



**IM3026**  
**Current Issues in Multimedia**

Chapter 3  
File Compression

# Topics

- Data Compression
- Types of Data Compression
- Compression Algorithms
- CODEC
- Examples of Images, Audio and Video file compression

# Data Compression

## Definition

- Storing data in a format that requires less space than usual.
- Data compression is particularly useful in communications because it enables devices to transmit or store the same amount of data in fewer bits.

# Data Compression

## Need of Data Compression

- Raw Video, Image and Audio files can very large.

# Data Compression

## Need of Data Compression

### Uncompress Audio

1 minute audio

<i>Audio Type</i>	<i>44.1 KHz</i>	<i>22.05 KHz</i>	<i>11.025 KHz</i>
<i>16 Bit Stereo</i>	10.1 Mb	5.05 Mb	2.52 Mb
<i>16 Bit Mono</i>	5.05 Mb	2.52 Mb	1.26 Mb
<i>8 Bit Mono</i>	2.52 Mb	1.26 Mb	630 Kb

# Data Compression

## Need of Data Compression

### Uncompress Image

<i>Image Type</i>	<i>File Size</i>
512 x 512 Monochrome	0.25 Mb
512 x 512 8-bit colour image	0.25 Mb
512 x 512 24-bit colour image	0.75 Mb

# Type of Compression

## Lossless vs. Lossy Compression

- Compression can be categorized in two broad ways:
  - Lossless Compression
  - Lossy Compression

# Type of Compression

## Lossless Compression

- Where data is compressed and can be reconstituted (uncompressed) without loss of detail or information.
- These are referred to as bit-preserving or reversible compression systems also.
- This technique can reduce the space needed by only about 50%.



# Type of Compression

## Lossy Compression

- Where the aim is to obtain the best possible *fidelity* for a given bit-rate or minimizing the bit-rate to achieve a given fidelity measure.
- Video and audio compression techniques are most suited to this form of compression.

# Compression Algorithm

## Compression Techniques

- Simple Repetition Suppression
- Run-length coding
- Content mixing
- Entropy encoding
- Vector Quantization
- Pattern Substitution
- Huffman Coding

# Compression Algorithm

## Simple Repetition Suppression

Example:

894000

we can replace with

894f32

where f is the flag for zero.

# Compression Algorithm

## Run-length Encoding

Example:

Original Sequence:

111122233333311112222

can be encoded as:

(1,4),(2,3),(3,6),(1,4),(2,4)

# Compression Algorithm

## Pattern Substitution

Example:

and you and I

becomes:

& you & I

# CODEC

## What is CODEC?

- Short for **compressor/decompressor**.
- A codec is any technology for compressing and decompressing data.

# CODEC

## Audio CODEC

- AAC
- AMR
- MP3
- WMA

# CODEC

## Video CODEC

- DivX
- Cinepak
- Indeo



# JPEG

## What is JPEG?

- "Joint Photographic Expert Group" -- an international standard in 1992.
- Works with color and grayscale images.
- It can reduce files sizes to about 5% of their normal size, some detail is lost in the compression.

# JPEG

## Typical Usage

- The JPEG compression algorithm is at its best on photographs and paintings of realistic scenes with smooth variations of tone and color.
- JPEG is *not* as well suited for line drawings and other textual or iconic graphics.

# JPEG

## JPEG File Extension

- .jpg
- .jpeg
- .jpe
- .jfif
- .jif

# GIF

## What is GIF?

- Stands for **Graphics Interchange Format**.
- It is a bit-mapped graphics file format.
- It is limited to 256 colors, it is more effective for scanned images such as illustrations rather than color photos.

# GIF

## Typical Usage

- GIFs are suitable for sharp-edged line art (such as logos) with a limited number of colors.
- GIFs can also be used to store low-color sprite data for games.
- GIFs can be used for small animations and low-resolution film clips.

# PNG

## What is PNG?

- Short for **P**ortable **N**etwork **G**raphics, and pronounced ping.
- It is a new bit-mapped graphics format similar to GIF.

# PNG

## PNG vs. GIF

- File size much bigger compare to GIF
- Support more colors
- Transparency images
- Not suitable for animation

# MPEG

## What is MPEG?

- Short for **Moving Picture Experts Group**, and pronounced m-peg.
- MPEG algorithms compress data to form small bits that can be easily transmitted and then decompressed.
- MPEG uses a type of lossy compression, since some data is removed.



# MPEG

## MPEG Standards

- MPEG-1
- MPEG-2
- MPEG-3
- MPEG-4
- MPEG-7
- MPEG-24

# MPEG

## MPEG-1

- **MPEG-1** is a standard for lossy compression of video and audio.
- Provide a video resolution of 352-by-240 at 30 frames per second (fps).
- This produces video quality slightly below the quality of conventional VCR videos.

# MPEG

## MPEG-2

- Offers resolutions of 720x480 and 1280x720 at 60 fps, with full CD-quality audio.
- MPEG-2 is used by DVD-ROMs.
- MPEG-2 can compress a 2 hour video into a few gigabytes.
- Encoding video in MPEG-2 format requires significantly more processing power.

# MPEG

## MPEG-3

- Was designed for HDTV but was abandoned in place of using MPEG-2 for HDTV.

# MPEG

## MPEG-4

- A graphics and video compression algorithm standard that is based on MPEG-1 and MPEG-2 and Apple QuickTime technology.
- Designed to transmit video and images over a narrower bandwidth and can mix video with text, graphics and 2-D and 3-D animation layers.

# MPEG

## MPEG-7

- Formally called the **Multimedia Content Description Interface**
- MPEG-7 provides a tool set for completely describing multimedia content.
- MPEG-7 is designed to be generic and not targeted to a specific application.

# MPEG

## MPEG-21

- MPEG-21 describes a standard that defines the description of content and also processes for **accessing, searching, storing** and **protecting** the copyrights of content.

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# Video for Windows

## AVI Format

- A format developed by Microsoft Corporation for storing video and audio information.
- AVI files are limited to 320 x 240 resolution, and 30 frames per second.

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# H.261

## What is H.261?

- **H.261** is a 1990 ITU-T video coding standard originally designed for transmission over ISDN lines on which data rates are multiples of 64 kbit/s.
- This is used for video sequences - video telephony.

# MP3

## What is MP3?

- **MPEG-1 Audio Layer 3**, more commonly referred to as **MP3**
- It is a patented digital audio encoding format using a form of lossy data compression.
- It shrinks the original sound data from a CD by a factor of 12 (down to 112-128kbps) without sacrificing sound quality.
- It can easily be transferred across the Internet.

# AAC

## What is AAC?

- Short for **Advanced Audio Coding**, one of the audio compression formats defined by the MPEG-2 standard.
- AAC boasts higher quality audio reproduction than MP3 and requires 30% less data to do so.

# Realaudio

## What is Realaudio?

- Is a standard for streaming audio data over the World Wide Web.
- RealAudio was developed by RealNetworks and supports FM-stereo-quality sound.

# MIDI

## What is MIDI?

- MIDI stands for **m**usical **i**nstrument **d**igital **i**nterface.
- A standard adopted by the electronic music industry for controlling devices, such as synthesizers and sound cards, that emit music.
- Computers that have a MIDI interface can record sounds created by a synthesizer and then manipulate the data to produce new sounds.