

Fast Access to, and Display of, Very Large Images

Fionn Murtagh

- 1. Lossless and lossy greyscale image compression.
- 2. Lossy compression of large colour images.

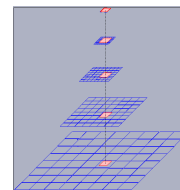
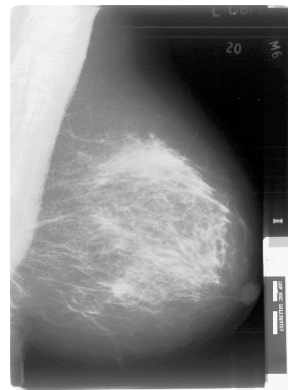
Principle

- Wavelet-based compression
- Make use of this for very fast decompression of low-resolution view of image
- If blockwise compression is used (due to memory constraints) use this for block - and resolution - based decompression
- Lossless compression through Haar a trous wavelet transform

Important issues

- Lossless vs. lossy compress?
- Colour or greyscale, input image format.
- Quick-view or thumbnail availability?
- Lower-resolution versions, (spatial) resolution versions appropriate for display area or type?
- Display or limited "block" or region of interest?

Digital Mammography



- A film, digitized at 42 microns, yields approx. a 4240 x 5670 16-bits-per-pixel image = 50 MB.
- We use a wavelet pyramidal representation to support lossless compression, with very fast decompression by resolution level and by block.

M. Lenoir, J. L. Starck, and F. Murtagh: Lossless image compression

	Comp. time (sec)	Decomp. time (sec)	Artifacts	Comp. ratio	Progressive transmission
JPEG	1.11	6.7	Y	< 36	Y (a, G)
Wavelet	4.5	7.1	Y	276	N
Fractal	18.3	9	Y	< 36	N
Math. Morpho.	13	7.86	N	< 210	N
Entropy	3.26	2.65	Y	276	Y (a, G)
Entropy + a trous	3.26	17	N	276	N
FAST	7.8	3.1	N	276	Y (a, Zero)

Table 1: Compression of an 824 x 824 image 2 image. Platform: Sun Ultra Enterprise 340, 640, and 2 processors

Software	CPU: time (sec)	Decompression time	Compression ratio
JPEG	2.6	0.7	1.4
Lossless scheme with Haar	4.3	4.4	1.7
Entropy + Haar	13.0	1.4	1.4

Table 2: Compression of an 824 x 824 image 2 image. Platform: Sun Ultra Sparc 340, 640, and 2 processors



Indicative results of lossy and lossless MegaCam image compression

- 12451x8268 MegaCam image (Y Mellier, IAP, F Bonnarel - Aladin, SXB)
- 412 MB FITS file
- Compressed with mr_comp (MR/1) to 4.1 MB i.e. < 1% of original size
- Compression took 789 secs on a 400 MHz Sparcstation
- Decompression to resolution scale 5 (as shown) took 0.43 sec.
- Lossless compression took 224 secs. and resulted in a compressed file of size 97.8 MB, i.e. 23.75% of original size.
- Decompression to full resolution took 214 secs.
- Decompression by block (region of interest) to specified resolution level is also possible, and fast.

References on this work

- IAJ, 26, 119-122, 1999
- AAS, 136, 579-590, 1999
- IJIST, 9, 48-45, 1998
- PASP, 108, 446-459, 1996

Compression and Delivery

- Compression *and* optimized delivery
- Wavelets offer good quality, controlled computational cost, and delivery strategy
- Optimal spatial resolution for target display, human visual system
- Well-adapted for delivery to varied display platforms - workstation, TV, games console, PDA, etc.

