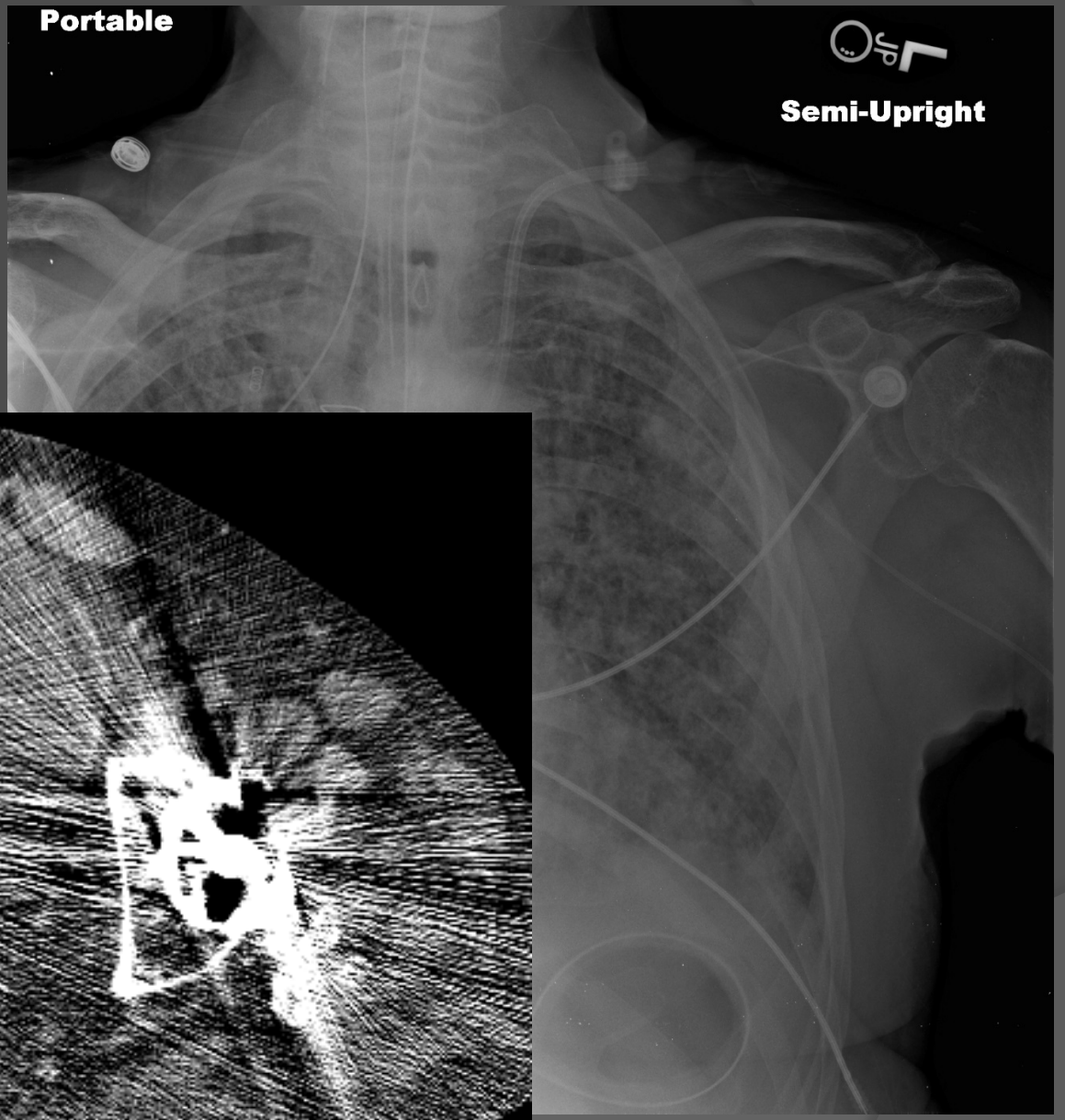
Why

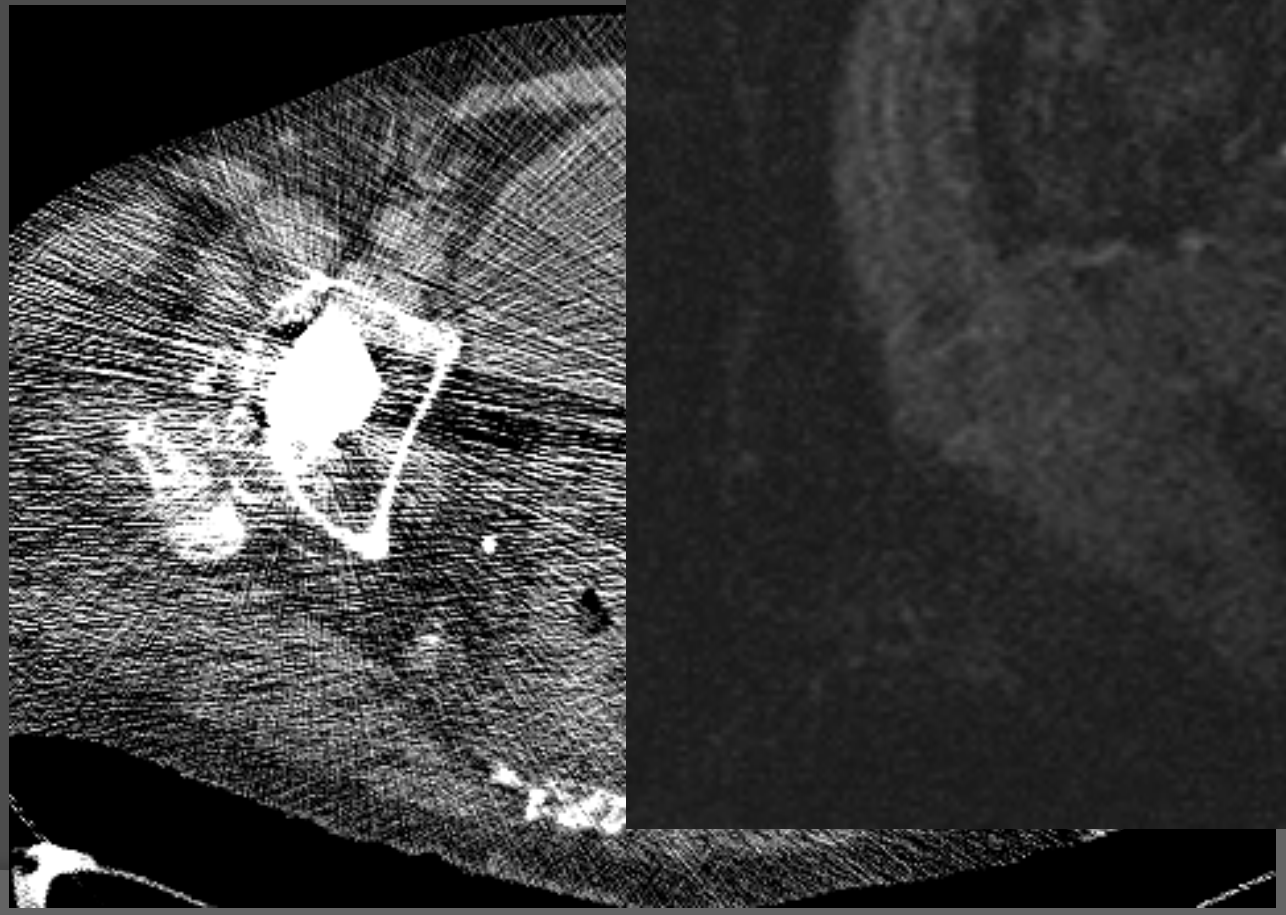
Crappy images

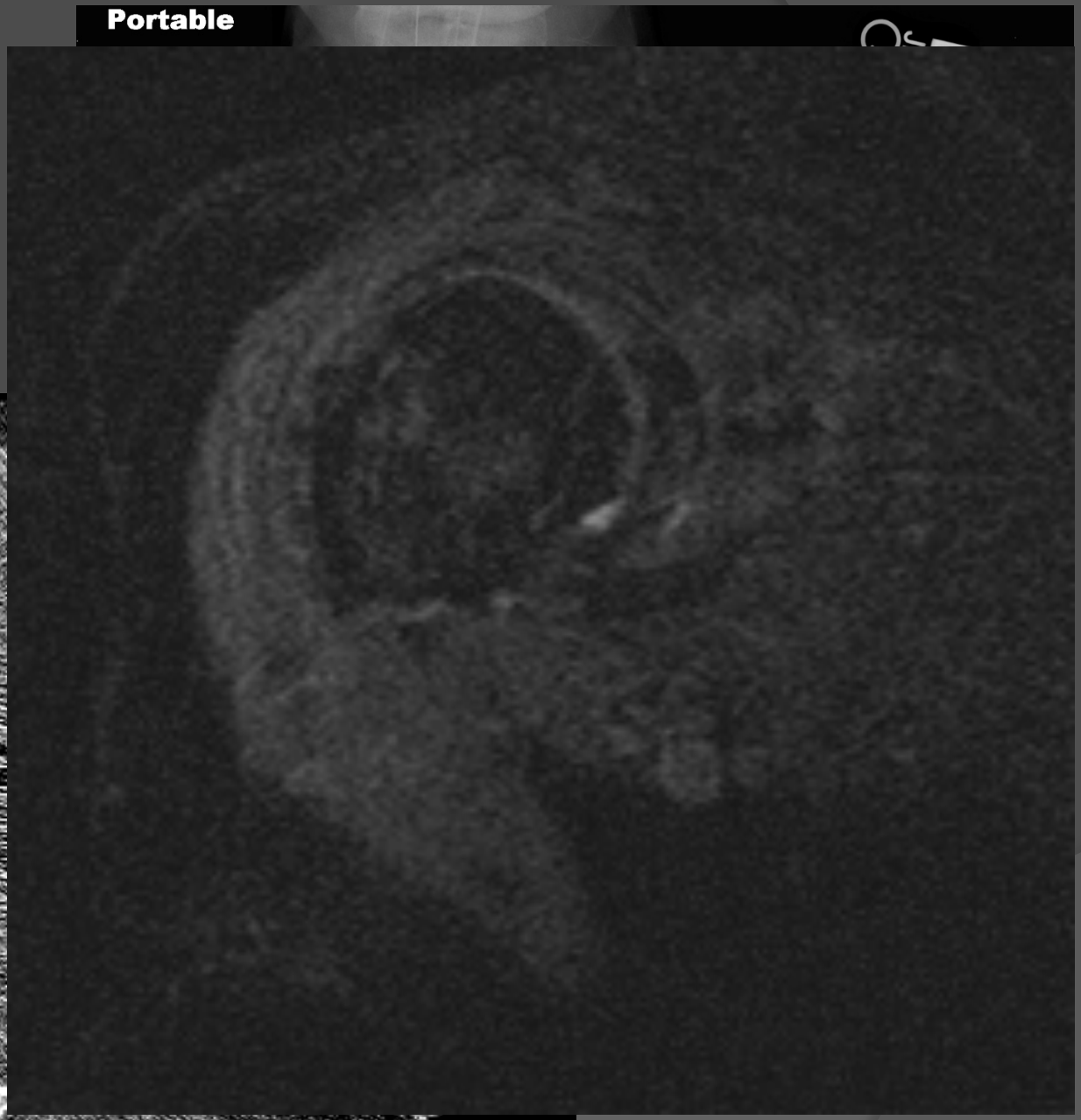




Why

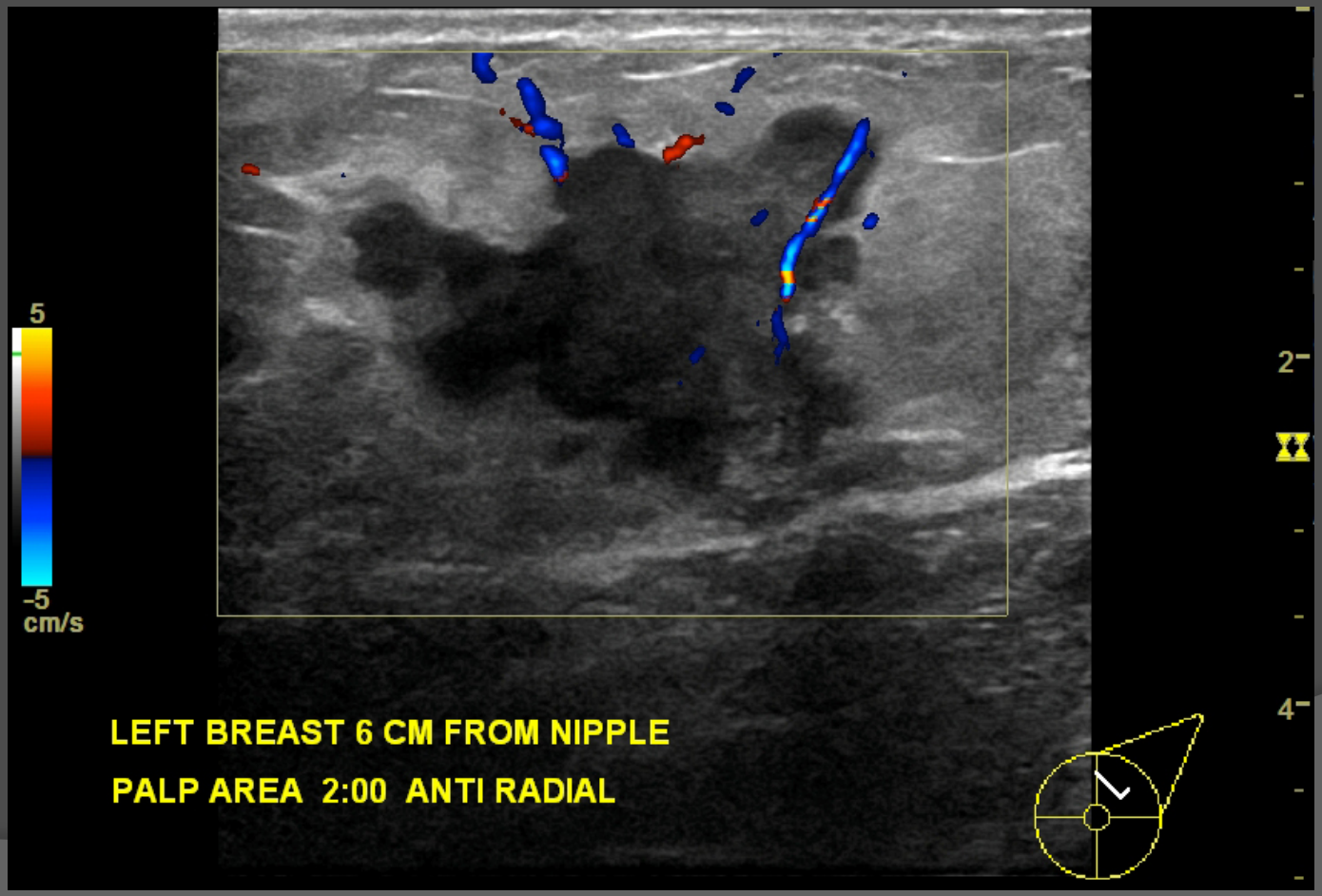
Crappy images





Why

"Pretty" images



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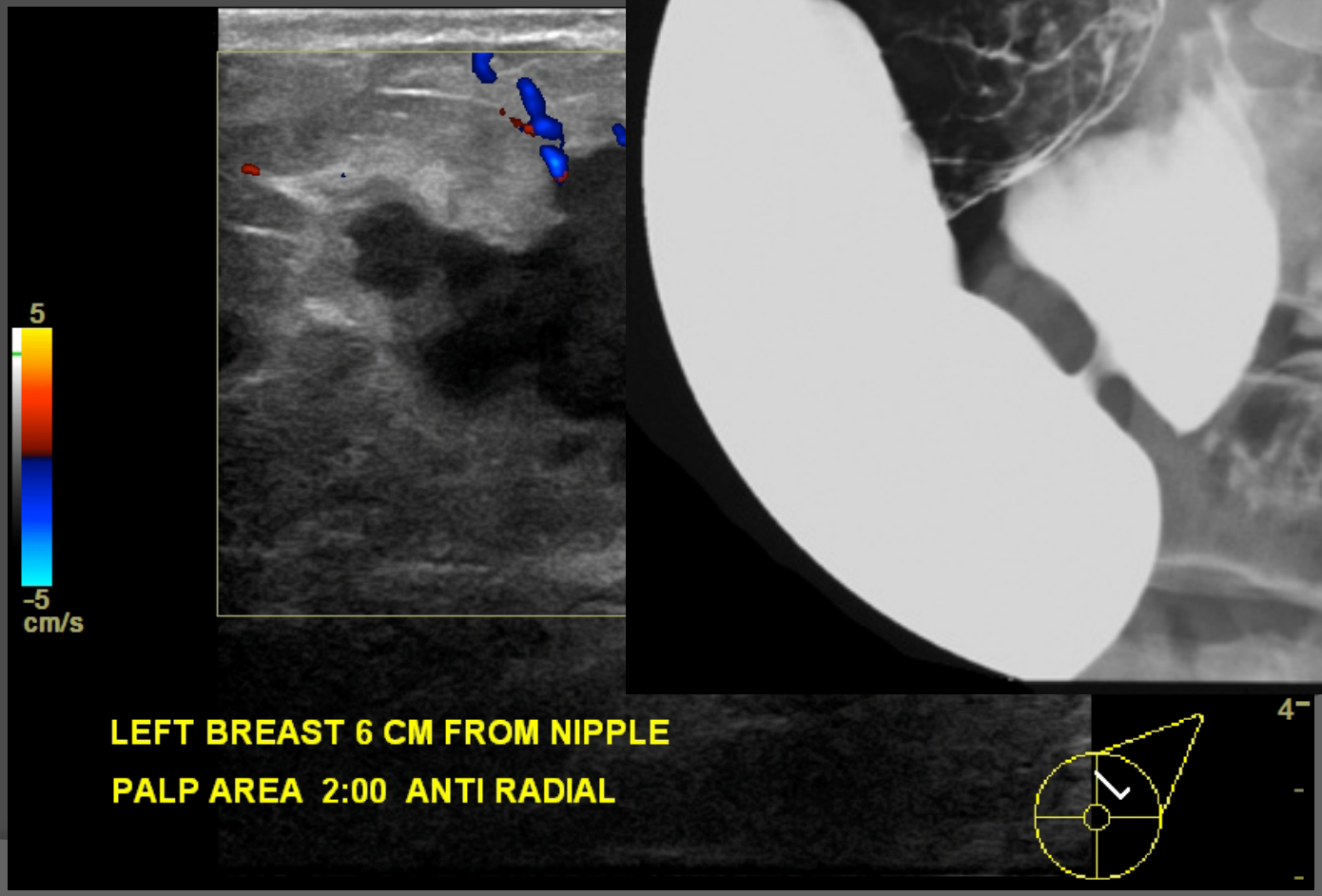
Why

"Pretty" images



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Why

Everyone in this room will give presentations utilizing diagnostic medical images

Make them look as nice as possible!

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Topics

- Images
  - Resolution
  - Formats
  - Acquiring
  - Editing
- Videos
- Presentations
  - PowerPoint
  - Keynote

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Resolution

DPI (dots per inch…..really pixels per inch)

- 72 DPI standard web
- 300 DPI standard print
- 600 DPI high-resolution print
- Various stages in between

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Resolution

- Modality
  - Cross-sectional (sonography, NM, CT and MR)
    - Typically 256 x 256 or 512 x 512
      - For a 4” image, about 64 or 128 DPI
  - Radiography
    - About 300 DPI
  - Mammography
    - About 600 DPI

Resolution

- Saving from PACS (Centricity at least)
  - Automatic/default 72 DPI…..even for mammo

Formats

DICOM

Digital Imaging and Communication in Medicine

TIFF/TIF

Tagged Image File Format

JPEG/JPG

Joint Photographic Experts Group

PNG

Portable Network Graphics

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Formats

- Typically greyscale
  - 12 bit (4096 shades)
    - DICOM
  - 8 bit (256 shades)
    - TIFF
    - JPEG
    - PNG

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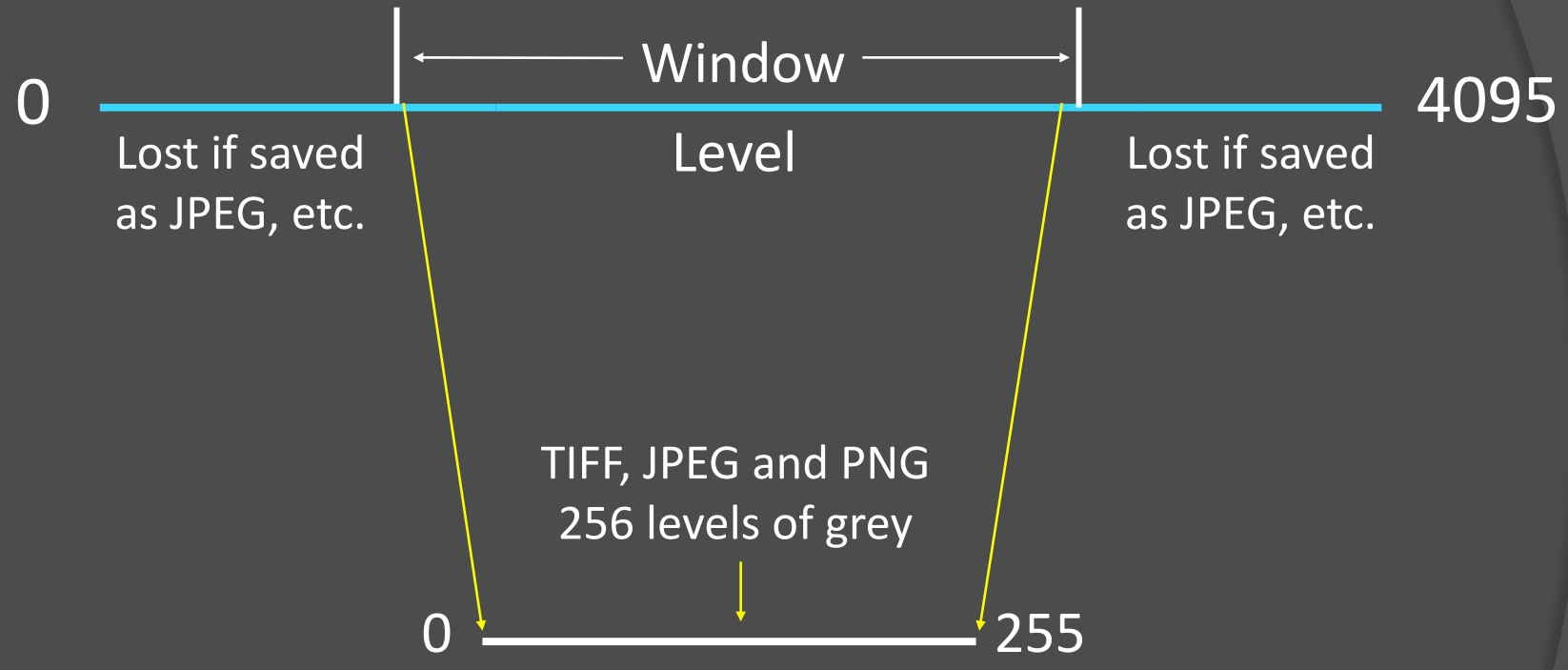
Formats



DICOM also contains textual data (eg, study parameters, patient demographics) and is more than an image format

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Formats

- Data compression
  - Ubiquitous
  - Makes file sizes smaller when saving
  - Types
    - Lossless
    - Lossy

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Formats

- Lossless
  - Ratio 2:1…..at best
  - No data is lost
- Lossy
  - Variable ratios…..often on order of 20:1
  - Data is permanently lost
    - Inexact approximations
    - Partial discarding

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Formats

Lossy

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Formats

- Lossless
  - DICOM
    - Legally must be lossless
  - TIFF
  - PNG
- Lossy
  - JPEG

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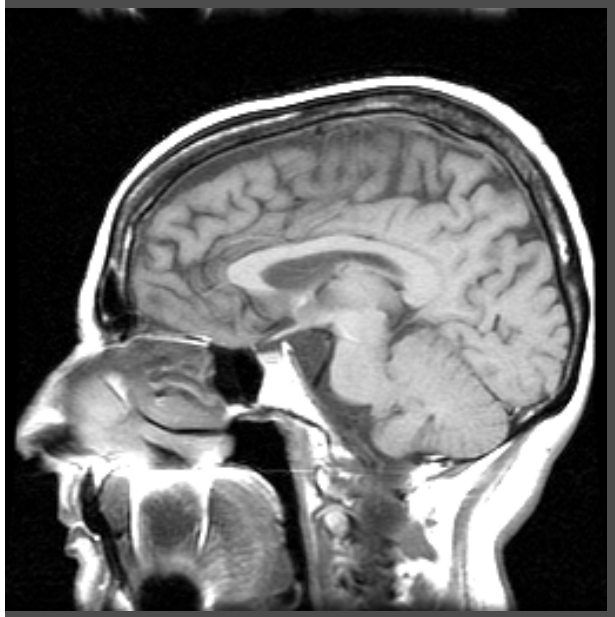
Formats

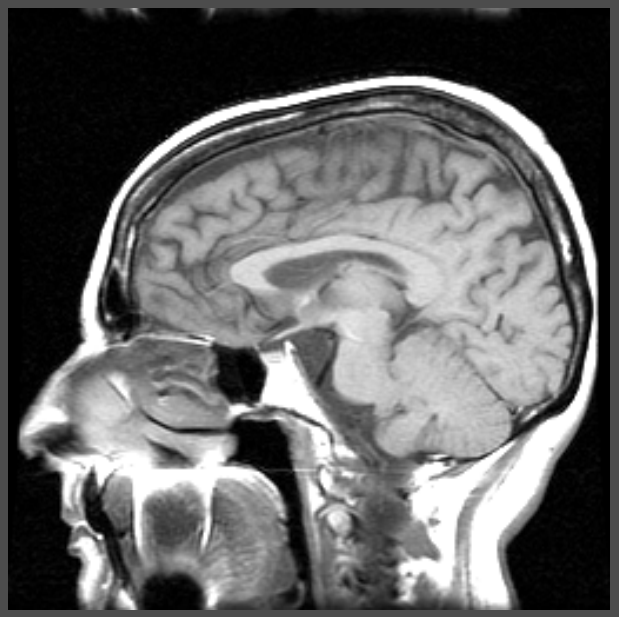
- JPEGs
  - Can't live with 'em, can't live without 'em
  - Every time a JPEG is saved, data/quality is permanently discarded
  - JPEQ quality levels
    - 0-100 (standard)
    - 1-12 (Adobe)
    - Higher quality level preserves data

Formats



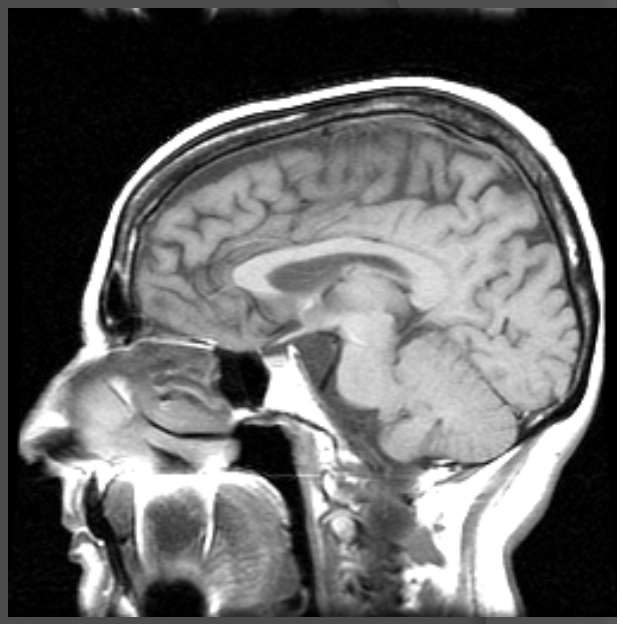
DICOM

Full spatial fidelity
Full dynamic range (W/L)
Format not fully supported
131 kB



TIFF

Full spatial fidelity
Limited dynamic range (W/L)
Format mostly supported
200 kB



JPEG 100

Variable spatial fidelity
Limited dynamic range (W/L)
Format 100% fully supported
50 kB

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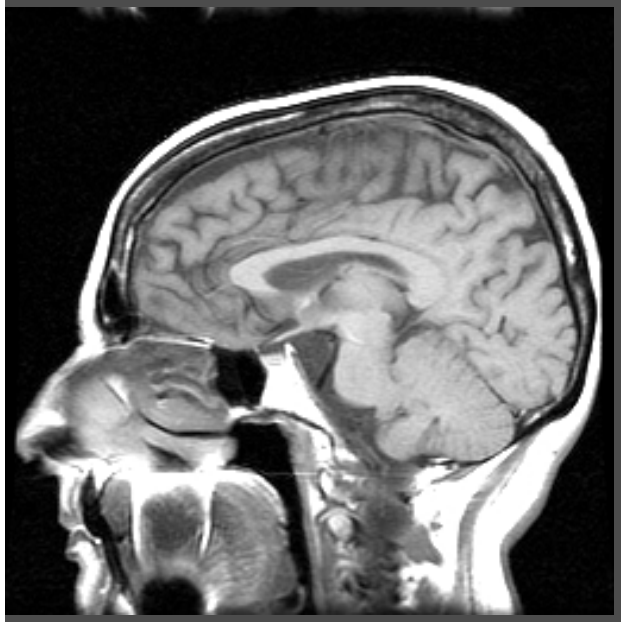
Formats

JPEG



Quality = 100
4:1 compression
50 kB

Quality = 50
20:1 compression
10 kB

Quality = 10
50:1 compression
4 kB

(DICOM image size: 131 kB)

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Formats

JPEG

Quality = 100

Quality = 25

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Formats

JPEG

Quality = 100

Quality = 100 - 25

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Formats

JPEG

Quality = 25

"Lost with lossy"

- Edges
  - Blur
  - Ripples
  - Echoes

Acquiring

- Digital
  - PACS (eg, GE Centricity)
  - Web
  - Screen capture
- Film…..if you know what this is

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PACS

- May not be officially allowed
  - Insert a thumb drive
    - Try saving to F:……or something similar
  - Ask an attending
- GE Centricity formats
  - DICOM
  - TIFF
  - JPEG
  - PNG

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PACS

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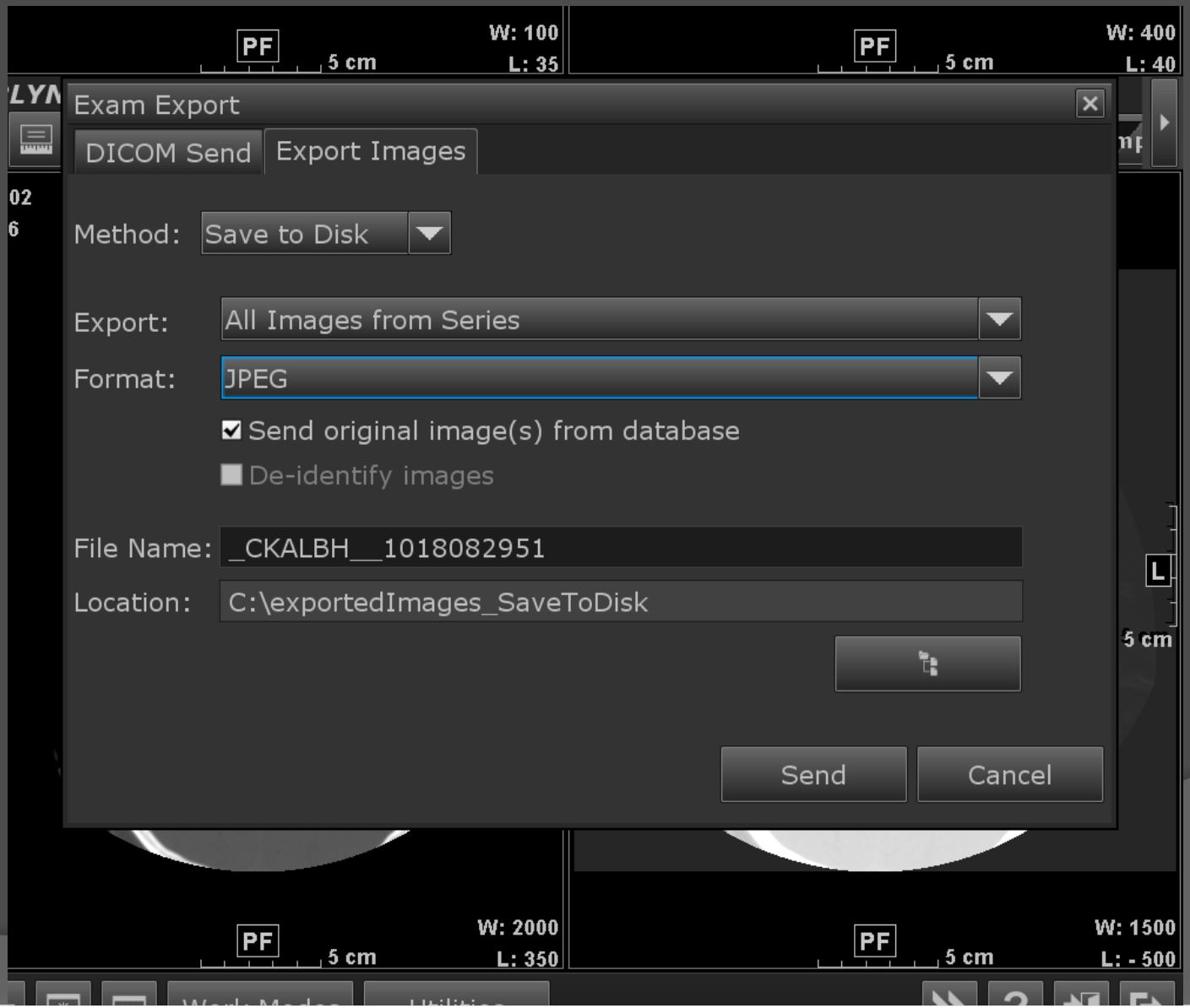
PACS



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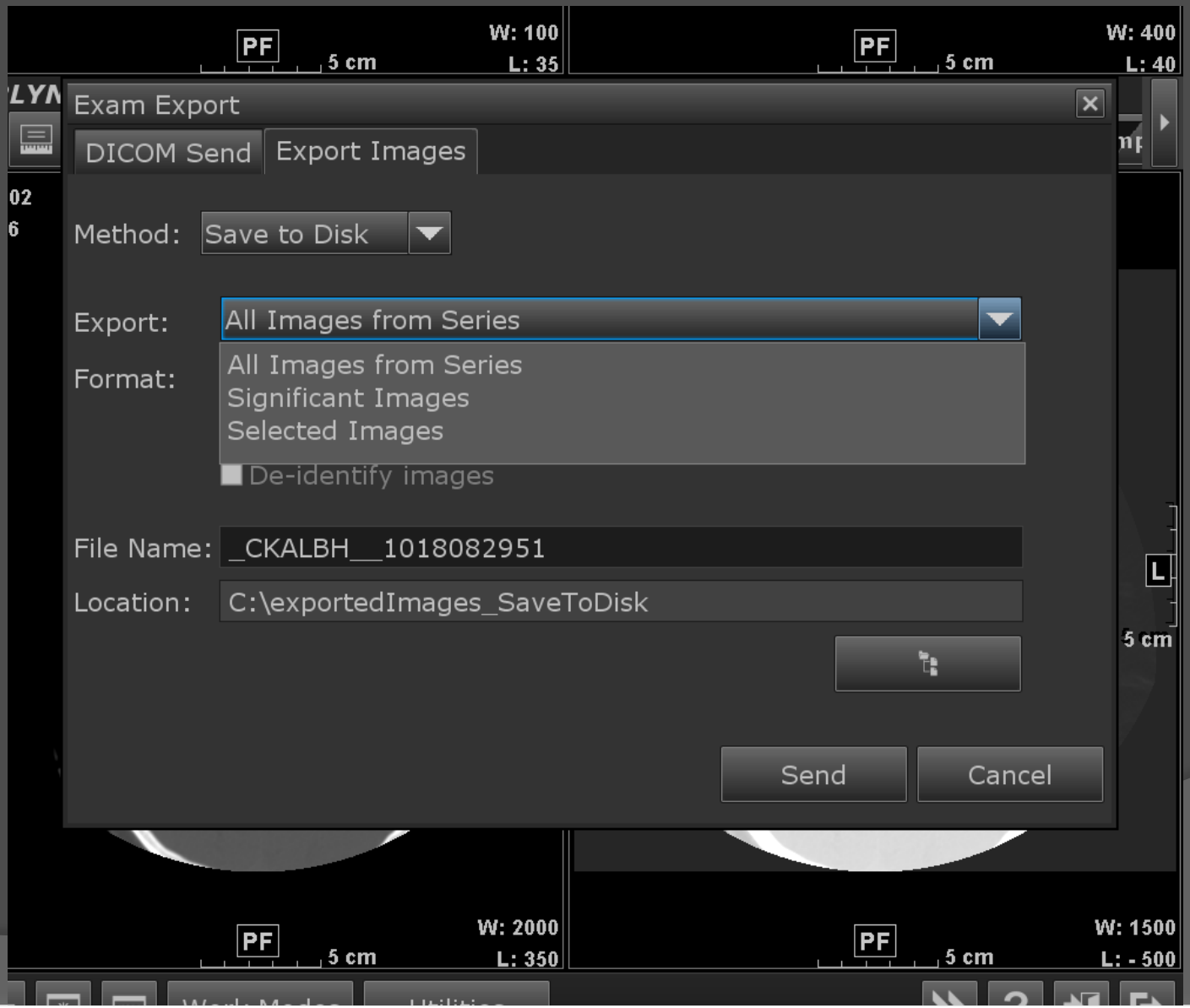
PACS



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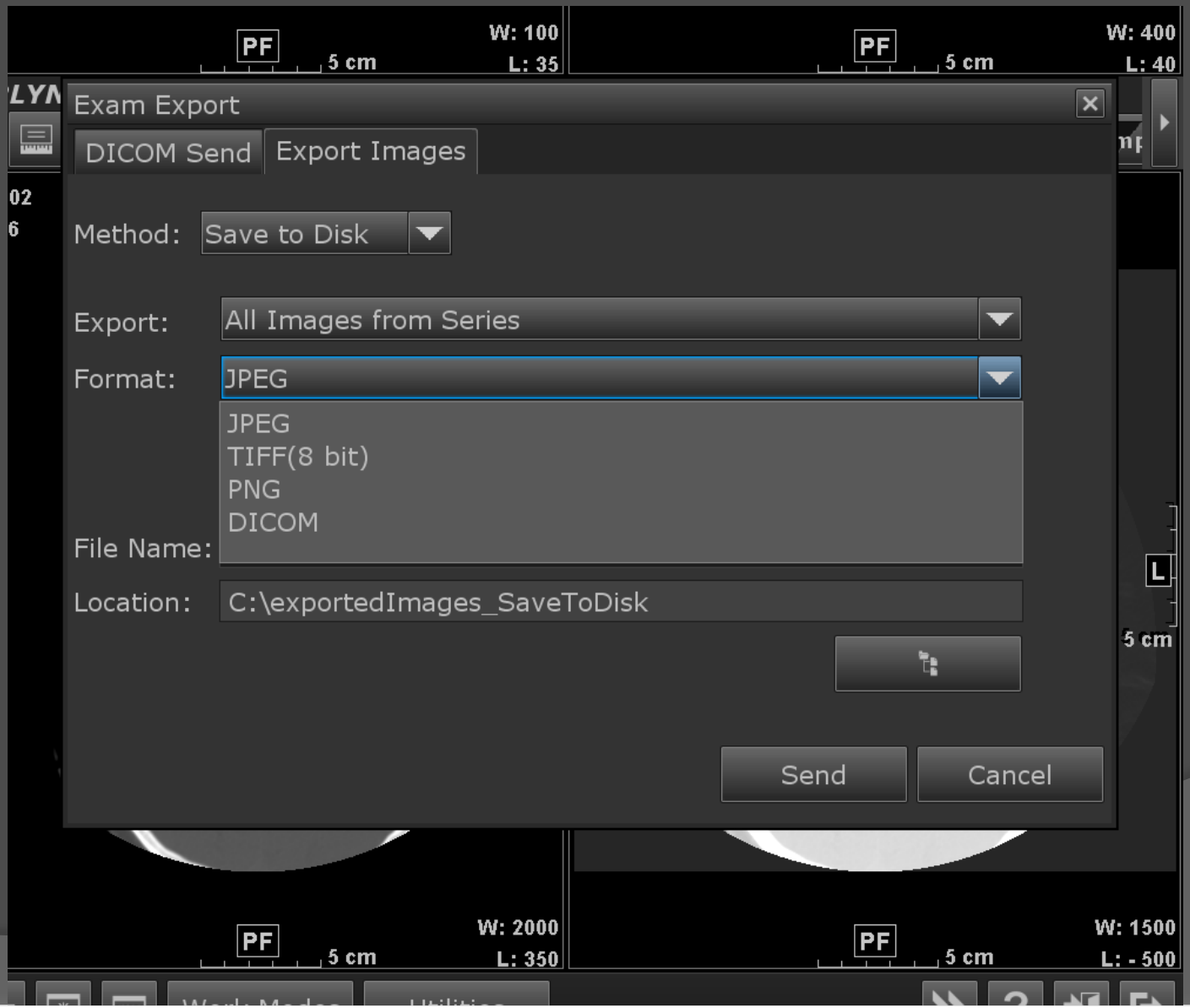
PACS



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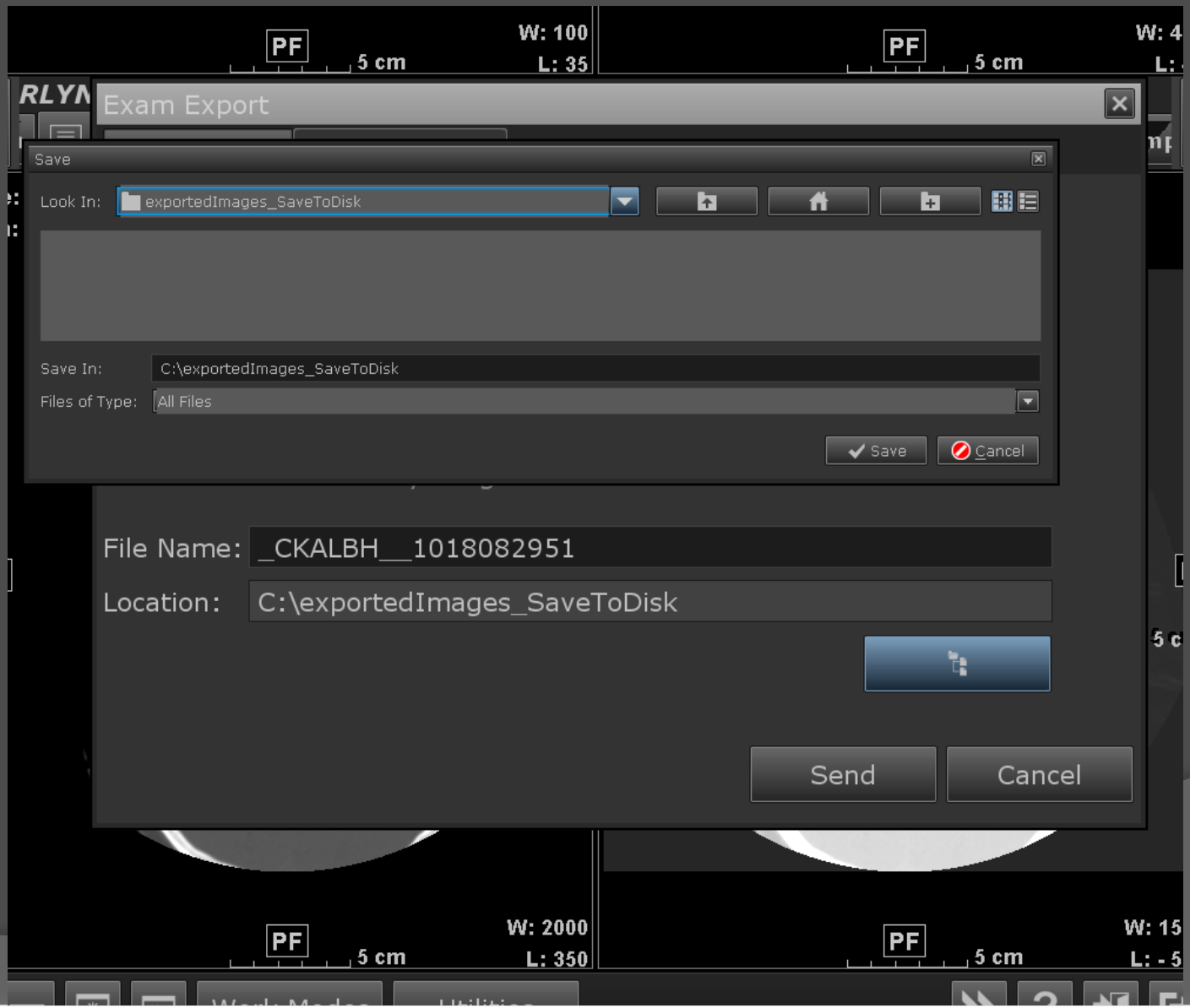
PACS



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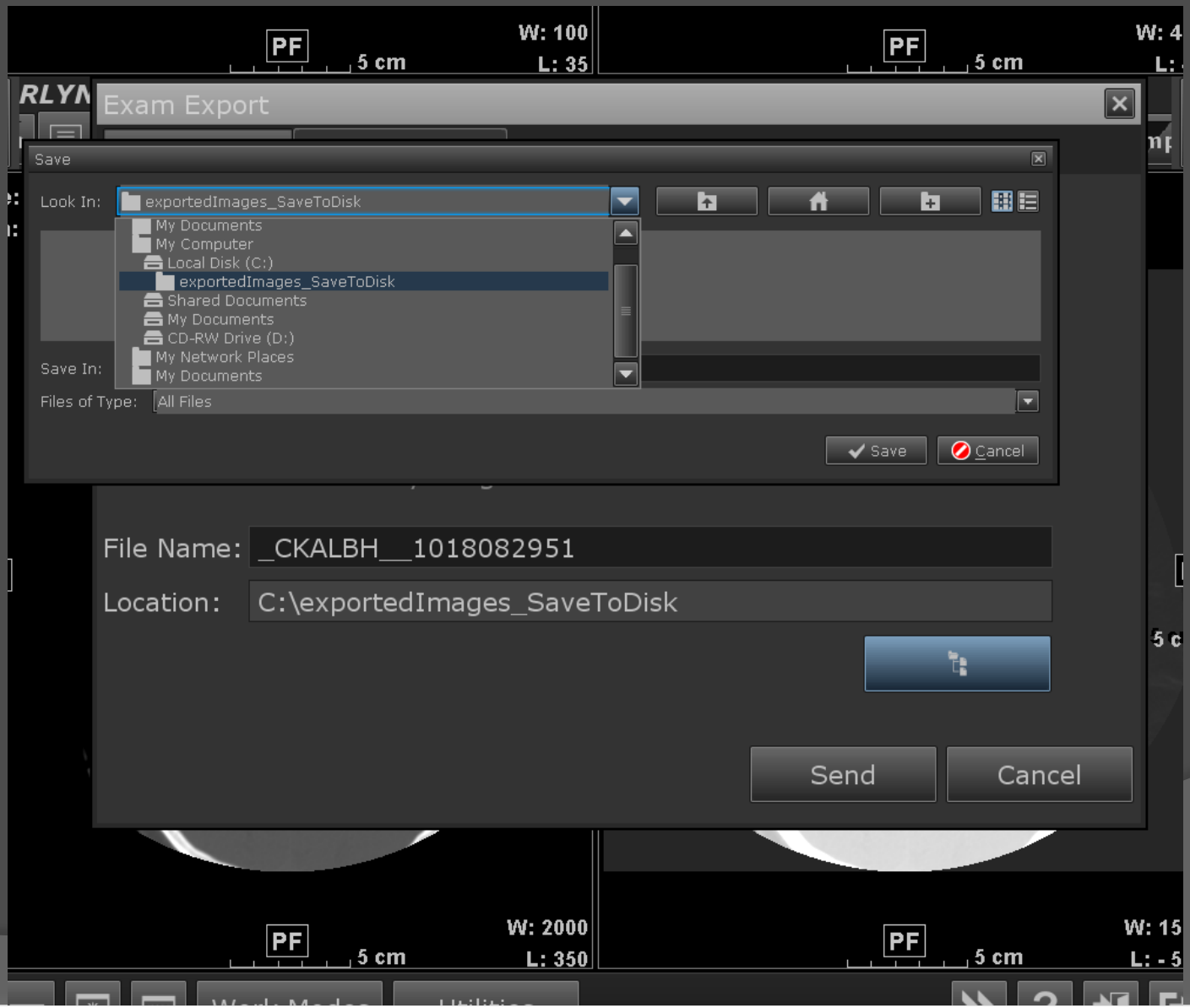
PACS



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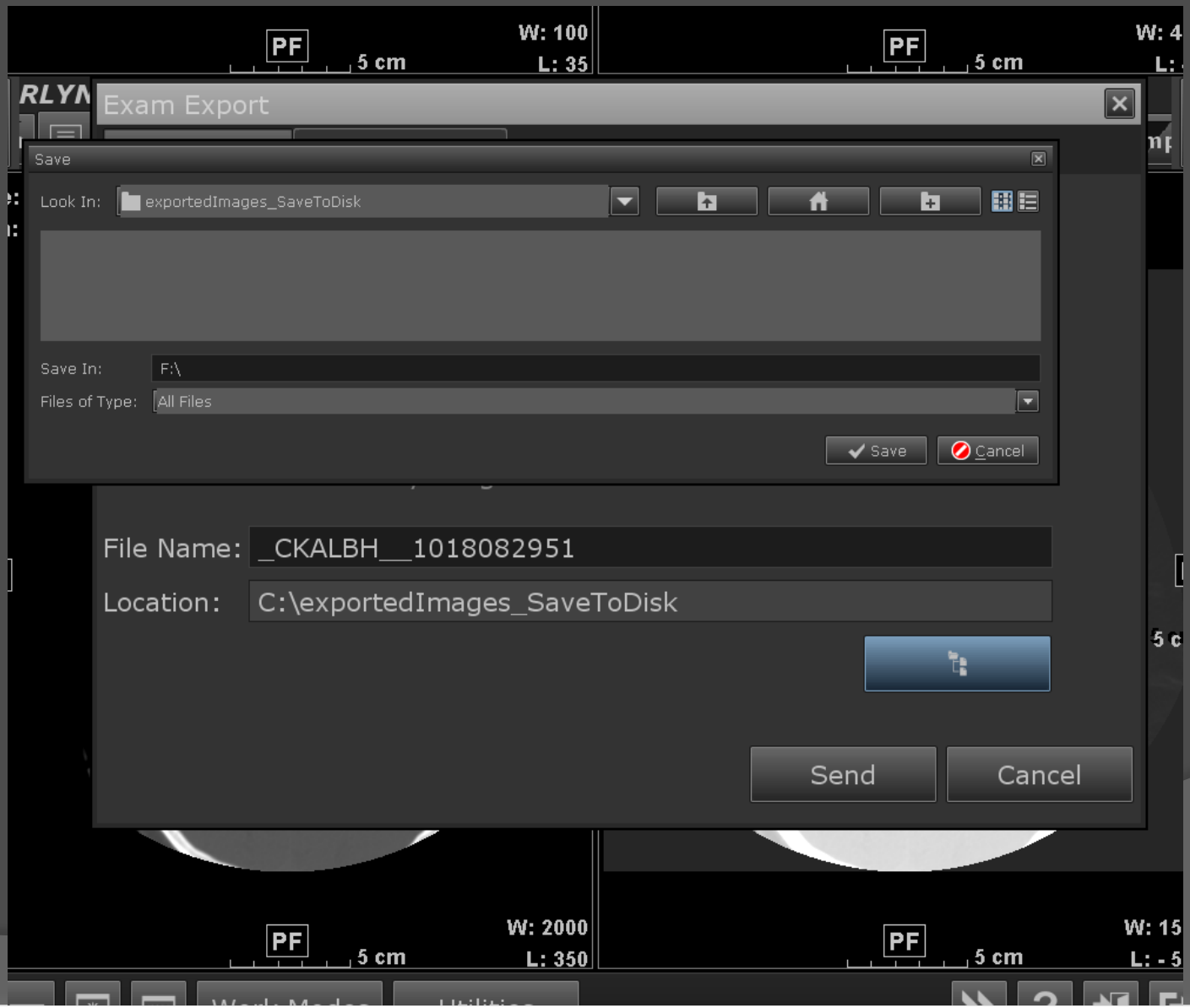
PACS



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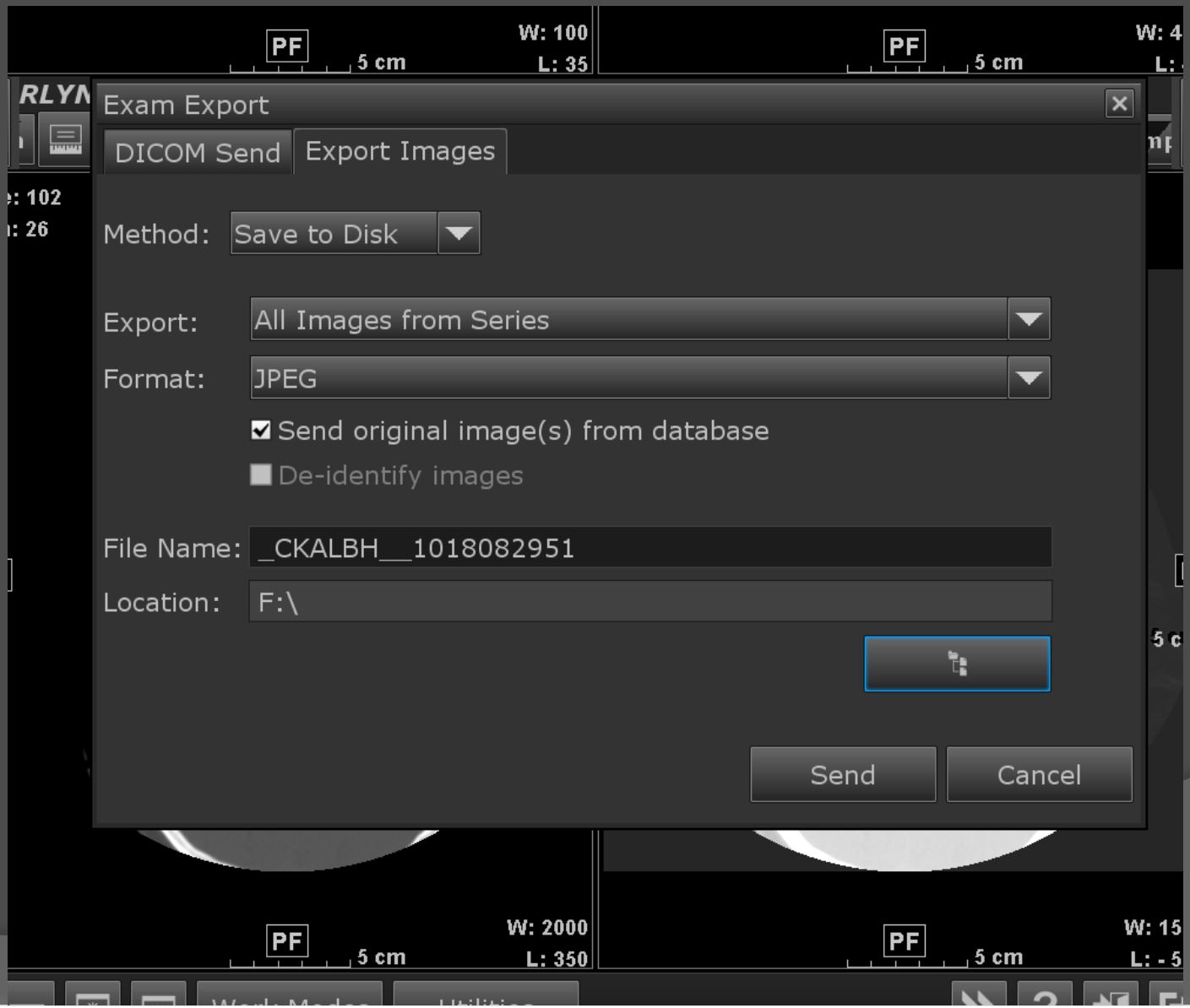
PACS



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Screenshots

- Windows
  - Whole screen: Print key
- Mac
  - Whole screen: Command-shift-3
  - Cropped area: Command-shift-4

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Screenshots

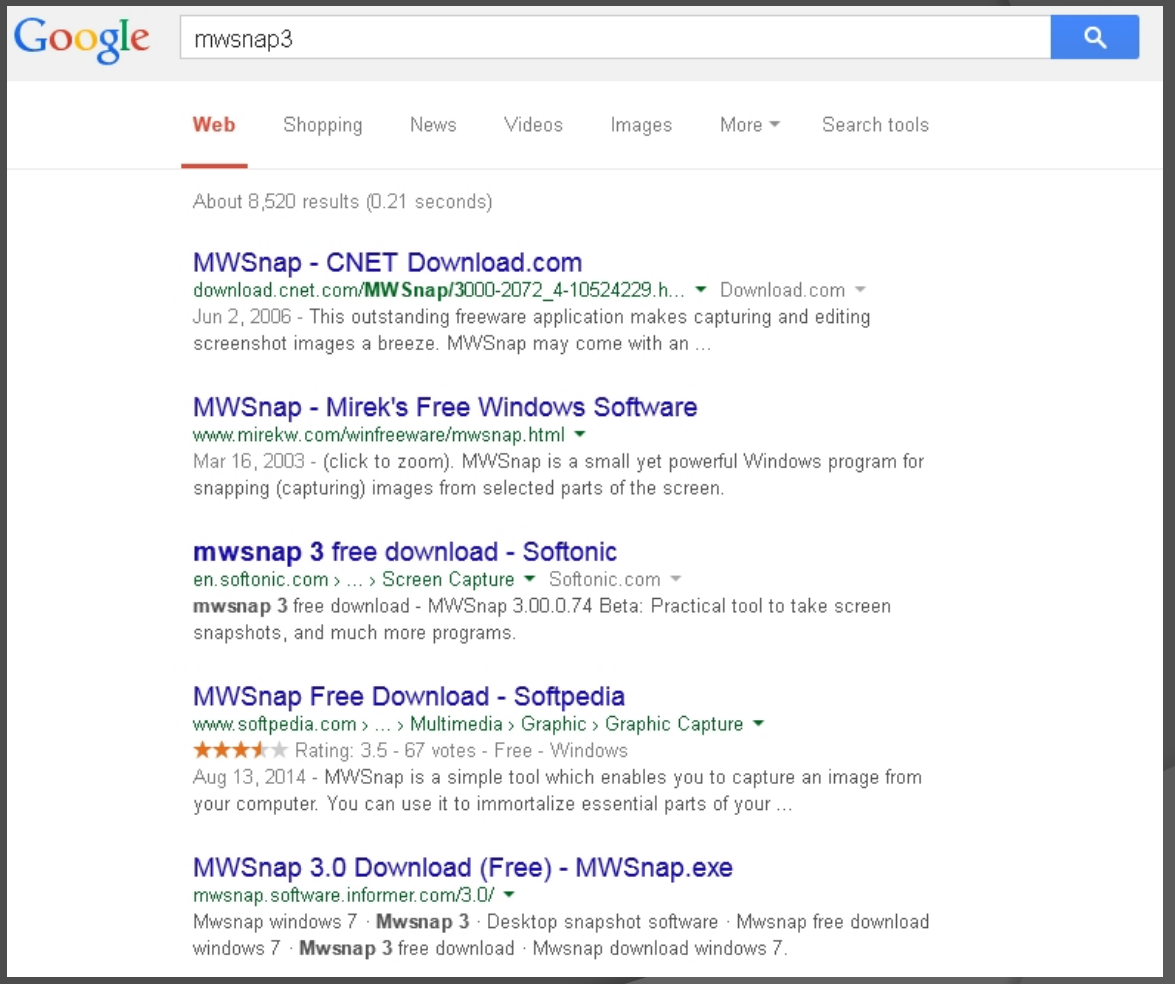
Free software

Windows

MWSnap

Crop

Batch



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Film

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Film

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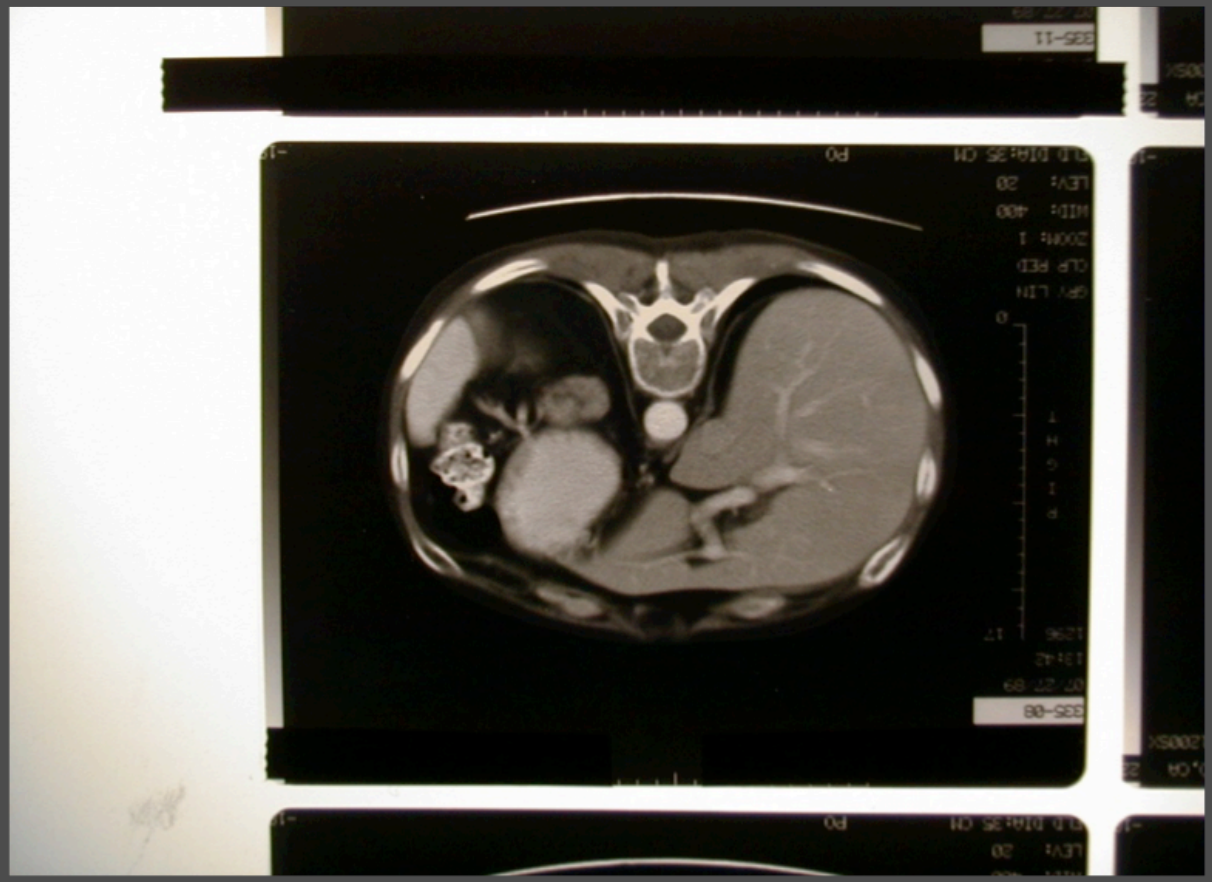
Film



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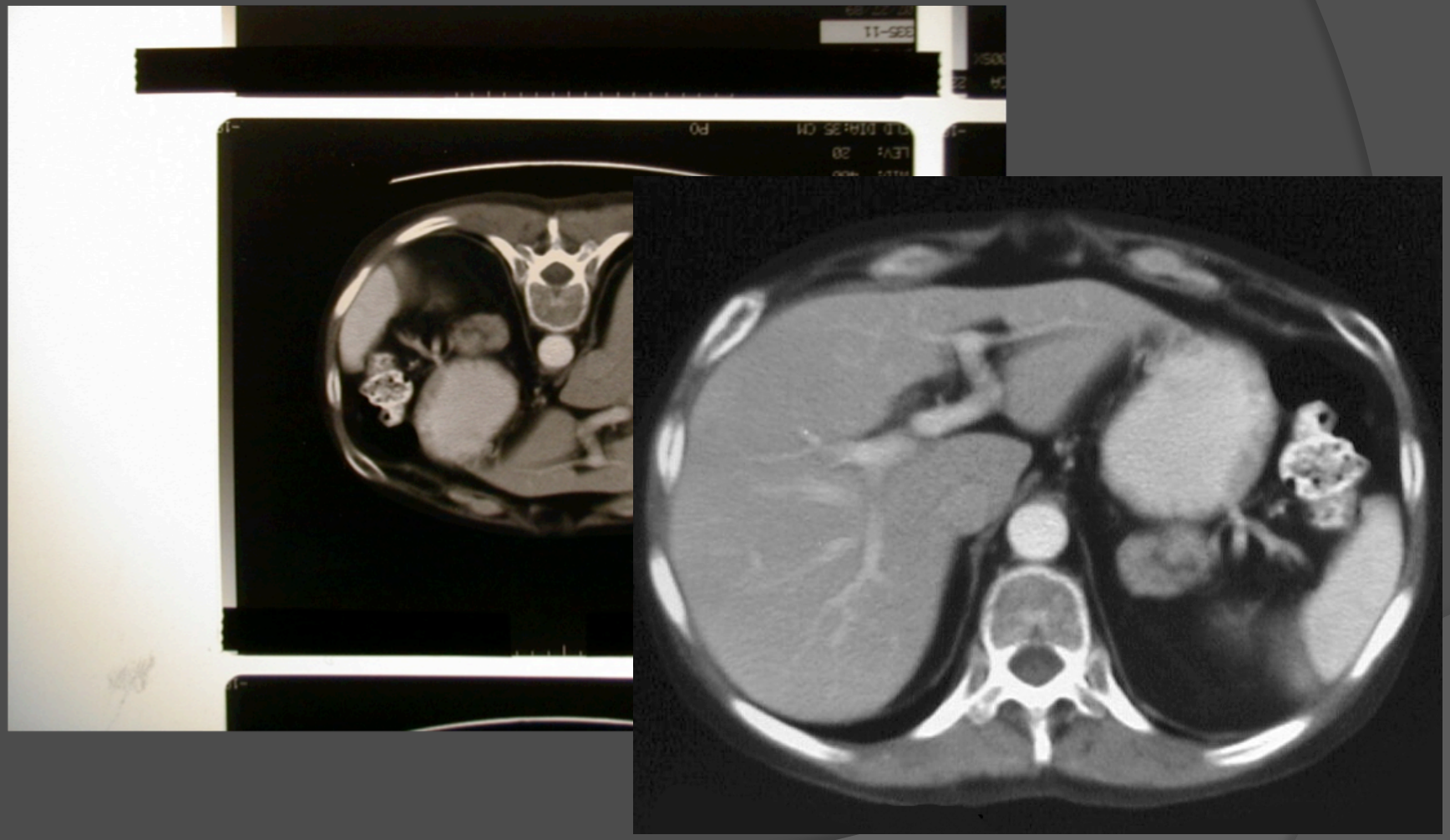
Film



Editing

- Greyscale conversion
  - Smaller files
  - Removes any unexpected color
- Cropping
- Brightness/contrast
- HIPAA compliance
- Tweaks

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Editing

- Photoshop
  - Does a lot, costs a lot
- Everything else
  - Does less, costs less…..or nothing

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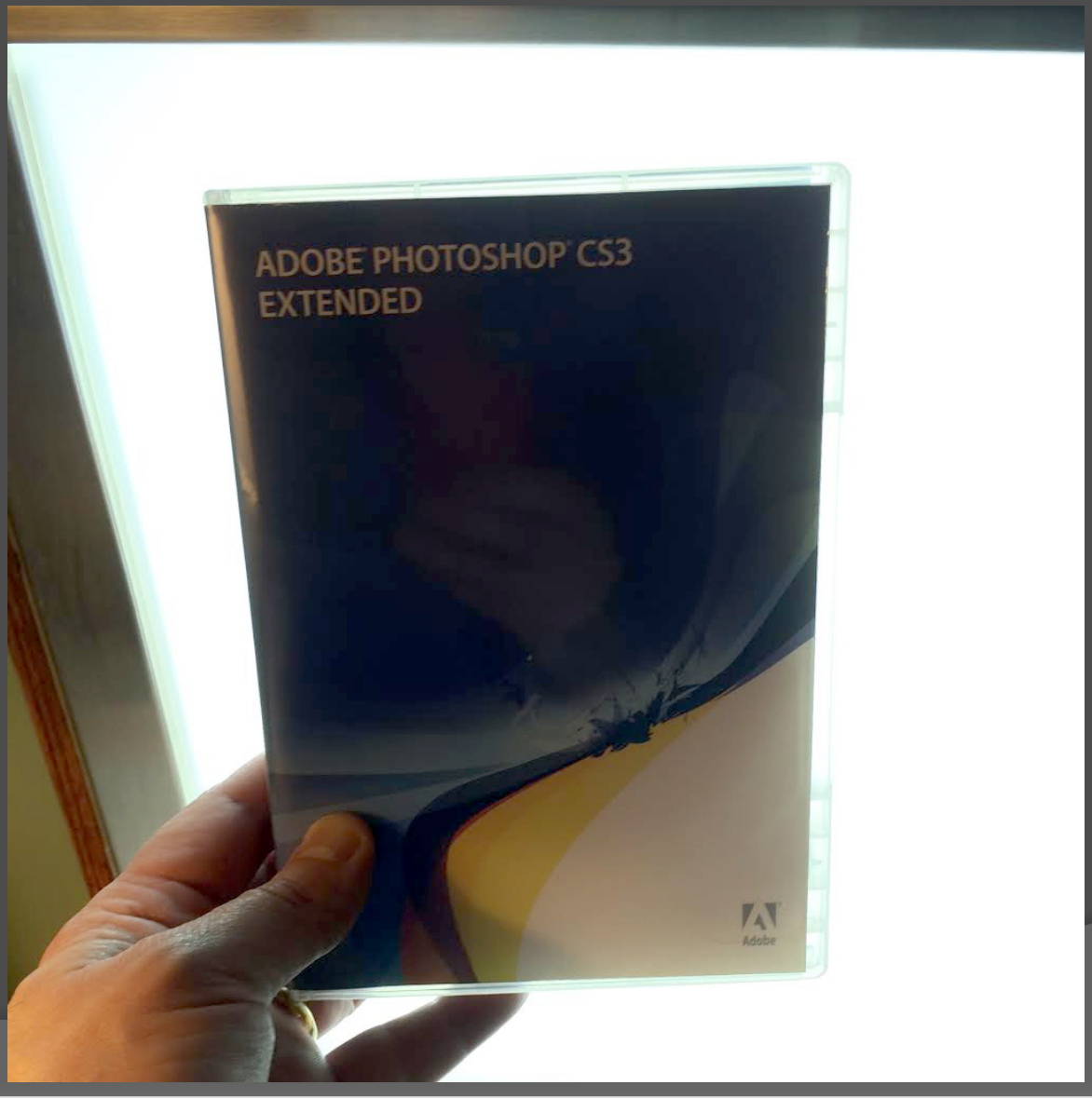
Photoshop



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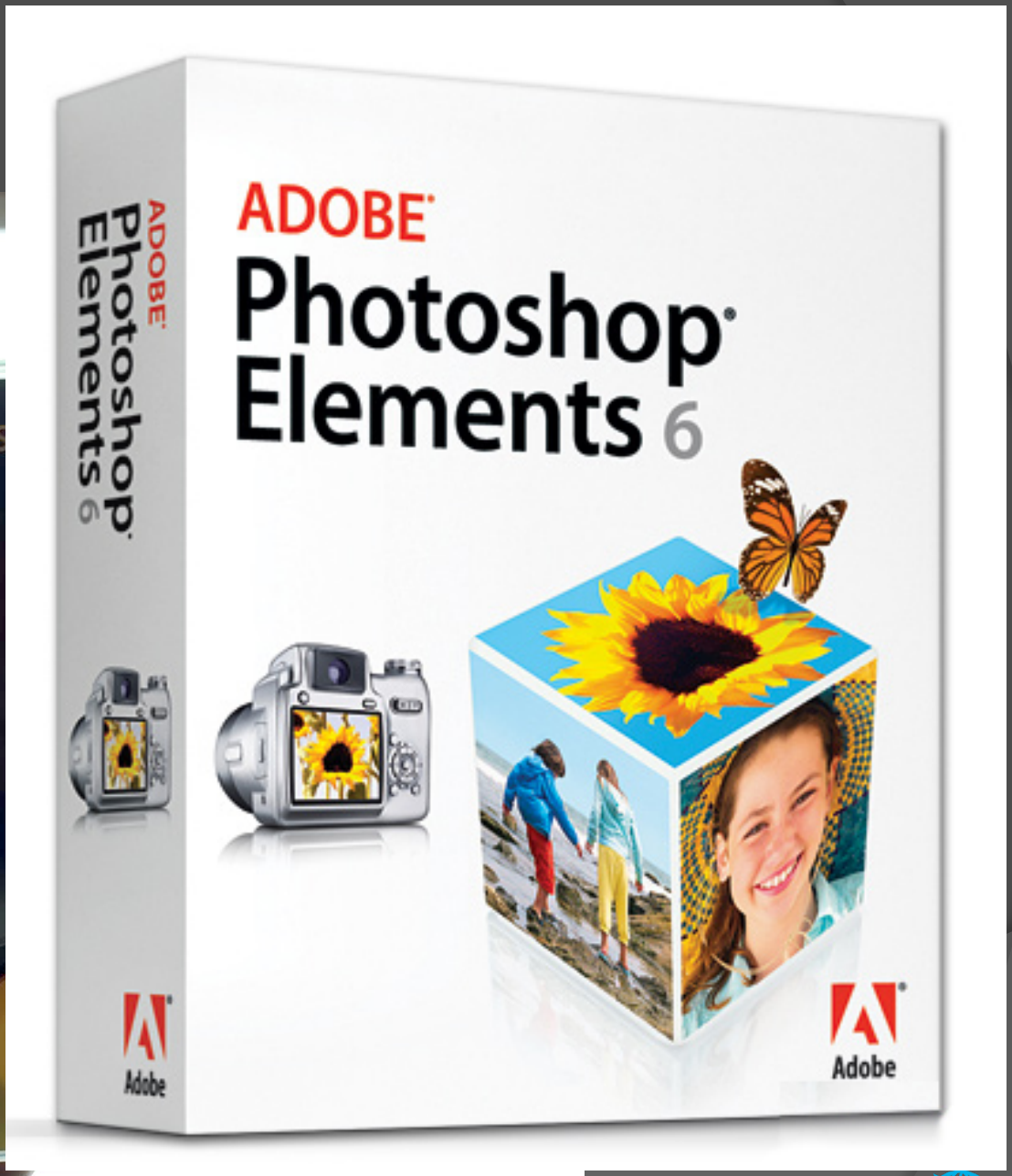
Photoshop

ADOBE PHOTOS
EXTENDED


ADOBE
Photoshop
Elements 6
Adobe
ADOBE
Photoshop
Elements 6
Adobe

Editing

- Photoshop
  - Now a subscription
    - Part of “Creative Cloud”
    - Many more products available than Photoshop
  - I have no financial relationship with Adobe

Editing

- Photoshop
  - Cheapest is $10/month
    - I pay way more for full Creative Cloud
- Cheap/free alternatives
  - Many exist
    - Acceptable for radiologists' needs

Photoshop

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Photoshop

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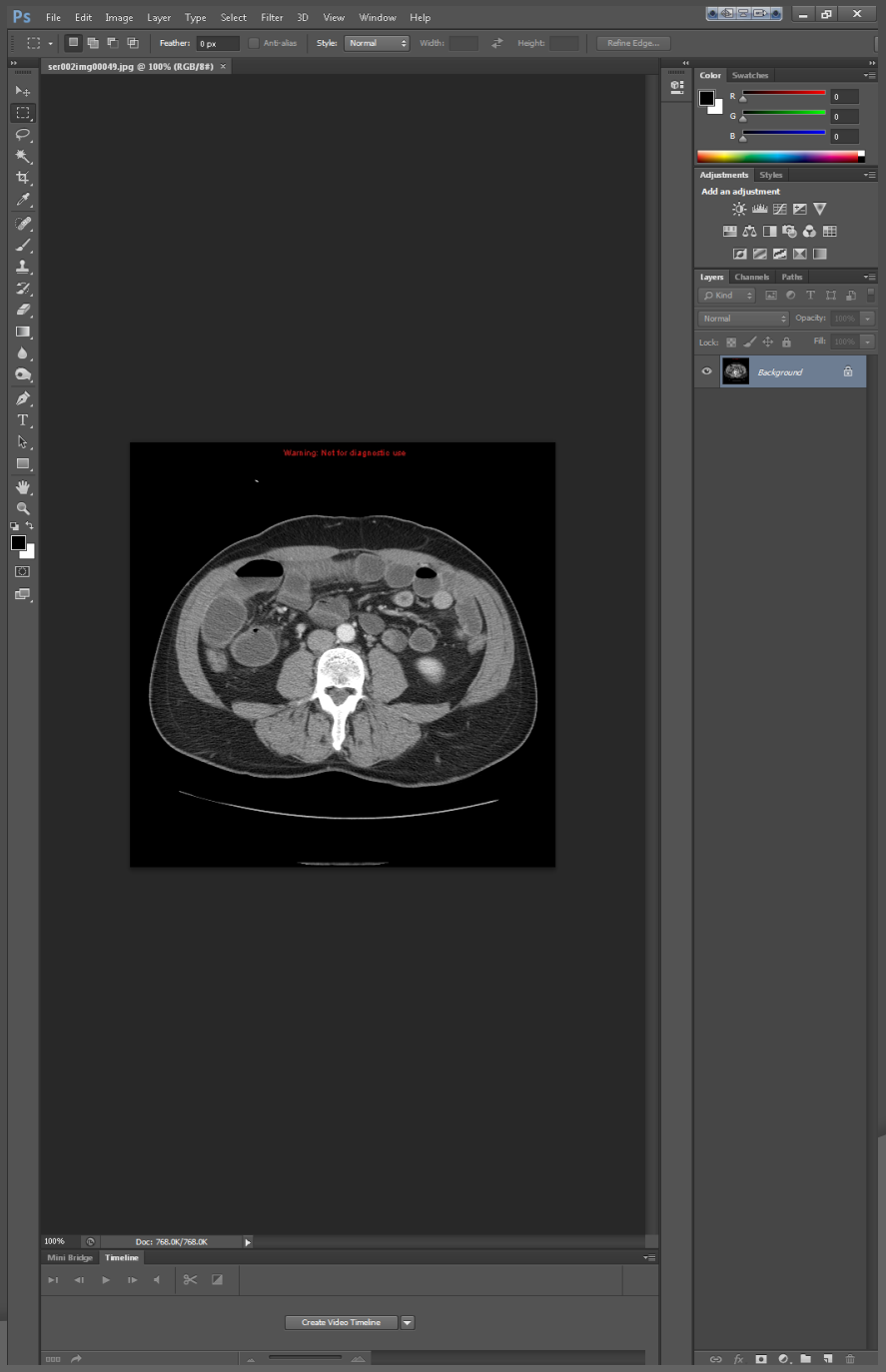
Photoshop



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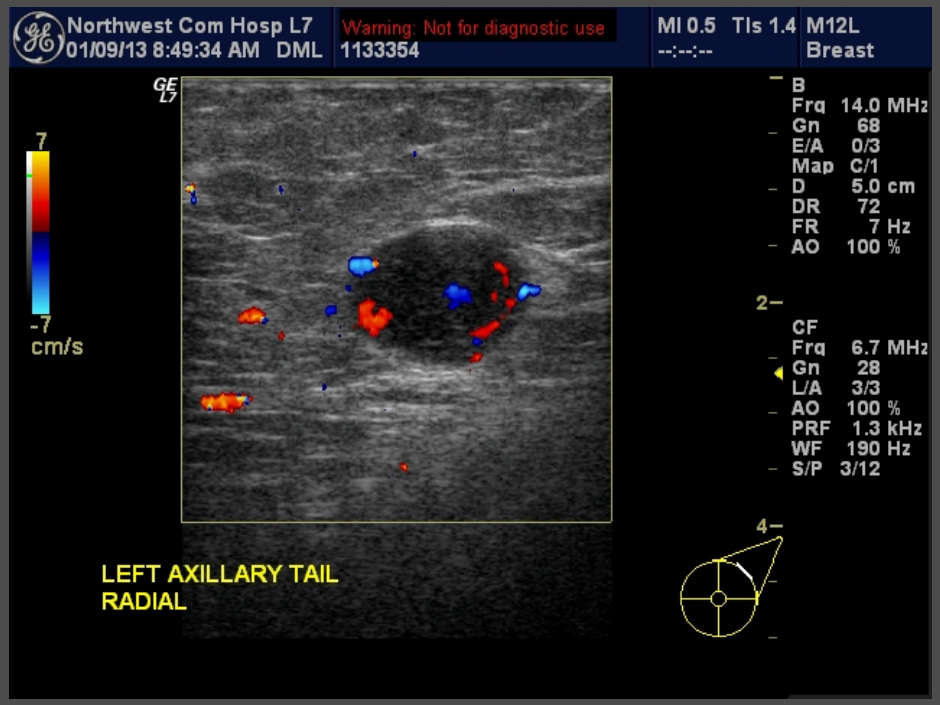
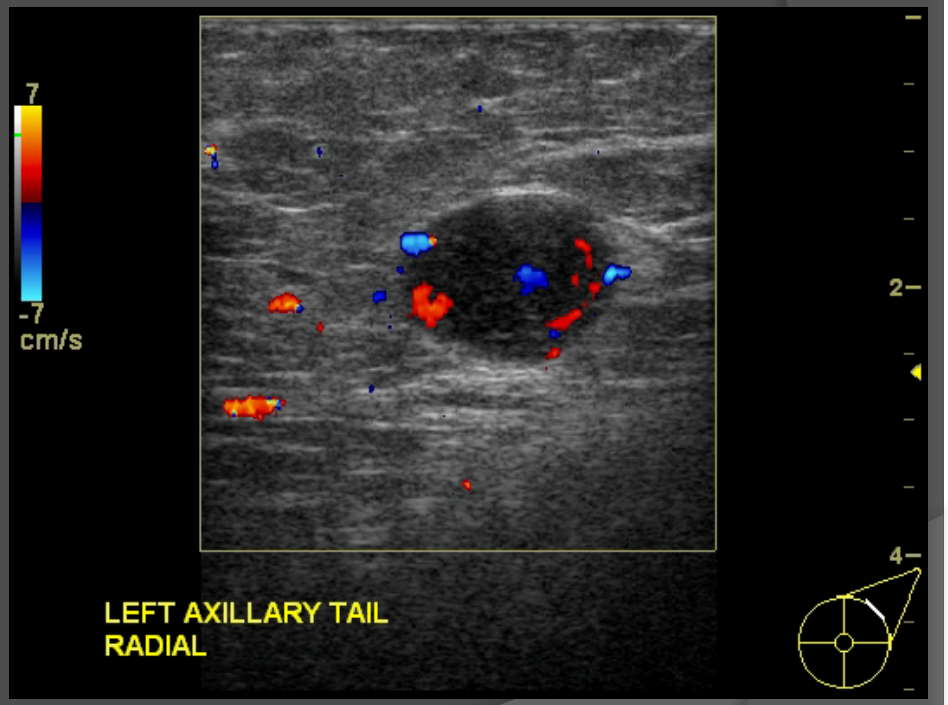
Photoshop





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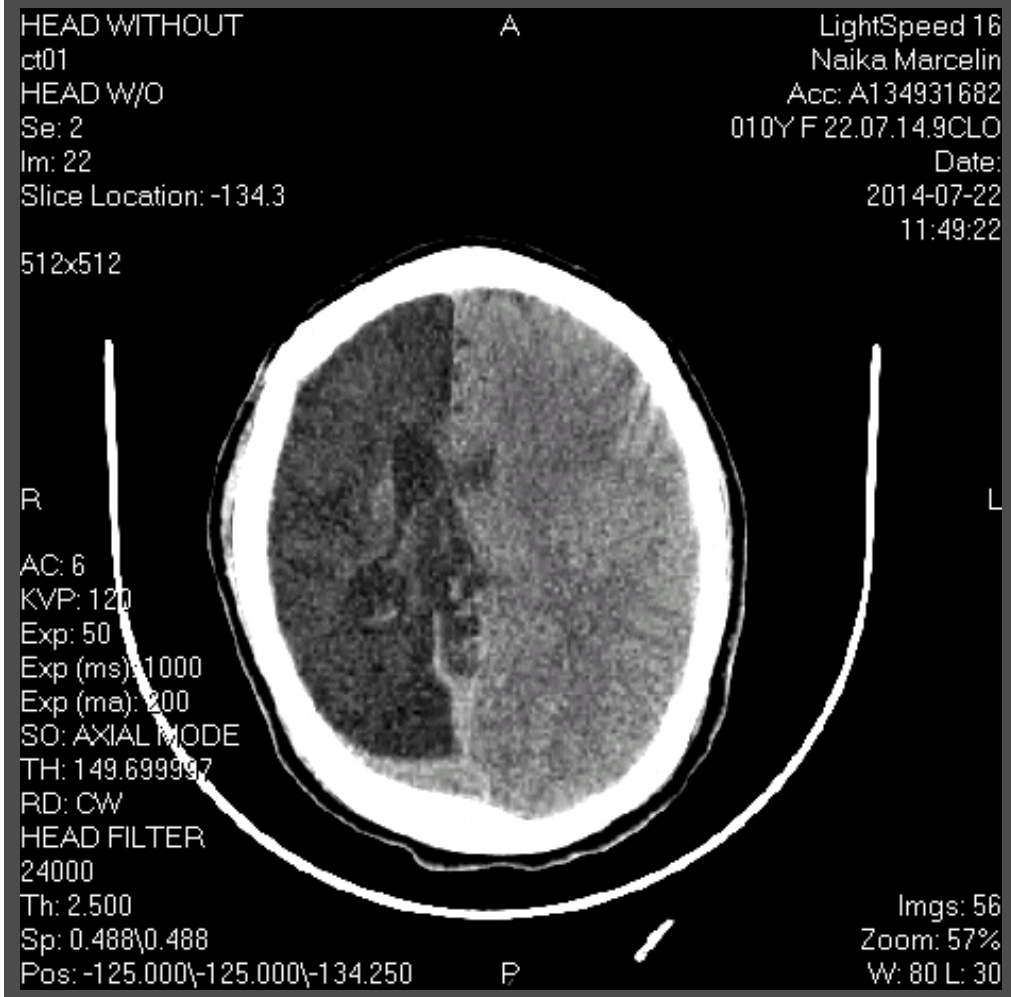
Photoshop



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Photoshop

Tell Denver mammo story

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Photoshop

72 DPI TIFF

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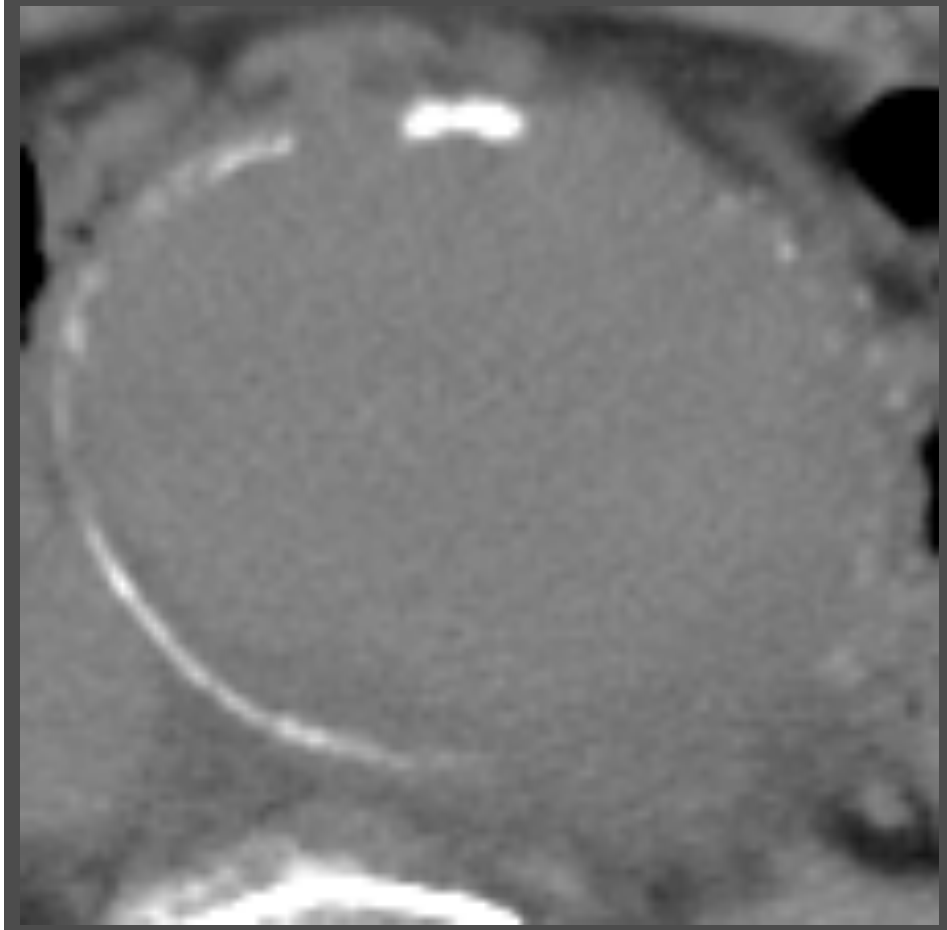
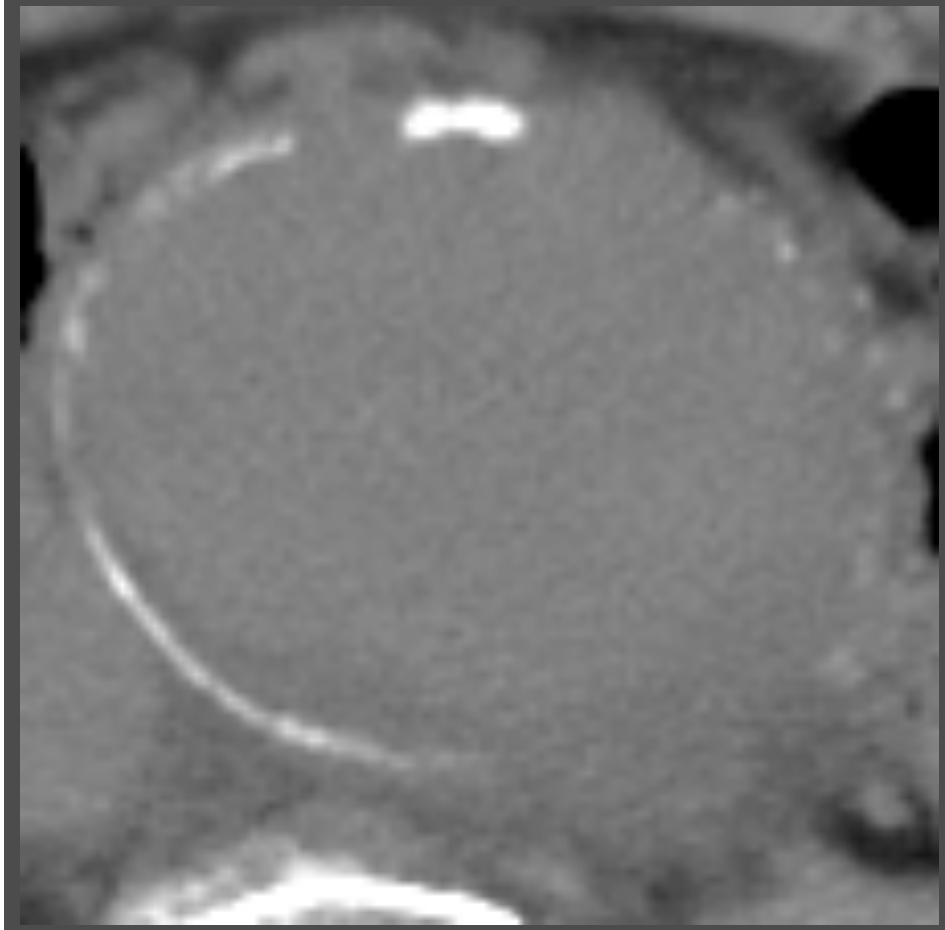
Photoshop

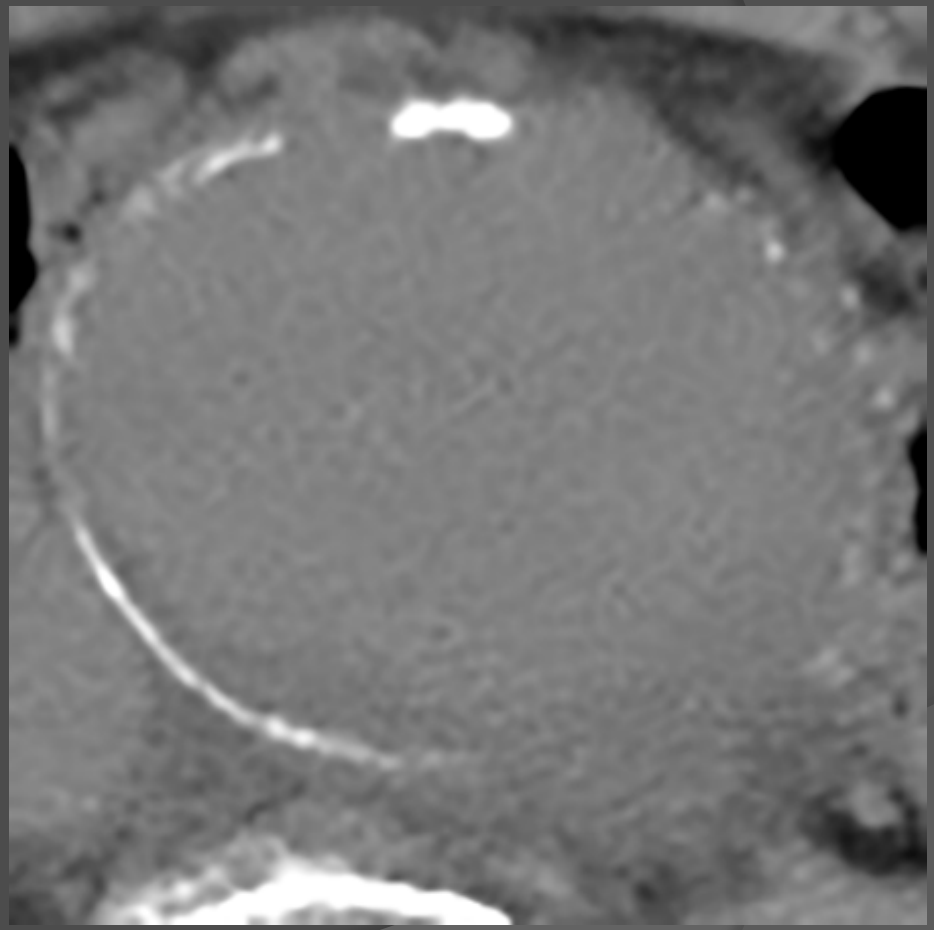


Can “increase” resolution

Photoshop



72 DPI TIFF



300 DPI TIFF

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Photoshop

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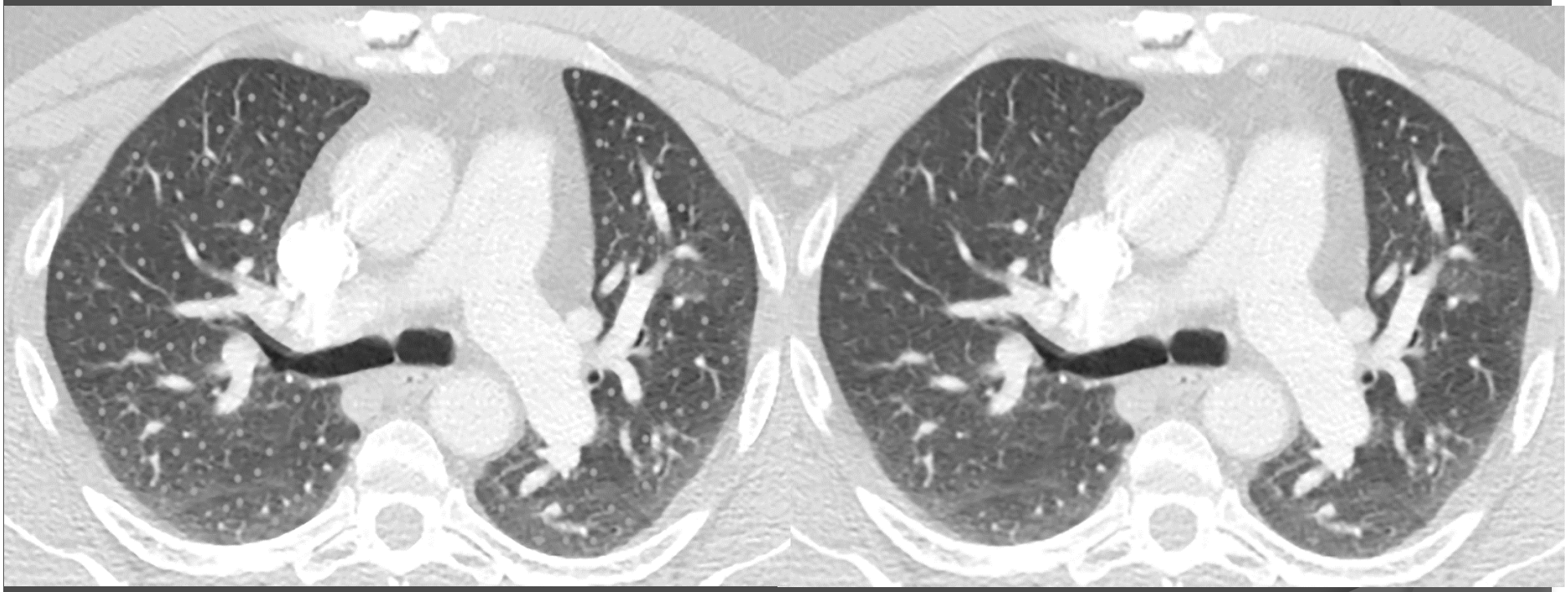
Photoshop



?miliary tuberculosis

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Photoshop

75 identical light grey fuzzy “dots” added

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Photoshop

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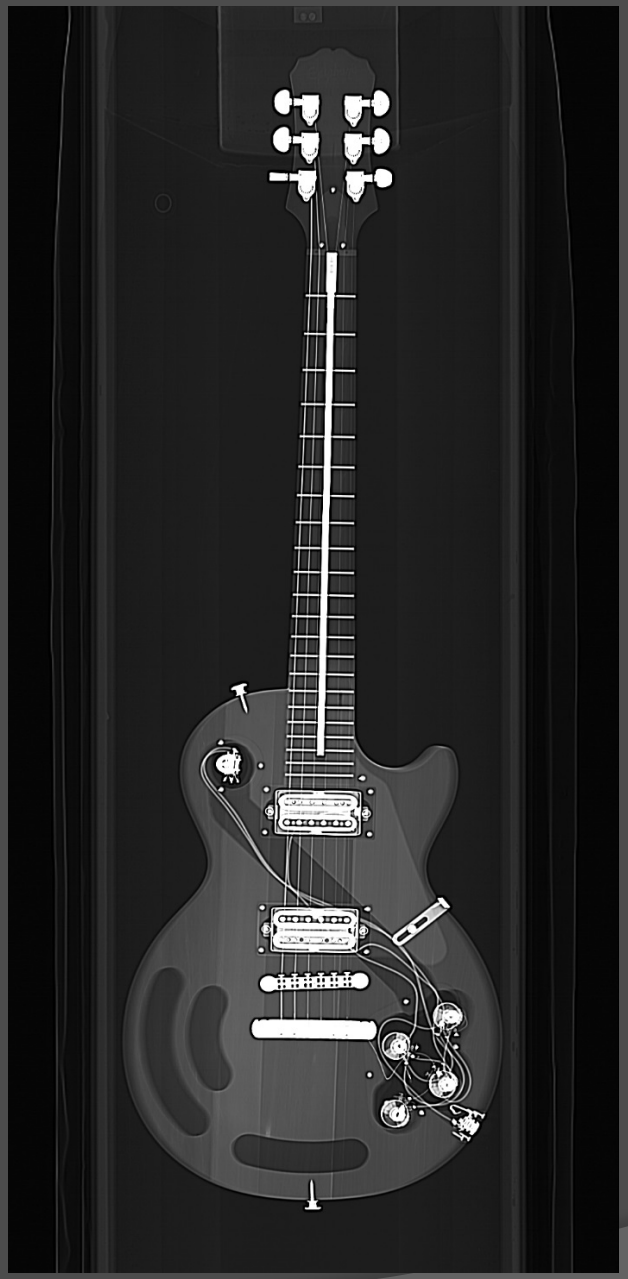
Photoshop



Photoshop

No one knows every “trick”

- I have taken 4 courses in 10+ years

Knowing a little can help a lot

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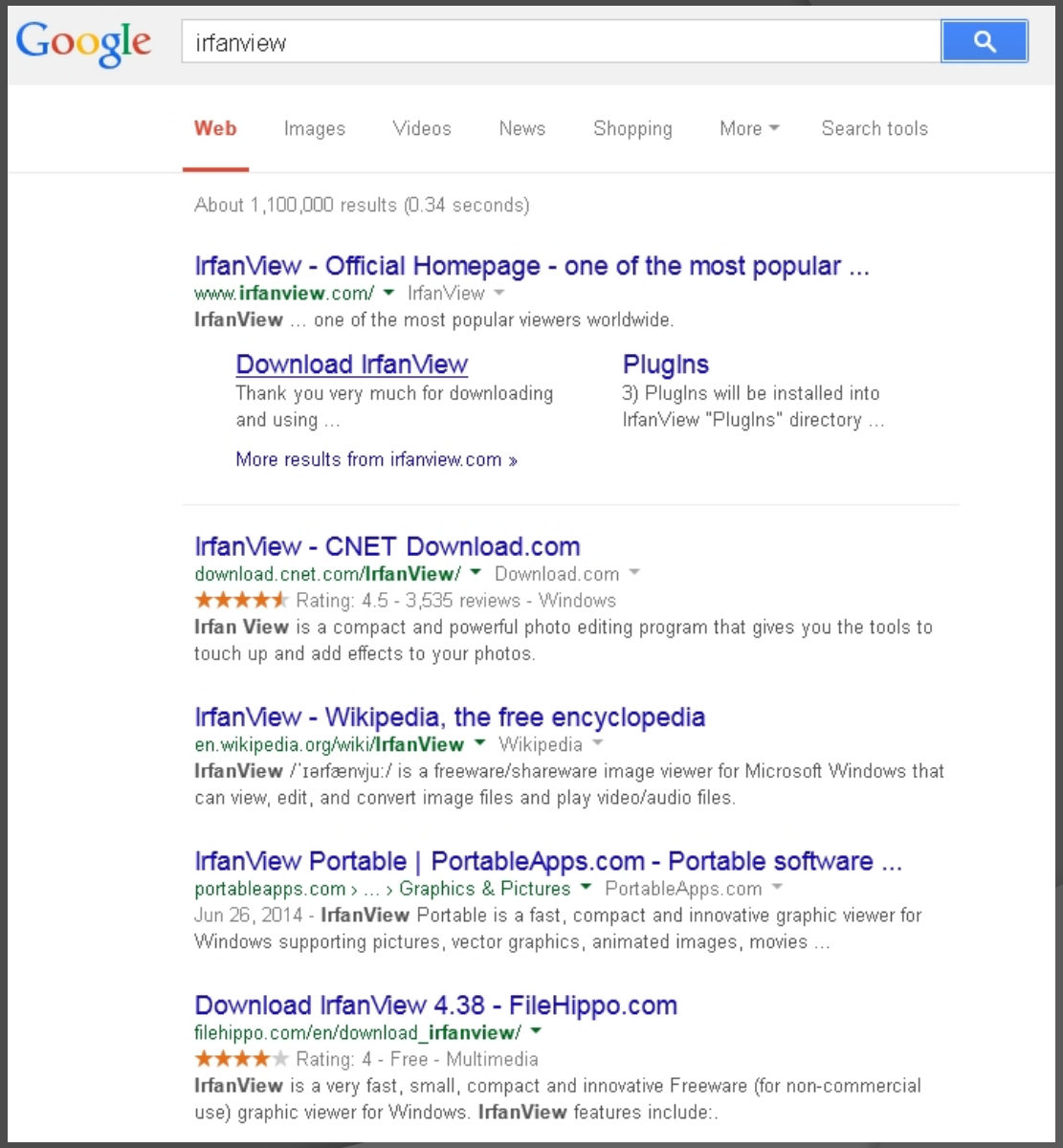
Everything Else

Free software

Windows

Ifranview

"Photoshop Lite"



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Ifranview

- Supports DICOM
- Easy to use
  - No course necessary
- Windows only

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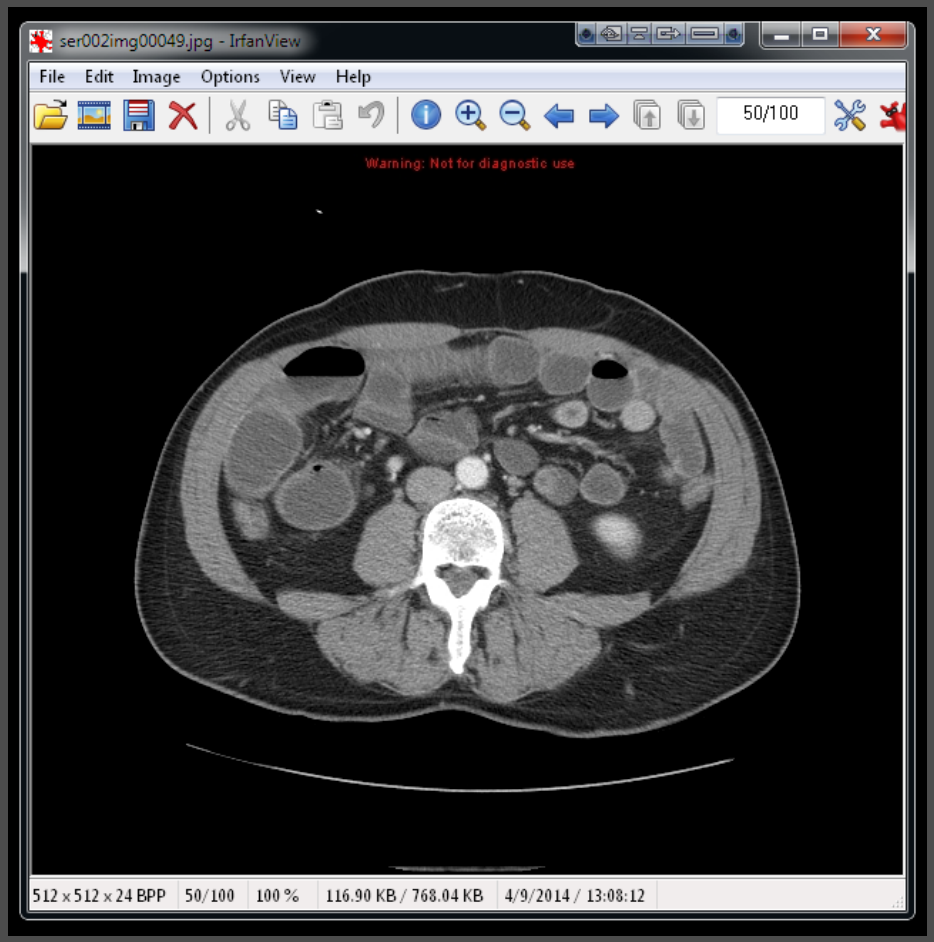
Ifranview



Great for batch cropping

- Easier than Photoshop
- Needed for videos

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The End

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