Fundamentals of Multimedia

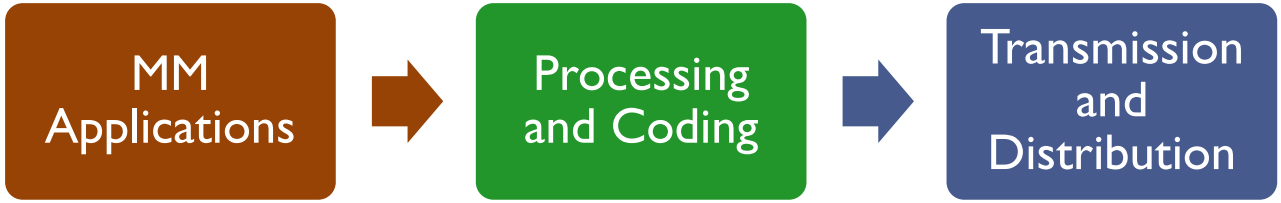
3rd Edition

Chapter 1 : Introduction and Multimedia

- This chapter considers what multimedia is.
- It also supplies an overview of multimedia software tools, such as video editors and digital audio programs.

1.1 The term "multimedia ".

- Applications that use multiple **modalities**, including text, images, drawings (graphics), animation, video, sound including speech, and **interactivity.**



Components of Multimedia Systems

Examples of how these modalities are put to use:

1. Video teleconferencing.
2. Distributed lectures for higher education.
3. Tele-medicine.
4. Co-operative work environments.
5. Searching in (very) large video and image databases for target visual objects.
6. " Augmented" reality: placing real-appearing computer graphics and video objects into scenes.
7. Including audio cues for where video-conference participants are located.
8. Building searchable features into new video, and enabling very high- to very low-bit-rate use of new, scalable multimedia products.
9. Making multimedia components editable.
10. Building "inverse-Hollywood" applications that can recreate the process by which a video was made.
11. Using voice-recognition to build an interactive environment, say a kitchen-wall web browser.

History of Multimedia:

1. **Newspaper: perhaps the *first mass communication medium,*** uses text, graphics, and images.
2. **Motion pictures:** conceived of in 1830's in order to observe motion too rapid for perception by the human eye.
3. **Wireless radio transmission:** Guglielmo **Marconi**, at Pontecchio, Italy, in 1895.
4. **Television:** the new medium for the 20th century, established video as a commonly available medium and has since changed the world of mass communications.
5. The **connection** between **computers** and ideas about **multimedia** covers what is actually only a short period:
   - 1945 - Vannevar Bush wrote a landmark article describing what amounts to a hypermedia system called **Memex.**
   - 1960 -Ted Nelson coined the term hypertext.
   - 2000 - WWW size was estimated at over 1 billion pages.

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Fig. 1.3 Evolution of audio storage media. Left to right: an Edison cylinder record, a flat vinyl record, a reel-to-reel magnetic tape, a cassette tape, and a CD

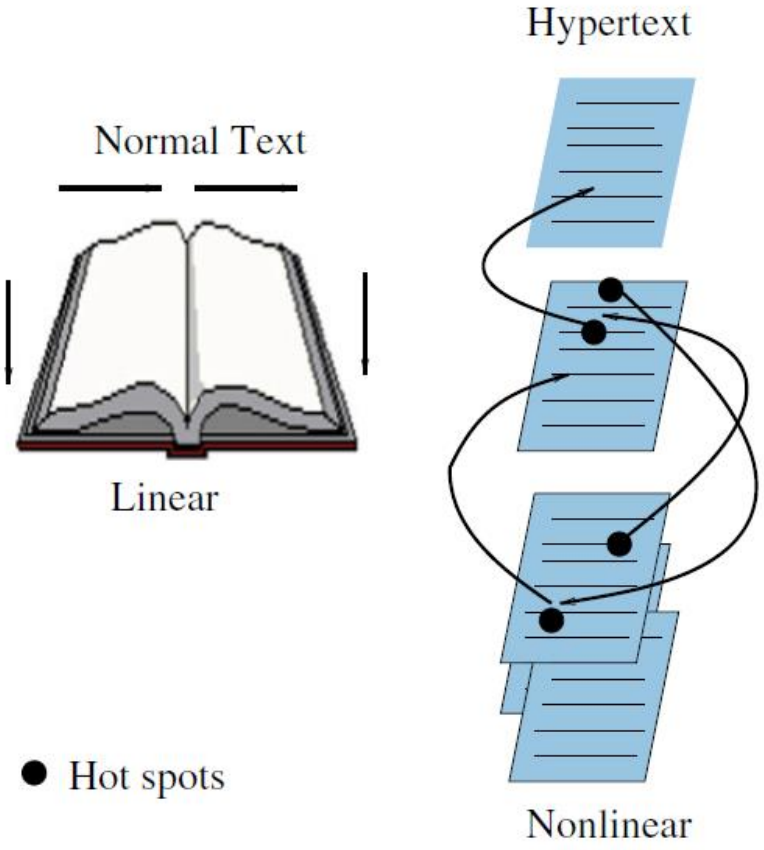
1.1 Multimedia and Computer Science

- Graphics, HCI, visualization, computer vision, data compression, graph theory, networking, database systems --- all have important contributions to make in multimedia at the present time.

Hypermedia and Multimedia

- A **hypertext** system: meant to be read nonlinearly, by following links that point to other parts of the document, or to other documents

Fig. 1.4 Hypertext is nonlinear



Hypermedia and Multimedia

- **HyperMedia:** not constrained to be text-based, can include other media, e.g., graphics, images, and especially the continuous media, sound and video that have interactions with one another.
  - The World Wide Web (WWW) | the best example of a hypermedia application.

- **Multimedia** means that computer information can be represented through audio, graphics, images, video, and animation in addition to traditional media.
- Multimedia, however, is not simply about putting different media together; rather, it focuses more on the integration of them so as to enable rich interaction among them, and as well between media and human beings.

Hypermedia and Multimedia

HyperTextMarkup Language (HTML)

- HTML uses tags to describe document elements.

```
<HTML>
<HEAD>
 <TITLE>
 A sample webpage.
 </TITLE>
 <META NAME = "Author" CONTENT = "Cranky Professor">
</HEAD> <BODY>
 <P>
 We can put any text we like here, since this is
 a paragraph element.
 </P>
</BODY>
</HTML>
```

Hypermedia and Multimedia

ExtensibleMarkup Language (XML)

- A markup language that has modularity of
  - Structure: defined in *Document Type Definition* (DTD) file
  - View: defined in *XML Style Sheet* (XSL) file
  - Data: Saved in a database and rendered in an XML (Xhtml) file based on DTD rules.

```
<?xml version="1.0" encoding="iso-8859-1"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0"
 "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transition.dtd">
 <html xmlns="http://www.w3.org/1999/xhtml">
 ... [html that follows
   the above-mentioned
   XML rules]
 </html>
```

SMIL (Synchronized Multimedia Integration Language)

- SMIL: pronounced "smile“ -- a particular application of XML (globally predefined DTD) that allows for specification of **interaction** among any media types and user input, in a temporally scripted manner.
- It enables scheduling and synchronization of different multimedia elements, and define their interactivity with the user.
- SMIL 2.0 is specified in XML using a modularization approach similar to the one used in xhtml:

SMIL

```
<!DOCTYPE smil PUBLIC "-//W3C//DTD SMIL 2.0"
"http://www.w3.org/2001/SMIL20/SMIL20.dtd">
<smil xlmns="http://www.w3.org/2001/SMIL20/Language">
<head> <meta name="Author" content="Some Professor" />
</head> <body> <par id="MakingOfABook">
<seq> <video src="authorview.mpg" />
        <img src="onagoodday.jpg" />
</seq>
<audio src="authorview.wav" />
<text src="http://www.cs.sfu.ca/mmbook/" />
</par> </body> </smil>
```

1.2.3 Multimedia in the New Millennium

Some important milestones in the development of multimedia in the new millennium:

2000	WWW size was estimated at over 1 billion pages.
2001	The first peer-to-peer file sharing (mostly MP3 music) system, Napster, later Gnutella, eMule, and BitTorrent
2003	Skype was released for free peer-to-peer voice over the Internet.
2004	Web 2.0 was recognized
	Facebook, the most popular online social network, was founded
2005	YouTube was created
2006	Twitter was created, Amazon Web services was launched.
2007	Apple launched the first generation of iPhone
2012	HTML5 for W3C was approved, supports many multimedia formats
2015	YouTube launched support for publishing and viewing 360◦ videos, with playback on its website and its Android mobile apps.
2016	HoloLens, a pair of mixed reality smartglasses developed
2017	TikTok, a video-sharing social networking service for creating and sharing short lip-sync, comedy, and talent videos
2019	5G cellular systems started deployment supporting low latency applications
2020	Due to the outbreak of corona virus Multimedia-empowered online meeting and teaching tools, e.g., Zoom, Google Class, and Microsoft Teams, saw booming use.

1.3 Overview of Multimedia Software Tools

- software tools available for carrying out tasks in multimedia are:

1. Music Sequencing and Notation
2. Digital Audio
3. Graphics and Image Editing
4. Video Editing
5. Animation
6. Multimedia Authoring and Broadcasting

1.Music Sequencing and Notation

- ***Cakewalk:*** *now called Pro Audio.*

  - The term sequencer comes from older devices that stored sequences of notes ("events", in MIDI [**Musical Instrument Digital Interface**]).
  - It is also possible to insert WAV files and Windows MCI commands (for animation and video) into music tracks (MCI is a ubiquitous component of the Windows API.)

- ***Cubase:*** another sequencing/editing program, with capabilities similar to those of Cakewalk. It includes some digital audio editing tools.
- ***Macromedia Soundedit:*** mature program for creating audio for multimedia projects and the web that integrates well with other Macromedia products such as Flash and Director.

2.Digital Audio

- tools deal with accessing and editing the actual sampled sounds that make up audio:
- **Adobe Audition** (formerly **Cool Edit**) is a powerful, popular digital audio toolkit that emulate a professional audio studio, including multitrack productions and sound file editing, along with digital signal processing effects.
- **Sound Forge** Like Audition, Sound Forge is a sophisticated PC-based program for editing WAV files.
- **Pro Tools: a** high-end integrated audio production and editing environment . It offers MIDI creation and manipulation; powerful audio mixing, recording, and editing software.

3. Graphics and Image Editing

- **Adobe Illustrator**: a powerful publishing tool from Adobe. Uses vector graphics; graphics can be exported to Web.
- **Adobe Photoshop**: the standard in a graphics, image processing and manipulation tool.
  - Allows layers of images, graphics, and text that can be separately manipulated for maximum flexibility.
  - Filter factory permits creation of sophisticated lighting-effects filters
- **GIMP**

GIMP is a free and open-source graphics editor alternative to Photoshop. It supports many bitmap formats, such as GIF, PNG, and JPEG. These are *pixel-based* formats, in that each pixel is specified. It also supports *vector-based* formats.

4. Video Editing

- **Adobe Premiere**: an intuitive, simple video editing tool for nonlinear editing, i.e., putting video clips into any order:

- Video and audio are arranged in "tracks".
- Provides a large number of video and audio tracks, super-impositions and virtual clips.
- A large library of built-in transitions, filters and motions for clips => effective multimedia productions with little effort.

- **Adobe After Effects:** a powerful video editing tool that enables users to add and change existing movies. Can add many effects: lighting, shadows, motion blurring; layers.

4. Video Editing

- **Final Cut Pro**: a video editing tool by Apple; Macintosh only.
- **CyberLink PowerDirector**: PowerDirector produced by CyberLink Corp.
  - is by far the most popular nonlinear video editing software.
  - It provides a rich selection of audio and video features and special effects
  - easy to use.
  - It supports all modern video formats (AVCHD 2.0, 4K Ultra HD, and 3D video)
  - It supports 64-bit video processing
  - it is not as "programmable" as Premiere.

5. Animation

Autodesk 3ds Max (formerly 3D Studio Max) includes a number of high-end professional tools for character animation, game development, and visual effects production. Models produced using this tool can be seen in several consumer games, such as for the Sony Playstation.

Autodesk Maya is a complete modeling, animation, and rendering package. It features a wide variety of modeling and animation tools, such as to create realistic clothes and fur. Autodesk Maya runs on Windows, MacOS, and Linux.

Blender is a free and open-source alternative to the paid Autodesk suite of tools. It also offers a complete modeling, animation, and rendering feature set, as well as Python scripting capabilities.

5. Animation

- **Animation Software (Rendering Tools):**

- **3D Studio Max:** rendering tool that includes a number of very high-end professional tools for character animation, game development, and visual effects production.
- **Softimage XSI:** a powerful modeling, animation, and rendering package used for animation and special effects in films and games.
- **Maya**: competing product to Softimage; as well, it is a complete modeling package.
- **RenderMan**: rendering package created by Pixar.

5. Animation

- **GIF Animation Packages :**

- simpler approach to animation, allows very quick development of effective small animations for the web.

- GIFs can contain several images, and looping through them creates a simple animation.

- Linux also provides some simple animation tools, such as **animate**.

6. Multimedia Authoring

- Tools that provide the capability for creating a complete multimedia presentation, including interactive user control, are called **authoring** programs.
- **Adobe Animate (Flash):** allows users to create interactive movies by using the score metaphor, i.e., a timeline arranged in parallel event sequences.
- **Adobe (Macromedia) Director**: uses a movie metaphor to create interactive presentations. It is very powerful and includes a built in scripting language, **Lingo**, that allows creation of complex interactive movies.
- **Adobe Dreamweaver:** Dreamweaver is a webpage authoring tool that allows users to produce web-based multimedia presentations without learning any HTML.

6. Multimedia Authoring and broadcassting

- Software Development Kits

- **Unity Engine** is a multimedia engine development kit targeting novice or small development teams for producing video games and other interactive off-the-shelf experiences. Unity can be deployed to many platforms, such as a PC, smartphone, or a console window. It is free for personal use and can also be used professionally with varying subscription costs and no royalties.
- **Unreal Engine** offers high-fidelity visuals out of the box, unlike Unity, but has a steep learning curve. It is commonly used by and for large game development studios targeting high-quality visual effects with the latest hardware.

- Multimedia Broadcasting

OBS, Xsplit : two widely used broadcasting tools. They offer built-in support for switching between different cameras and other multimedia sources for real-time broadcasting.

1.4 The Future of Multimedia

Multimedia research remains young and is vigorously growing. It brings many exciting topics together, and we will certainly see great innovations that will dramatically change our life in the near future:

- Camera-based object tracking
- Face recognition
- 3D video capture technology
- *Google Glass*
- Advanced immersive applications: such as interactive livecast/gamecast, multi-party media production, online gaming, and augmented reality (AR) and virtual reality (VR).
- *Crowdsourcing for multimedia*
- Digital fashion
- *Animated lifelike virtual agents*

End of Chapter 1

Introduction and Multimedia Data Representations