

How do I decide if JPEG 2000 is for me?

Choosing standards when there are so many...

Simon Tanner

Director

King's Digital Consultancy Services

Email: simon.tanner@kcl.ac.uk

www.digitalconsultancy.net



JPEG 2000 features

- **Open Standard**
 - **Part 1 (core coding) designed to be Royalty Free**
- **One algorithm for lossless & lossy compression**
- **One master supports multiple derivatives**
 - **One file can supply both lossless and lossy data**
 - **Progressive display, multi-resolution & scalable quality**
- **Easily handles large images**
 - **Multiple components, tiles and high bit-depth images**
- **Generous metadata support in file format**
- **Colour management is built into JPEG 2000**
- **Motion JPEG 2000**

JPEG 2000: who's using it?

■ On-line image collections

- ContentDM collections use JPEG 2000
- Murals of Northern Ireland
<http://ccdlibraries.claremont.edu/col/mni/>

■ Geospatial Imaging

- Britain and Iraq: browse maps <http://cdm.cch.kcl.ac.uk/iraq/>
- Open Geospatial Consortium

■ Medical Imaging

- The American Society for Cell Biology <http://cellimages.ascb.org/>

■ Moving images

- Dance Heritage Coalition www.danceheritage.org/preservation/
- Digital Cinema Initiative www.dcinovies.com/

■ Google Book Search and the Internet Archive

JPEG 2000 scalability and compression

- It utilizes a wavelet transform and an arithmetic coding scheme to achieve 'scalability' in its design and operation.
- It offers improved compression
 - better quality for a given file size, or
 - smaller file size for a given quality (~20%)
- In exchange for better performance it is significantly more complex
 - requires more processor cycles and more memory resources for equivalent tasks
- At high compression, JPEG 2000 exhibits different kinds of typical compression artefacts (smoothing) to JPEG.

JPEG 2000 lossless compression

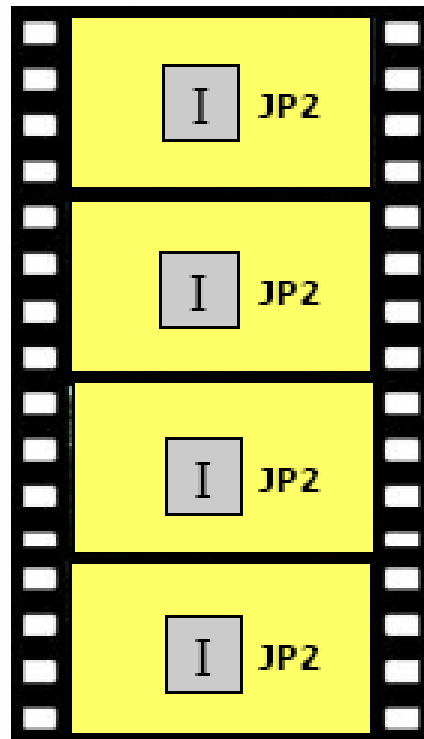
- **JPEG 2000 can encode images both losslessly and lossily. The original JPEG is lossy only.**
- **A single JPEG 2000 file, for example losslessly encoded, can be used efficiently to generate multiple versions for multiple applications.**
- **JPEG 2000 makes it feasible for only the source image to be stored permanently.**

Motion JPEG 2000 (MJ2)

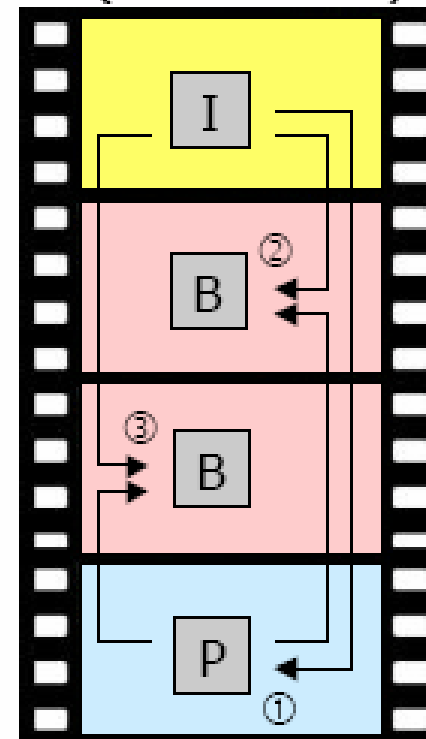
- **Motion JPEG 2000 is developed for image sequences.**
 - **In Motion JPEG 2000 each frame is coded individually.**
 - **Intra-frame coding allows for random access and reduced complexity.**
 - **Great for preservation encoding of film.**
- **In MPEG the encoding uses a series of frames – inter-frame coding. This allows for improved compression efficiency but the coding technique is more complex.**

Motion JPEG 2000

Intra-frame coding
(Motion JPEG2000 Structure)



Inter-frame coding
(MPEG-Structure)



Motion JPEG 2000

- **Motion JPEG 2000 the following parameters in Digital Cinema are possible, but not limited to:**
 - **Resolutions of 8192x8192 Pixels (e.g. 4096x3112 for 35mm Film Scans)**
 - **Colourspace: sRGB, SRGB-YCC**
 - **Number of colour channels: 3-4 (e.g. RGBA)**
 - **Bitdepth: 10-16 Bit/colour component**
- **Can be synchronised with sound**
- **Compression types:**
 - **mathematically lossless**
 - **visual lossless**
 - **lossy**

Motion JPEG 2000

■ Particularly useful in:

■ Medical applications

■ Digital Cinema archive, editing and distribution

- Resolution, color gamut and dynamic range exceed DC requirements

■ Digital encoding and preservation of film

■ Where re-tasking of the image data needs to be easily achieved

JPEG 2000 metadata

- The JPEG 2000 file format supports the integration of image metadata with the image, and particularly encourages the use of XML for metadata.
- Published XML DTD and schema definition.
- Draft mappings of Dublin Core to JPEG 2000.
- OpenGIS Geography Markup Language (GML) is implemented for JPEG 2000 for Geographic Imagery (GMLJP2).
- The MJ2 file format based on the MPEG4 syntax is expandable to integrate additional data, like the Society of Motion Picture and Television Engineers (SMPTE) metadata directory or unique extensions.

Deciding which image standard is for you

- What range of image content and size does it support?
- What sorts of compression does it support?
Lossless essential.
- Can it store uncompressed image data?
- How does it specify the colour of the image?
- Does it have fields for including metadata?
- Is it a native format for browsers?
- Is it an “open” standard?
- Is its feature set suitable and how much does the application need to rely on extensions?

Conclusions

JPEG 2000 Images

- JPEG 2000 scalability provides real benefits to preservation by enabling only the source image to be stored permanently
- More metadata storable within the file format
- Is more complex than other image standards
 - will it last and can behaviour/functionality be retained in the long term?

Motion JPEG (MJ2)

- Motion JPEG 2000 is a realistic preservation standard for moving image content
- MJ2 and MPEG will co-exist
- Storing the moving images and audio separately - a good thing for digital preservation?

JPEG 2000 Further Guidance

- **Colyer, Greg and Richard Clark. 2003. Guide to the practical implementation of JPEG 2000. London: British Standards Institute, ISBN: 0580412423 BSI: PD 6777:2003.**
<http://www.jpeg.org/jpeg2000guide/>
- **JPEG 2000 for Digital Cinema Applications, Eric Edwards and Siegfried Foessel**
www.jpeg.org/public/DCINEMA-v2.pdf
- **Digital Video Preservation Reformatting Project : a Report Media Matters (June 2004)**
www.danceheritage.org/preservation/