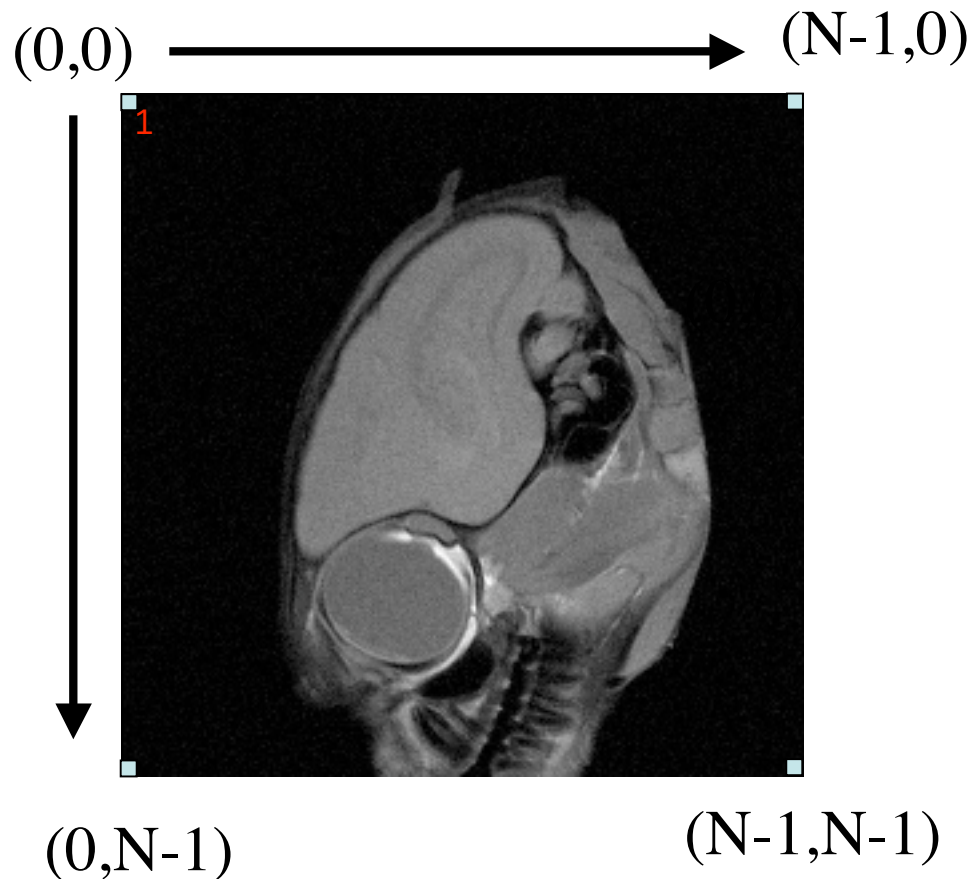


Image as an Array



$\text{Image}(\text{col}, \text{row})$

where row and col run from 0 to $N-1$ for a square image array of size $N \times N$.

Often $N = 2^m$ but not necessary.

Example is a 256×256 MR image of head of a marmoset.

Image File Format

- Header
 - info about data
 - Data
-
- Footer
 - uncommon but can be continuation of header info

Image Header

- Description of image file(s)
 - array dimensions (rows, cols, slices, volumes, etc)
 - scale for dimensions (usually mm/pixel, etc.)
 - numeric data type
 - offset in bytes to image data
 - units for pixel data (ml/min/100gm, etc)
 - demographic information
 - imager specific information

Data in Medical Images

- **byte** (unsigned: 0-255)
 - low dynamic range images
- **two byte (16-bit) integer** (signed: -32768 to +32767 or unsigned: 0-65535)
 - MRI, CT, Nuc Med, etc.
- **four byte (32-bit) float** (signed fractions)
 - Parametric images - flow and clearance rates, etc.

Dynamic range may not use all of the assigned byte space.

File Layout

Header Image Data



M^{th} image starts at byte location =
 $(\text{header size} + 1) + \text{image size} * (M - 1)$

image size (pixels) = rows x cols

image size (bytes) = rows x cols x bytes/pixel

Limited Number of Grey Scales lead to False Contouring



Original 8-bit image,
256 gray levels



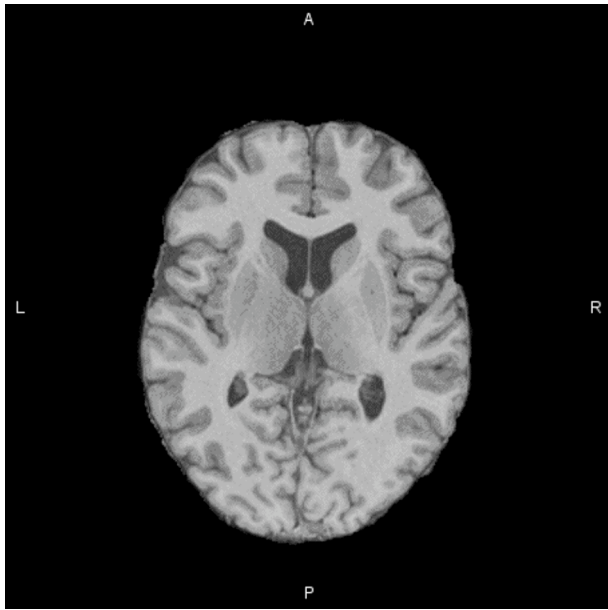
Quantized to 6 bits ,
64 gray levels



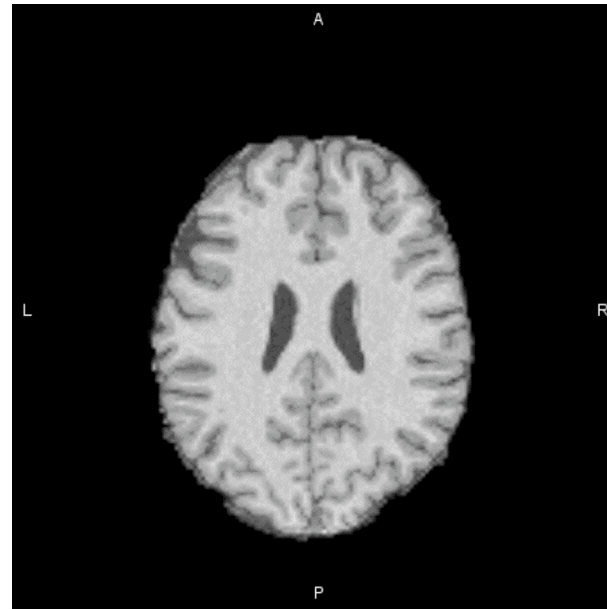
Quantized to 3 bits ,
8 gray levels



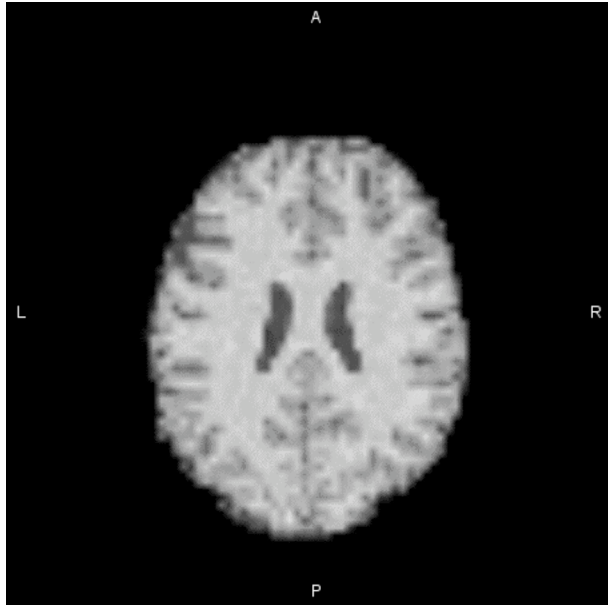
Quantized to 1 bits ,
2 gray levels



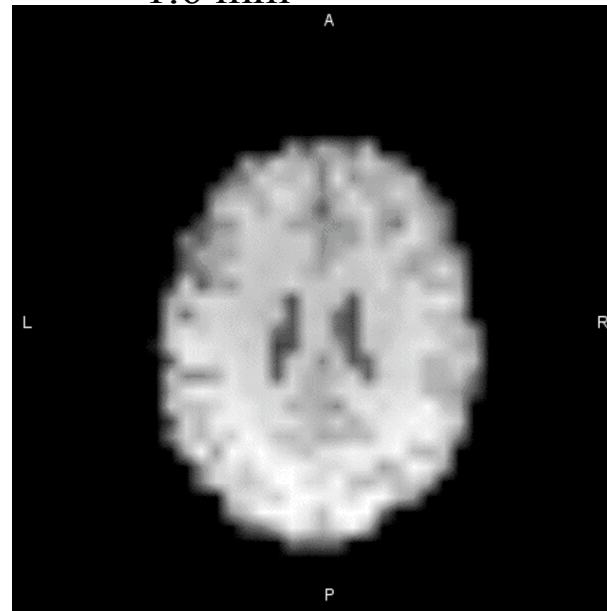
256x256 – Original
0.8 mm



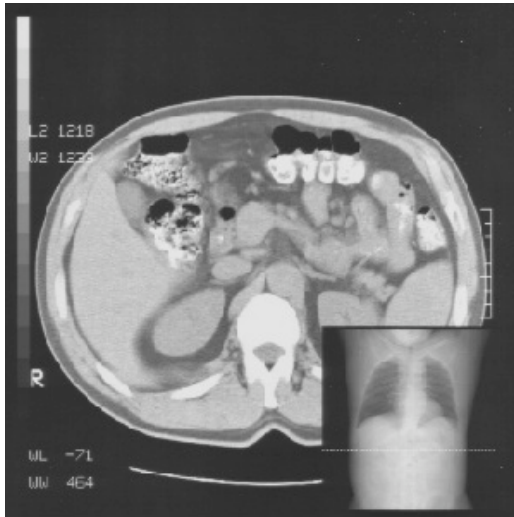
128x128 – Sampled
1.6 mm



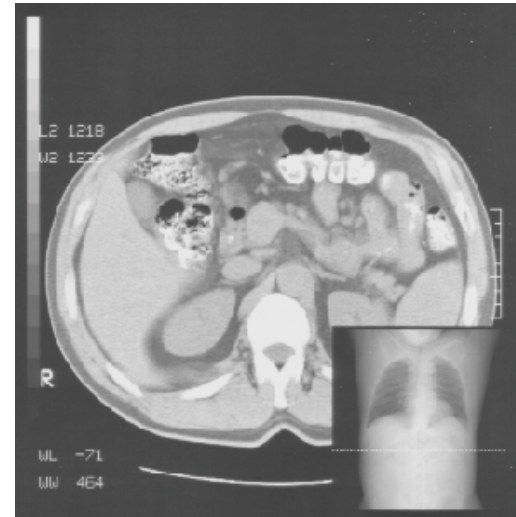
64x64 – Sampled
3.2 mm



32x32 – Sampled
6.4 mm



tga format – Original
size 88KB – ratio 1:1



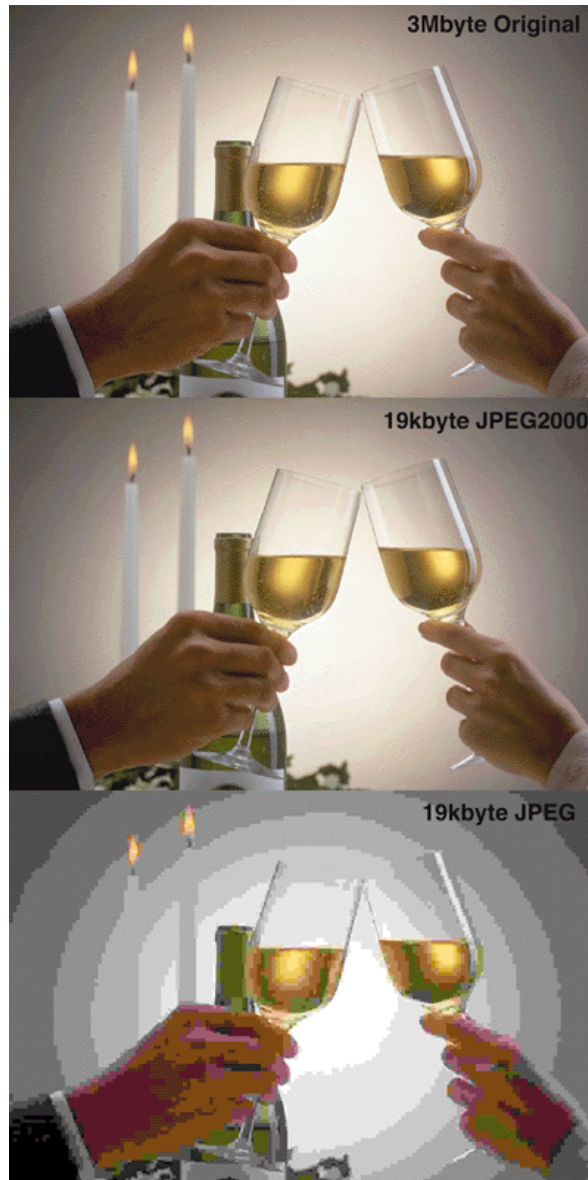
jpg format – 0% comp-
size 54KB – ratio 1.6:1



jpg format – 50% comp
– size 8KB – ratio 11:1



jpg format – 95% comp
– size 2KB – ratio 44:1



Original

158: 1 compression

Wavelet
(JPEG 2000)

Standard JPEG