

Answer on Question #54809, Programming, Other

Explain the techniques used in MPEG compression.

Answer:

The MPEG committee began life in late 1988 by the hand of Leonardo Chiariglione and Hiroshi Yasuda with the immediate goal of standardising video and audio for compact discs. A meeting between the International Standards Organisation (ISO) and the International Electrotechnical Commission (IEC) in 1992 resulted in a standard for audio and video coding, known as MPEG-1. MPEG-2 became a bone fide standard in 1994 after a five day meeting of ISO and ITC in Singapore. The technology behind MPEG-1 and 2 are inherently the same.

The MPEG system consists of two layers :

- System Layer (timing information to synchronise video and audio)
- Compression Layer (includes audio and video streams)

Only the MPEG-1 standard will be described in detail here.

The MPEG standard is designed to be generic, meaning that it will support the needs of many applications. The objectives include :

- Delivery of acceptable video quality at compressed data rates in excess of 1.0 Mbits/s
- Support both symmetric and asymmetric compression/decompression applications.
- Random access playback should be possible
- Fast-play and fast reverse in addition to normal playback should be supported
- Audio video synchronisation should be maintained.
- Data errors should not be catastrophic
- The processing requirements should not preclude the development of low-cost semiconductor based implementation which may encode in real time.

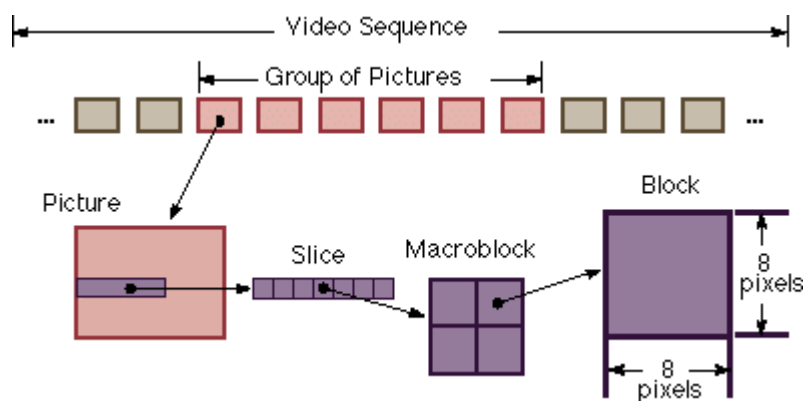


Fig. 1 - The MPEG data hierarchy

The MPEG standard is primarily a bitstream specification, although it also specifies a typical decoding process to assist in interpreting the bitstream specification. This

approach supports data interchange, but does not restrict innovation in the means for creating or decoding that bitstream. The bitstream specification is based on a data hierarchy, shown in figure 2. The data hierarchy is pretty self-explaining and is useful for the following reasons :

- Groups of pictures allow random access into a sequence
- Slices aid error recovery, in that if one slice contains an error then it can be skipped.

The bitstream architecture is based on a sequence of pictures, each of which contains the data needed to create a single display-able image. There are four different kinds of picture, depending on how each picture is to be decoded :

- **I-Picture**

These are intra-coded, which means they are coded independent of any other pictures.

- **P-Picture**

These are predicted pictures and are coded using motion compensation from previous I or P-pictures.

- **B-Picture**

These are interpolated pictures, which are coded by interpolating between a previous and a future I or P-picture. This process is called bi-directional prediction.

- **D-Picture**

These pictures are a special format and are used to implement sequence searches.

The above description of MPEG has been very terse and a lot of detail has had to be left out. However MPEG is not the only compression technique on the market, there are many algorithms available. The next section presents a brief overview of the competitors to MPEG and looks at the advantages and disadvantages for each method.