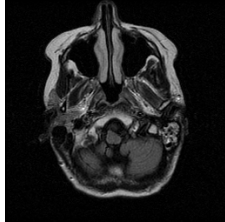


DICOM - Digital Imaging and Communications in Medicine



Overview

- Quick introduction to the standard
- The DICOM file format
- JPEG2000 in DICOM

The DICOM standard

Why was it developed?

- Needed an open standard for image communication between
 - medical imaging hardware/software (CT, ultrasound, etc)
 - hospitals/doctors/dentists
 - countries

Fun Facts

- Has become the main standard in medical imaging.
- Developed by NEMA - National Electrical Manufacturers Association, but in cooperation with organisations from all over the world
- It's a huge standard, and continuously evolving.
- Easy for companies to participate in the process.
- According to NEMA, every big manufacturer of medical equipment supports the standard.
- All image communication between hospitals in Norway uses DICOM.

The DICOM standard

Divided into several parts:

- Conformance statement
 - Every product claiming to be "DICOM compliant" has to come with a clearly defined conformance statement
 - States
 - what part of the standard is implemented
 - optional components
 - Allows a user to compare two DICOM implementations and see whether they are fully compatible.

The DICOM standard

- Networking
 - A protocol on top of TCP/IP
 - Higher-level networking (syntax, semantics) between PACS (Picture Archive and Communication System)
- An offline file format
 - allowing hospitals to burn patient data onto a CD or DVD for the patient to take home
- Printing
- ... and a whole lot more!

The DICOM File Format

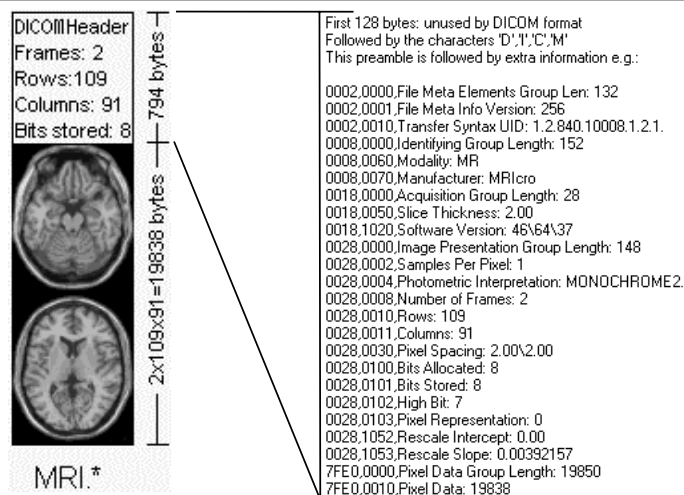
1. Header containing

- the patient's name / id
- type of media (CT, MRI, audio recording, etc.)
- image dimensions
- ...

2. Body, containing "information objects"

- *medical reports*
- *audio recordings*
- *images*

A Typical DICOM Image File



Images in DICOM files

A single DICOM file can contain any amount of images.

The format needs to be specified in the header:

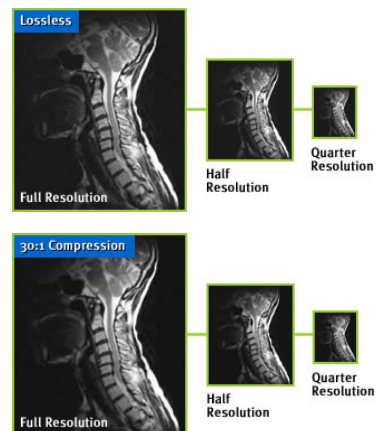
- native, as defined in the standard:
 - raw data
 - lossless JPEG, RLE or LZW
 - lossy JPEG

or

- an encapsulated format:
 - JPEG2000 (JPEG2000-3D)
 - MJPEG for animations
 - MPEG-4

JPEG2000 in DICOM

- Accepted by NEMA in 2001, so it's a relatively new addition to the standard
- Lossless or lossy coding
- Resolution scalability
 - We don't always need the image shown at full resolution



JPEG2000 in DICOM

- Region of Interest Encoding in JPEG2000
 - use lossless compression on the important parts of an image
 - code the less important parts using a lossy algorithm



Original image



Image with encoded with
ROI

Wrapping up

- DICOM is a very successful standard, taken up all over the world.
- It is huge, and continuously evolving - it's impossible to actually "conform to the standard".
- It's much more than the file format!

References

- <http://www.psychology.nottingham.ac.uk/staff/cr1/dicom.html> – *great introduction to the DICOM file format*
- <http://www.dclunie.com/> -has "*everything*"
- <http://www.barre.nom.fr/medical/samples/> - *image samples*
- <http://medical.nema.org/dicom/> - *the official standard*