Maharaja Agrasen Institute of Technology
ETCS 211
Computer Graphics & Multimedia
UNIT 4

LOSSY COMPRESSION METHODS MPEG

MPEG STANDARD FOR COMPRESSING VIDEO

The name MPEG is an acronym for Moving Pictures Experts Group. MPEG is a method for video compression, which involves the compression of digital images and sound, as well as synchronization of the two.

There currently are several MPEG standards.

MPEG-1 is intended for intermediate data rates, on the order of 1.5 Mbit/sec.

MPEG-2 is intended for high data rates of at least 10 Mbit/sec.

MPEG-3 was intended for HDTV compression but was found to be redundant and was merged with MPEG-2.

MPEG-4 is intended for very low data rates of less than 64 Kbit/sec.

i. In principle, a motion picture is a rapid flow of a set of frames, where each frame is an image. In other words, a frame is a spatial combination of pixels, and a video is a temporal combination of frames that are sent one after another.

ii. Compressing video, then, means spatially compressing each frame and temporally compressing a set off names.

iii. Spatial Compression: The spatial compression of each frame is done with JPEG (ora modification of it). Each frame is a picture that can be independently compressed.

iv. Temporal Compression: In temporal compression, redundant frames are removed.

v. To temporally compress data, the MPEG method first divides frames into three categories:

vi. I-frames, P-frames, and B-frames. Figure1 shows a sample sequence off names.

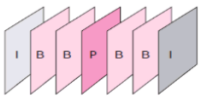
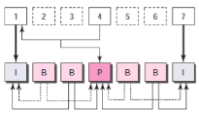


Fig1: MPEG frames

vii. Figure2 shows how I-, P-, and B-frames are constructed from a series of seven frames.



I-frames: An intracoded frame (I-frame) is an independent frame that is not related to any other frame.

They are present at regular intervals. An I-frame must appear periodically to handle some sudden change in the frame that the previous and following frames cannot show. I-frames are independent of other frames and cannot be constructed from other frames.

P-frames: A predicted frame (P-frame) is related to the preceding I-frame or P-frame. In other words, each P-frame contains only the changes from the preceding frame. P-frames can be constructed only from previous I- or P-frames. P-frames carry much less information than other frame types and carry even fewer bits after compression.

B-frames: A bidirectional frame (B-frame) is related to the preceding and following I-frame or P-frame. In other words, each B-frame is relative to the past and the future. Note that a B-frame is never related to another B-frame.

The luminance component contains the gray scale picture & the chrominance components provide the color, hue & saturation.

The MPEG decoder has three parts, audio layer, video layer, system layer.

The system layer reads and interprets the various headers in the source data and transmits this data to either audio or video layer.

The basic building block of an MPEG picture is the macro block as shown:

The macro block consist of 16×16 block of luminance gray scale samples divided into four 8×8 blocks of chrominance samples.

The MPEG compression of a macro block consist of passing each of the °6 blocks their DCT quantization and entropy encoding similar to JPEG.

A picture in MPEG is made up of slices where each slice is continuous set of macro blocks having a similar gray scale component.

The concept of slice is important when a picture contains uniform areas.

The MPEG standard defines a quantization stage having values (1, 31). Quantization for intra coding is:

$$QDCT = (16 \times DCT) + sign(DCT) \times quantizer\ scale) 2 \times quantizer - scale \times \theta$$

Where

DCT = Discrete cosine transform of the coefficienting encoded

Q = Quantization coefficient from quantization table

Quantization rule for encoding,

$$QDCT = 16 \times DCT2 \times quantizer - scale \times \theta QDCT = 16 \times DCT2 \times quantizer - scale \times \theta$$

The quantized numbers Q_(DCT)are encoded using non adaptive Haffman method and the standard defines specific Haffman code tables which are calculated by collecting statistics.

Audio compression can be used for speech or music. For speech we need to compress a 64 kHz digitized signal, while for music we need to compress a 1.411 MHz signal. Two categories of techniques are used for audio compression: predictive encoding and perceptual encoding.

Predictive encoding

In predictive encoding, the differences between samples are encoded instead of encoding all the sampled values. This type of compression is normally used for speech. Several standards have been defined such as GSM (13 kbps), G.729 (8 kbps), and G.723.3 (6.4 or 5.3 kbps). Detailed discussions of these techniques are beyond the scope of this book.

Perceptual encoding: MP3

The most common compression technique used to create CD-quality audio is based on the perceptual encoding technique. This type of audio needs at least 1.411 Mbps, which cannot be sent over the Internet without compression. MP3 (MPEG audio layer 3) uses this technique.

VIVA VOICE

1. What is the difference between lossless and lossy compression techniques?
2. What are the advantages of huffman encoding?
3. Why are compression techniques used?
4. Define compression & decompression?
5. What is the need for compression?
6 What are the different types of compression available? List the difference between them
7. Write down the difference between jpeg2 and jpeg4
8. List the various compression techniques
9. List the benefits of DCT
10 Define quantization
11. Differentiate MPEP2 and MPEG 4

12. Write short notes on jpeg
13. Discuss the various levels of RAID technologies
14. Write short notes on mpeg
15. Write notes on file format standard
16. Explain the multimedia I/O technologies
17. With a neat diagram explain the architecture of MPEG standard
18. What is MIDI? Explain how it is used for music recording