6.0 Multimedia System and Media Representation

Image Format

BMP

JPEG

PNG

BMP

- A BMP file is an image saved in the Bitmap (BMP) **raster image** format developed by Microsoft. It contains uncompressed image data that supports **monochrome** and color images at variable color bit depths and image **metadata**. Users commonly save digital photos as BMP files.

BMP Continue

- Microsoft developed the BMP format, also known as the Device Independent Bitmap (DIB) format, to save images that appear consistent across different devices. The BMP format begins with a file header, including the bitmap identifier, file size, width, height, data compression method (optional), color options, and bitmap data starting point. After the header, the format stores raw pixel image data and optional ICC Color Profile data.
- **NOTE:** Since BMP files are uncompressed, they may be large. Therefore, the JPEG and PNG image formats are common alternatives to the BMP format for saving and transferring digital images.

JPEG

- Stands for "Joint Photographic Experts Group." JPEG is a popular image file format. It is commonly used by digital cameras to store photos since it supports 2^{24} or 16,777,216 colors. The format also supports varying levels of compression, which makes it ideal for web graphics.
- The 16 million possible colors in a JPEG image are produced by using 8 bits for each color (red, green, and blue) in the RGB color space. This provides 2^{8}or 256 values for each of the three colors, which combined allow for 256 x 256 x 256 or 16,777,216 colors. Three values of 0 produce pure black, while three values of 255 create pure white.

JPEG Continue

- The JPEG compression algorithm may reduce the file size of a bitmap (BMP) image by ten times with almost no degradation in quality. Still, the compression algorithm is lossy, meaning some image quality is lost during the compression process. For this reason, professional digital photographers often choose to capture images in a raw format so they can edit their photos in the highest quality possible. They typically export the pictures as JPEG (.JPG) images when they are shared or published on the web.

PNG

- A PNG file is an image saved in the Portable Network Graphic (**PNG**) format, commonly used to store web graphics, digital photographs, and images with transparent backgrounds. It is a **raster graphic**similar to a **.JPG** image but is compressed with **lossless** compression and supports transparency.

PNG Continue

- PNG is one of the most common image formats, along with **JPEG**, **GIF**, **TIFF**, and **EPS**. Examples of when you might encounter a PNG file include:
- Downloading an image from the Internet or an image attached to an email
- Saving a digital photograph with an image editor, such as a logo or icon designed by a graphics professional or web designer
- Taking a **screenshot** in Windows or macOS 10.4 and later (Ubuntu Linux also stores print screen screenshots in the PNG format)

MPEG Compression

- MPEG compression operates through a series of intricate encoding and decoding steps, each aimed at reducing the data size of audiovisual content without compromising perceptible quality.

Process

1. Data Preprocessing – Before compression begins, the audio and video data undergo preprocessing, including techniques such as color space conversion, downsampling, and transformation to optimize the data for compression.

2. Lossy Compression – MPEG compression employs lossy compression algorithms, which exploit redundancies in the data and discard non-essential information based on human perception. This step significantly reduces the data size while attempting to preserve visual and auditory quality.

Process Continues

- **Entropy Coding –** Following lossy compression, entropy coding techniques—such as Huffman and arithmetic coding—are applied to further compress the data by efficiently representing recurring patterns and reducing the entropy in the encoded bitstream.
- **Decoding and Reconstruction –** Upon transmission or storage, the encoded MPEG data undergoes decoding and reconstruction processes, where the compressed data is unpacked and transformed back into a format suitable for playback or further processing.

Where is MPEG Compression Used?

- Digital Television and Broadcasting
- Internet Streaming and VOD
- Physical Media Formats
- Video Conferencing and Telecommunications

Digital Video Formats

- Audio Video Interleave (AVI)
- QuickTime Movie(MOV)

AVI

- AVI, or Audio Video Interleave, is an older video format originally developed by Microsoft. It became popular in the 1990s and is known for its broad support of various codecs and its compatibility with different operating systems. AVI files can deliver good video quality and also support multiple audio tracks.
- Although AVI has many advantages, there are also some limitations. The file sizes can be relatively large, which can affect the transmission and streaming of AVI files. In addition, AVI does not support the latest video and audio codecs, which can lead to compatibility issues. Nevertheless, AVI is still used in many applications, especially for video editing and sharing video content.

MOV

- MOV, or QuickTime Movie, is a video format developed by Apple and is closely associated with the QuickTime media framework. It is mainly used on Apple devices and in the Apple software environment. MOV can offer high quality and supports various video and audio codecs as well as subtitles and chapter markers.
- Since MOV is closely tied to the Apple platform, compatibility with non-Apple devices and applications can be a challenge. It is important to ensure that the required codecs are present on the device to play MOV files. Nevertheless, MOV is a popular format for video editing, especially with Apple Final Cut Pro, and is often used for exporting videos and movies.

Comparison

Both AVI and MOV formats offer a balance between video quality and file size, but they do so in different ways. AVI files use less compression, which can result in larger file sizes but also preserves more detail in the video or audio. On the other hand, MOV files use more advanced compression techniques, which can reduce file size while still maintaining high perceived quality. This makes MOV files a good choice for applications where high-quality multimedia content is required, but storage space or bandwidth is limited. However, the choice between lossless (AVI) and lossy (MOV) compression ultimately depends on the specific requirements of the application and the preferences of the user.