CSCE 590 INTRODUCTION TO IMAGE PROCESSING

Image Formats

Ioannis Rekleitis

Many different file formats

- **JPEG/JFIF**
- **JPEG 2000**
- **GIF**
- **PNG**
- **TIFF**
- **PPM, PGM, PBM, and PNM**

- **Exif**
- **BMP**
- **WebP**
- **HDR raster formats**
- **HEIF**
- **BAT**
- **BPG**

Many different file formats

- **JPEG/JFIF** (Joint Photographic Experts Group) is a lossy compression method; JPEG-compressed images are usually stored in the **JFIF** (JPEG File Interchange Format) file format. The JPEG/JFIF filename extension is **JPG** or **JPEG**. Nearly every digital camera can save images in the JPEG/JFIF format, which supports eight-bit grayscale images and 24-bit color images (eight bits each for red, green, and blue). JPEG applies lossy compression to images, which can result in a significant reduction of the file size. Applications can determine the degree of compression to apply, and the amount of compression affects the visual quality of the result. When not too great, the compression does not noticeably affect or detract from the image's quality, but JPEG files suffer generational degradation when repeatedly edited and saved. (JPEG also provides lossless image storage, but the lossless version is not widely supported.)

- **JPEG 2000** is a compression standard enabling both lossless and lossy storage. The compression methods used are different from the ones in standard JFIF/JPEG; they improve quality and compression ratios, but also require more computational power to process. JPEG 2000 also adds features that are missing in JPEG. It is not nearly as common as JPEG, but it is used currently in professional movie editing and distribution (some digital cinemas, for example, use JPEG 2000 for individual movie frames).

Many different file formats

- **GIF** ([Graphics Interchange Format](#)) is in normal use limited to an 8-bit palette, or 256 colors (while 24-bit color depth is technically possible).[1][2] GIF is most suitable for storing graphics with few colors, such as simple diagrams, shapes, logos, and cartoon style images, as it uses [LZW](#) lossless compression, which is more effective when large areas have a single color, and less effective for photographic or [dithered](#) images. Due to GIF's simplicity and age, it achieved almost universal software support. Due to its animation capabilities, it is still widely used to provide image animation effects, despite its low compression ratio compared to modern video formats.

- **PNG** ([Portable Network Graphics](#)) file format was created as a free, open-source alternative to GIF. The PNG file format supports eight-bit paletted images (with optional transparency for all palette colors) and 24-bit truecolor (16 million colors) or 48-bit truecolor with and without alpha channel - while GIF supports only 256 colors and a single transparent color. Compared to JPEG, PNG excels when the image has large, uniformly colored areas. Even for photographs – where JPEG is often the choice for final distribution since its compression technique typically yields smaller file sizes – PNG is still well-suited to storing images during the editing process because of its lossless compression. PNG provides a patent-free replacement for GIF (though GIF is itself now patent-free), and can also replace many common uses of TIFF. Indexed-color, grayscale, and truecolor images are supported, plus an optional alpha channel. PNG is designed to work well in online viewing applications like [web browsers](#) and can be fully streamed with a progressive display option. PNG is robust, providing both full file integrity checking and simple detection of common transmission errors.

Many different file formats

- **TIFF** ([Tagged Image File Format](#)) format is a flexible format that normally saves eight bits or sixteen bits per color (red, green, blue) for 24-bit and 48-bit totals, respectively, usually using either the **TIFF** or **TIF** filename extension. The tagged structure was designed to be easily extendible, and many vendors have introduced proprietary special-purpose tags – with the result that no one reader handles every flavor of TIFF file. TIFFs can be lossy or lossless, depending on the technique chosen for storing the pixel data. Some offer relatively good lossless compression for [bi-level (black&white) images](#). Some digital cameras can save images in TIFF format, using the [LZW](#) compression algorithm for lossless storage. TIFF image format is not widely supported by web browsers. TIFF remains widely accepted as a photograph file standard in the printing business. TIFF can handle device-specific color spaces, such as the [CMYK](#)defined by a particular set of printing press inks. [OCR](#) (Optical Character Recognition) software packages commonly generate some form of TIFF image (often [monochromatic](#)) for scanned text pages.

Many different file formats

- **PPM, PGM, PBM, and PNM:** [Netpbm format](#) is a family including the **portable pixmap** file format (PPM), the **portable graymap** file format (PGM) and the **portable bitmap** file format (PBM). These are either pure [ASCII](#) files or raw binary files with an ASCII header that provide very basic functionality and serve as a lowest common denominator for converting pixmap, graymap, or bitmap files between different platforms. Several applications refer to them collectively as PNM (Portable aNy Map).

Many different file formats

- The **Exif** ([Exchangeable image file format](#)) format is a file standard similar to the JFIF format with TIFF extensions; it is incorporated in the JPEG-writing software used in most cameras. Its purpose is to record and to standardize the exchange of images with [image metadata](#) between digital cameras and editing and viewing software. The metadata are recorded for individual images and include such things as camera settings, time and date, shutter speed, exposure, image size, compression, name of camera, color information. When images are viewed or edited by image editing software, all of this image information can be displayed.

- The actual Exif metadata as such may be carried within different host formats, e.g. TIFF, JFIF (JPEG) or PNG. IFF-META is another example.

Other raster formats

- CD5 (Chasys Draw Image)
- DEEP (IFF-style format used by TVPaint)
- ECW (Enhanced Compression Wavelet)
- FITS (Flexible Image Transport System)
- FLIF (Free Lossless Image Format) - a work-in-progress lossless image format which claims to outperform PNG, lossless WebP, lossless BPG and lossless JPEG2000 in terms of compression ratio. It uses the MANIAC (Meta-Adaptive Near-zero Integer Arithmetic Coding) entropy encoding algorithm, a variant of the CABAC (context-adaptive binary arithmetic coding) entropy encoding algogithm.
- ICO, container for one or more icons (subsets of BMP and/or PNG)
- ILBM (IFF-style format for up to 32 bit in planar representation, plus optional 64 bit extensions)
- IMG (ERDAS IMAGINE Image)
- IMG (Graphics Environment Manager (GEM) image file; planar, run-length encoded)
- JPEG XR (New JPEG standard based on Microsoft HD Photo)
- Layered Image File Format for microscope image processing
- Nrrd (Nearly raw raster data)
- PAM (Portable Arbitrary Map) is a late addition to the Netpbm family
- PCX (Personal Computer eXchange), obsolete
- PGF (Progressive Graphics File)
- PLBM - Planar Bitmap, proprietary Amiga format
- SGI
- SID (multiresolution seamless image database, MrSID)
- Sun Raster is an obsolete format
- TGA (TARGA), obsolete
- VICAR file format (NASA/JPL image transport format)
- XISF (Extensible Image Serialization Format)

Sample Images

Sample Images can be found:

- http://sipi.usc.edu/database/

- http://www.hlevkin.com/00main.htm

Questions?