Data Compression

Coding Requirements

•Let us consider the general requirements imposed on most multimedia systems:

Storage — multimedia elements require much more storage space than simple text. For example a full screen true colour image is 6404803=921600bytes:

•The size of one second of uncompressed CD quality stereo audio is

44:1kHz22=176400bytes :

•The size of one second of uncompressed PAL video is

384288325frames=8294400bytes :

Throughput—continuous media require very large throughput. For example, an

uncompressed CD quality stereo audio stream needs 176400bytes =sec. A raw digitised PAL TV signal needs

$$(13.5MHz + 6.75MHz + 6.75MHz) \times 8\text{bits}$$
$$= 216 \times 10^6 \text{bits/sec}$$
$$= 27 \times 10^6 \text{Bytes/sec.}$$

Interaction— to support fast interaction, the end-to-end delay should be small. A ‘face-to-face’ application such as video conferencing,requires the delay to be less than 50ms. Further more, multimedia elements have to be accessed randomly .

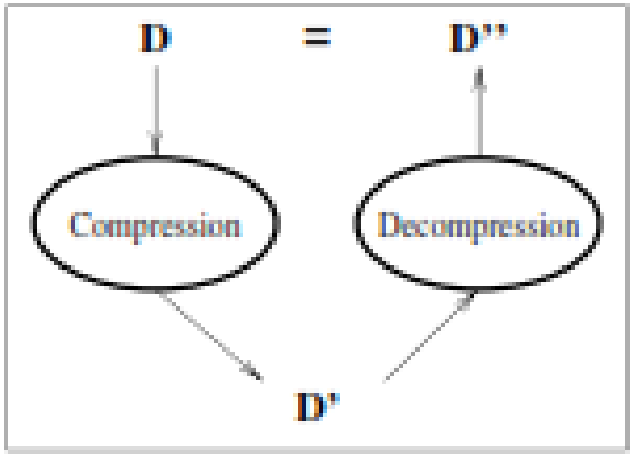
Conclusion :

- Multimedia elements are very large.
- We need to reduce the data size using compression.

Kinds of coding methods

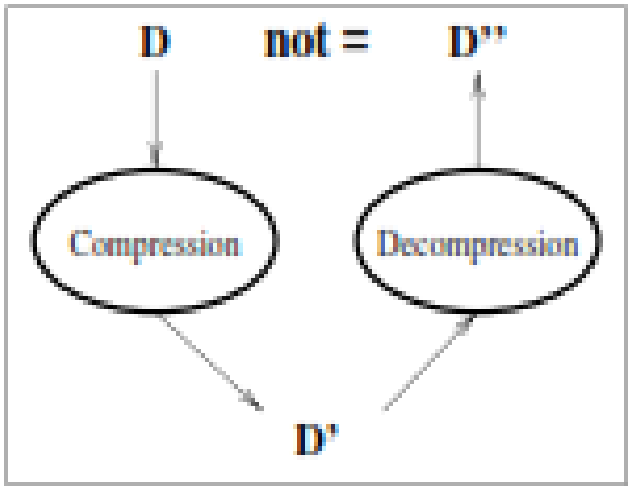
lossless

- The compression process does not reduce the amount of information.
- The original can be reconstructed exactly



lossy

•The compression process reduces the amount of information.
•Only an approximation of the original can be reconstructed.



Categories of Compression Techniques

Entropy coding	Run-length coding	
	Huffman coding	
	Arithmetic coding	
Source coding	Prediction	DPCM
		DM
	Transformation	FFT
		DCT
	Vector Quantisation	
Hybrid coding	JPEG	
	MPEG	
	H.261	

- Entropy coding is lossless .
- Source coding and hybrid coding are lossy.

Coding techniques

•Vector Quantisation—a data stream is divided into blocks of n bytes (where n>1). A predefined table contains a set of patterns is used to code the data blocks.

•LZW — a general compression algorithm capable of working on almost any type of data. It builds a data dictionary of data occurring in a nun compressed data stream. Patterns of data are identified and are matched to entries in the dictionary. When a match is found the code of the entry is output.

Pattern	Code
Begin	1
End	2
tion	3
...	...

Input function Begin x := 3; ...

Output func@3 @1@4 ...

Since the code is shorter than the data pattern, compression is achieved. The popular zip application used this method to compress files.

Differential coding—(also known as prediction or relative coding). The most known coding of this kind is DPCM (Differential Pulse Code Modulation).

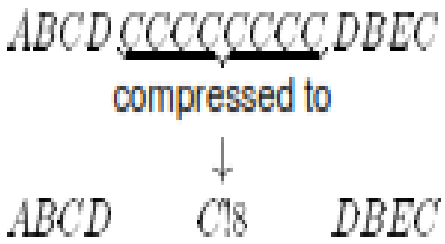
This method encodes the difference between the consecutive samples instead of the sample values. For example,

PCM	215	218	210	212	208	...
DPCM	215	3	-8	2	-4	...

DM (Delta Modulation) is a modification of DPCM. The difference is coded with a single bit.

Run-length coding

•Digital images ,audio and video data stream often contain sequences of the same bytes.
•By replacing the sequence with its length, a substantial reduction of data can be achieved.
•A special flag that does not occur in the data can be used to indicate the length of sequence .
For example:



•In practice, there are many variances of this basic compression techniques.
•One particular variance, known as Zero suppression, assumes that only one symbol in the data stream appear very often, for example, a 0 in scanned text. A sequence of zeros is replaced by a flag and the number of occurrences .