JPEG AND MPEG FILES

Color images are based on the fact that any color can be represented to the human eye by using a particular combination of the base colors red, green, and blue (RGB). Computer monitor screens, digital camera images, or any other still color images are formed by varying the intensity of the three primary colors at pixel level, resulting in the creation of virtually any corresponding color from the real raw image. Each intensity created on any of the three pixels is represented by 8 bits, as shown in Figure 17.6. The intensities of each 3-unit pixel are adjusted, affecting the value of the 8-bit word to produce the desired color. Thus, each pixel can be represented by using 24 bits, allowing 2^{24} different colors. However, the human eye cannot distinguish all colors among the 2^{24} possible colors. The number of pixels in a typical image varies with the image size.

GIF Files

JPEG is designed to work with full-color images up to 2^{24} colors. The graphics interchange format (GIF) is an image file format that reduces the number of colors to 256. This reduction in the number of possible colors is a trade-off between the quality of the image and the transmission bandwidth. GIF stores up to $2^8 = 256$ colors in a table and covers the range of colors in an image as closely as possible. Therefore, 8 bits are used to represent a single pixel. GIF uses a variation of Lempel-Ziv encoding (Section 17.6.3) for compression of an image. This technology is used for images whose color detailing is not important, such as cartoons and charts.

Moving Images and MPEG Compression

A motion image, or video is a rapid display of still images. Moving from one image to another must be fast enough to fool the human eye. There are different standards on the number of still images comprising a video clip. One common standard produces a motion image by displaying still images at a rate of 30 frames per second. The common standard that defines the video compression is the Moving Pictures Expert Group (MPEG), which has several branch standards:

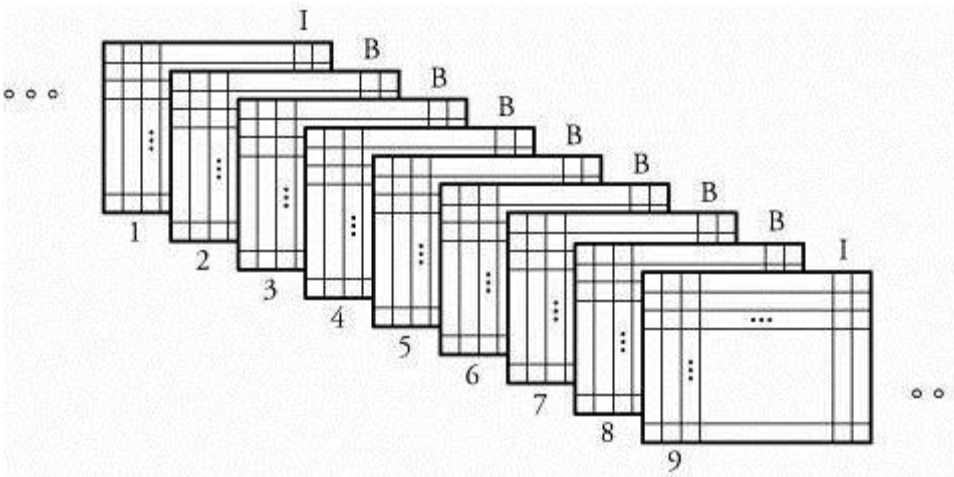
- MPEG-1, primarily for video on CD-ROM
- MPEG-2, for multimedia entertainment and high-definition television (HDTV) and the satellite broadcasting industry
- MPEG-4, for object-oriented video compression and videoconferencing over low-bandwidth channels
- MPEG-7, for a broad range of demands requiring large bandwidths providing multimedia tools
- MPEG-21 for interaction among the various MPEG groups

Logically, using JPEG compression for each still picture does not provide sufficient compression for video as it occupies a large bandwidth. MPEG deploys additional compression. Normally, the difference between two consecutive frames is small. With MPEG, a base frame is sent first, and successive frames are encoded by computing the differences. The receiver can reconstruct frames based on the first base frame and the submitted differences. However, frames of a completely new scene in a video may not be compressed this way, as the difference between the two scenes is substantial. Depending on the relative position of a frame in a sequence, it can be compressed through one of the following types of frames:

- Interimage (I) frames. An I frame is treated as a JPEG still image and compressed using DCT.
- Predictive (P) frames. These frames are produced by computing differences between a current and a previous I or P frame.
- Bidirectional (B) frames. A B frame is similar to a P frame, but the P frame considers differences between a previous, current, and future frames.

Figure 7.9 illustrates a typical grouping of frames, with I, P, and B frames forming a sequence. In any frame sequence, I frames appear periodically as the base of the scene. Normally, there is a P frame between each two groups of B frames.

Figure 7.9. Snapshot of moving frames for MPEG compression



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