University of Technology
Computer Science
Department

الجامعـــــة التكنولوجيـــــة
قسـم علوم الحاسوب

Introduction to MM

First Class/ Multimedia Branch

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Lecture 1 Introduction

Introduction to Multimedia

Multimedia means that computer information can be represented through **text, images, graphics, audio, video and animation** in addition to traditional media.

Video can be considered as an **Iintegrated Multimedia** because it contains all the components of multimedia (images, sound and text).

Shot is any number of **Frames** (images) in a time period (30 images per second), those images are similar in characteristics.

A good general working **definition** for this module is:

Multimedia is the field concerned with the computer controlled integration of text, graphics, drawings, still and moving images (Video), animation, audio, and any other media where every type of information can be represented, stored, transmitted and processed digitally.

A Multimedia Application is an application which uses a collection of multiple media sources e.g. text, graphics, images, sound/audio, animation and/or video.

A Multimedia System is a system capable of processing multimedia data and applications and supports more than a single kind of media. A multimedia System is characterized by the processing, storage, generation, manipulation and rendition of multimedia information.

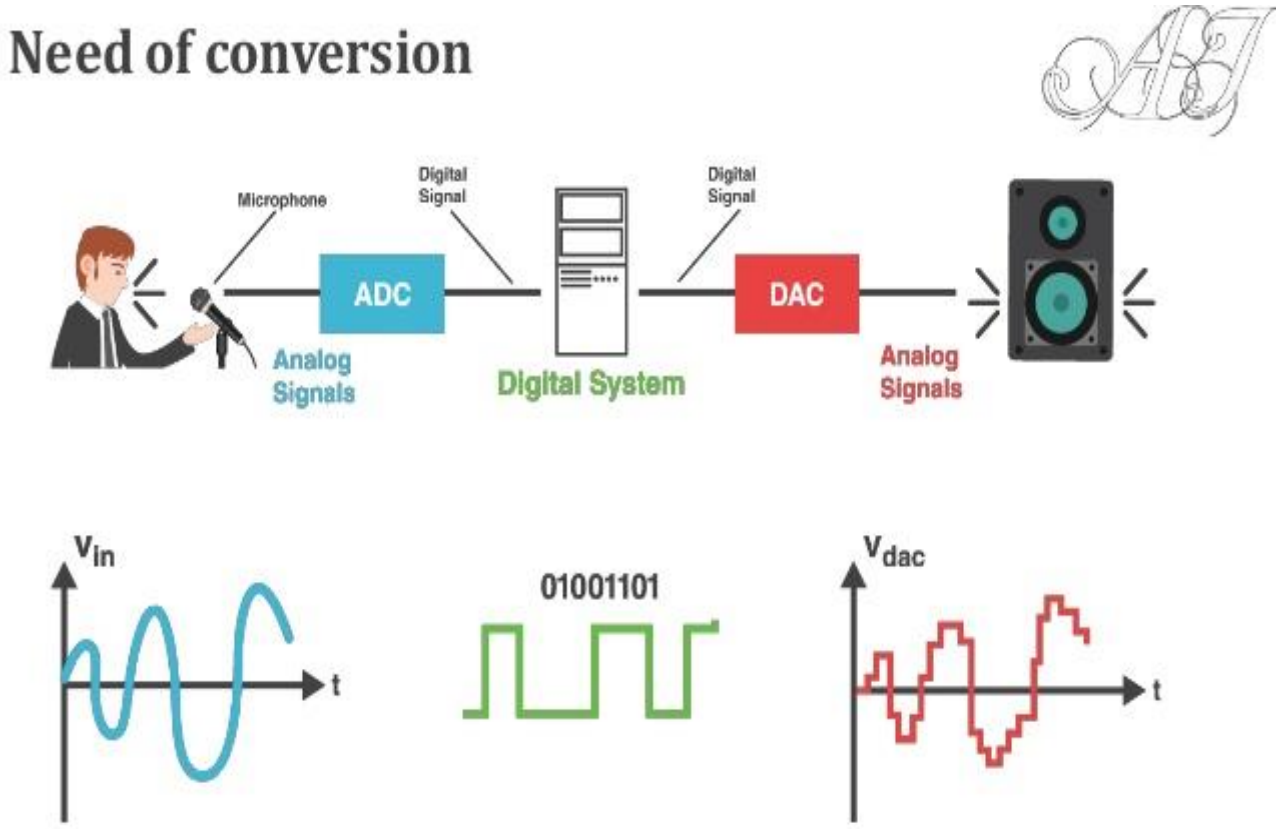
The development of powerful multimedia computers and the evolution of the Internet have led to an explosion of applications of multimedia world wide. These days' multimedia systems are used for **education, in presentations, as information kiosks** (اكشاك المعلومات). In information technology, a kiosk is a small physical structure (often including a computer and a display screen) that displays information for people walking by , and in the **gaming industry.** In fact, multimedia has applications everywhere: in businesses, at schools and universities, at home, and even in public places.

Elements of Multimedia

We have seen that a multimedia system consists of several elements such as sound, graphics, text, and video. We now describe what each one contains.

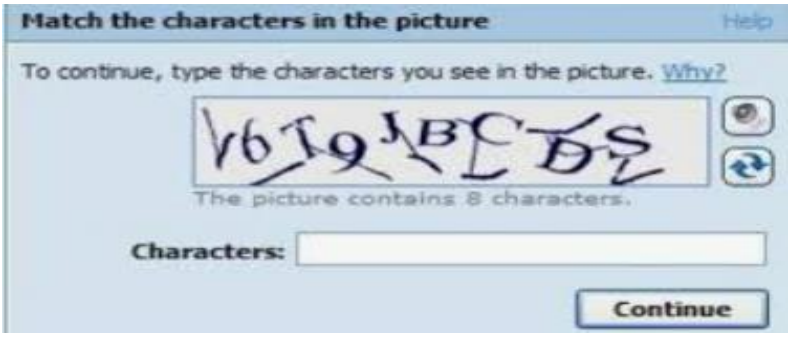
1) The first element of multimedia we consider is **audio.** The word audio is slightly different from **sound.** Audio consists of the sounds we can hear. This may seem contradictory, but it is well known that humans do not hear all possible sounds.

Audio is one of the most appealing elements of any successful multimedia presentation. It can be used in a number of ways in a multimedia application, for example, to reinforce a message or theme, or to catch the interest and alert the audience. As part of audio content in a multimedia system, we may use music, sound effects, or speech to accomplish the goals of our presentation. The audio that appears in a multimedia presentation is of two types. It is either computer generated, or recorded and converted into a digital format.



2) Graphic element. Multimedia presentations are graphics based. Information communicated through pictures is easier to understand and retain. Graphic elements in a multimedia system could be still pictures (like photographs) converted to digital format with the help of scanners, or generated on the computer. They may be flat (or two-dimensional), such as photographs and paintings, or they may appear solid (or three-dimensional), like sculptures (منحوتات) and objects around us. They may be either static graphic elements or animated. Further, animations may be two-dimensional, as in old cartoon films, or three-dimensional.

3) Computer-generated text is another element of multimedia. A few words appearing in a predominantly graphic multimedia system can have a powerful effect. On the Internet, text is used much more than on stand-alone multimedia products, so it takes on an added importance. Also, text and art can be mixed together in interesting ways to reinforce the message being transmitted. Text can also be animated in interesting ways.



4) Images: Image processing is computer imaging where application involves a human being in the visual loop. In other words the image are to be examined and a acted upon by people. Image processing systems are used in many and various types of environments, such as:

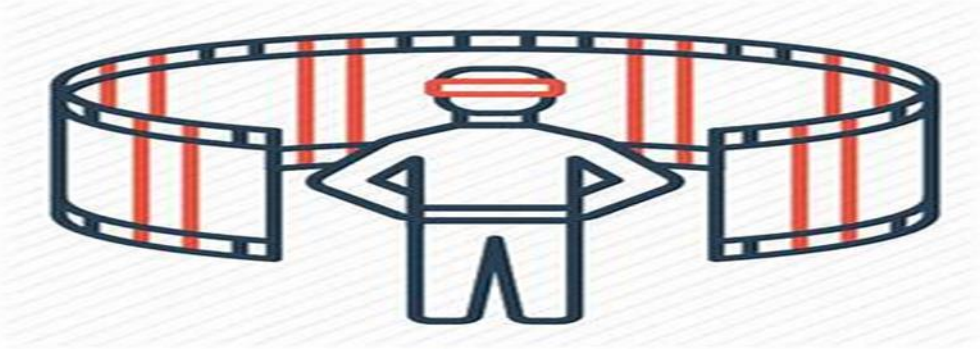
1. Medical community
2. Computer – Aided Design
3. Virtual Reality

The major topics within the field of image processing include:

1. Image restoration.
2. Image enhancement.
3. Image compression.

5) Finally, we mention that **video** is another element of multimedia. Obviously, video and audio are closely related, and together they are the most

effective means of communication that can be a part of the multimedia system.



The word multimedia comes from the Latin words *multus* which means numerous and *media* which means middle or center. Multimedia therefore means multiple intermediaries or multiple means . Multimedia is a combination of following elements :

مهمة

- **Text (e.g. books,letters,newspapers)**
- **Images and graphics (e.g. photographs ,charts,maps ,logos , sketches)**
- **Sound (e.g. radio, gramophone records and audio cassettes)**
- **Video and animation (e.g. TV, video cassettes and motion pictures)**

Multimedia Uses:

1. Video teleconferencing (عقد المؤتمرات عن بعد).

2. Tele-medicine**.**

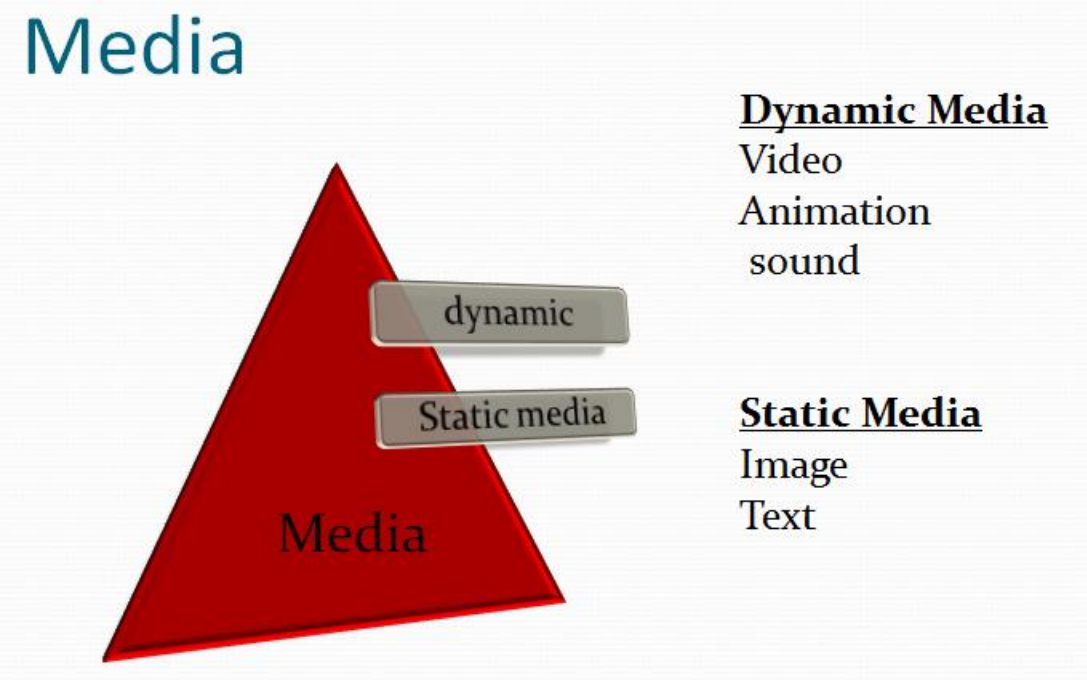
3. "Augmented" reality placing real-appearing computer graphics and video objects into scenes.

1) Video conferencing

Also called teleconferencing, in which people in different geographical locations can have a meeting -can see and hear one another- using computers and communications. Video conferencing may eliminate the need for some travel for the purpose of meeting and allow people who cannot travel to visit "in person".

2) Telemedicine

The use of medical information exchanged from one site to another via electronic communications for the health and education of the patient or healthcare provider and for the purpose of improving patient care.



Lecture 2 Multimedia and Hypermedia

Multimedia and Hypermedia

History of Multimedia:

1. Newspaper: perhaps the first mass communication medium uses text, graphics, and images.

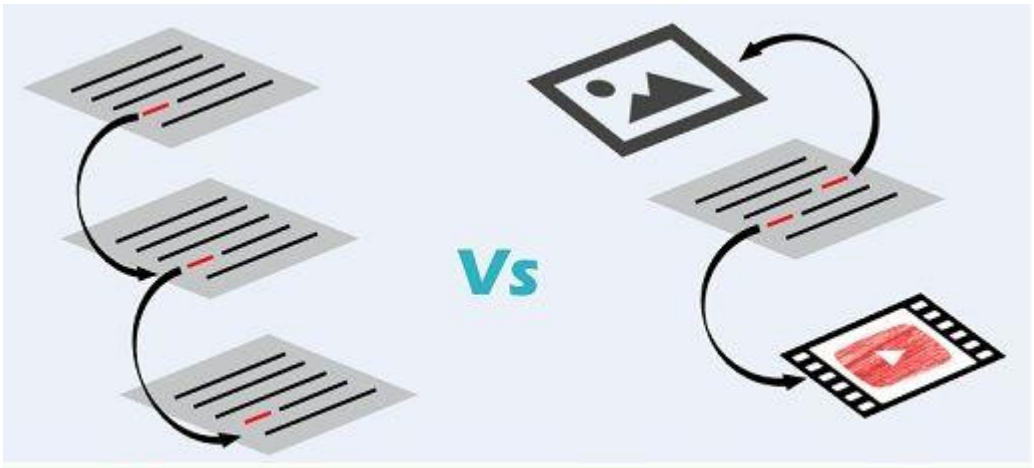
2. Motion pictures: conceived of in 1830's in order to observe motion too rapid for perception by the human eye.

3. Wireless radio transmission: The early history of radio is the history of technology that produces and uses radio instruments that use radio waves. Within the timeline of radio, many people contributed theory and inventions in what became radio

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.

Hypertext system: meant to be read nonlinearly, by following links that point to other parts of the document, or to other documents.

Hypermedia: not constrained to be text-based, can include other media, e.g., graphics, images, and especially the continuous media, sound and video.



Example Hypermedia Applications:

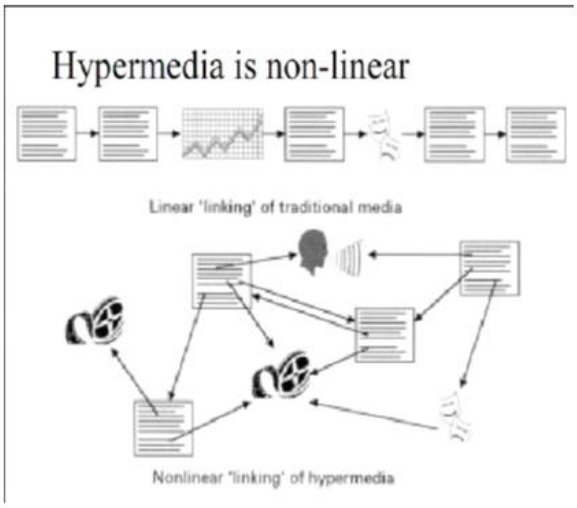
1. The World Wide Web (WWW) is the best example of a hypermedia application.

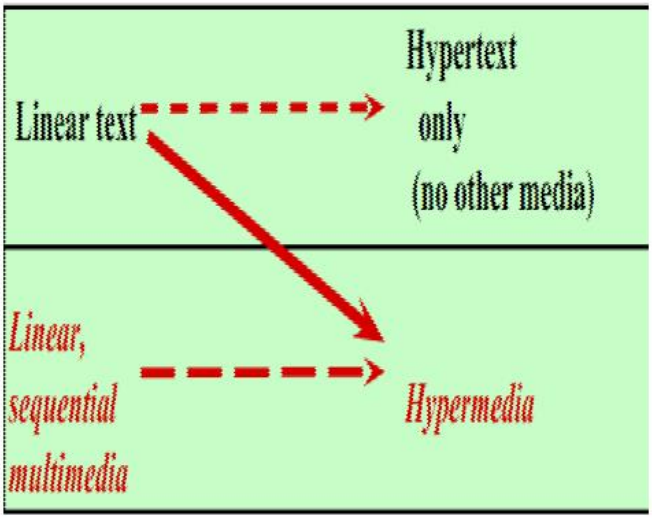
2. Power point

3. Adobe Acrobat

Hyperlinking allows the user to “jump” from one part of the multimedia application to another .

The World Wide Web is a partial hypermedia system since is supports graphical hyperlinks and links to sound and video files. New hypermedia systems under development will allow objects in computer videos to be hyperlinked





Hypertext and hypermedia, are the techniques for linking non-linear information. The two terms are distinct in a manner that the hypertext allows

only text to be hyperlinked while hypermedia could use various multimedia elements such as images, audio and video, in order to link the text and media over the World Wide Web. However, hypertext is a part of the hypermedia as hypermedia includes text, image, audio, video, etcetera.

BASIS FOR COMPARISON	HYPERTEXT	HYPERMEDIA
Basic	It is a text that links to the other chunks of the text under the same or separate document.	It can be considered as the enhanced version of hypertext where other graphics is also the part of the link.
Involves	Text	Graphics, image, audio, video, etc.
Relation	Is a part of hypermedia.	Comes in the superior level entity.
Represents	Multimedia content present in the electronic text format.	It can contain various multimedia elements which are linked with each other non-linearly.

Internet Technology

The Internet began as a small group of interconnected Local Area Networks (LANs) and has grown into a worldwide network that spans many thousands of networks and millions of computers. The Internet really is nothing more than a huge wide area network. It is one of the fastest growing sources of information and a large computer network of networks all connected together and sharing resources and information. No one actually know how many web pages are actually out there last count was about 4 billion – but this number changes daily even hourly.

Internet enables us to find information that would otherwise be time-consuming, difficult, or impossible to locate. It has enabled us to shop and buy without leaving home. Traditionally, the Internet had several main applications

1. E-mail.
2. Newsgroup.
3. E-commerce.

Definition: Internet

• The Internet is a global system of interconnected computer networks that use the standard Internet protocol suite (TCP/IP) to serve billions of users worldwide.

• It is a network of networks that consists of millions of private, public, academic, business, and government networks, of local to global scope, that are linked by cables, wireless and optical networking technologies.

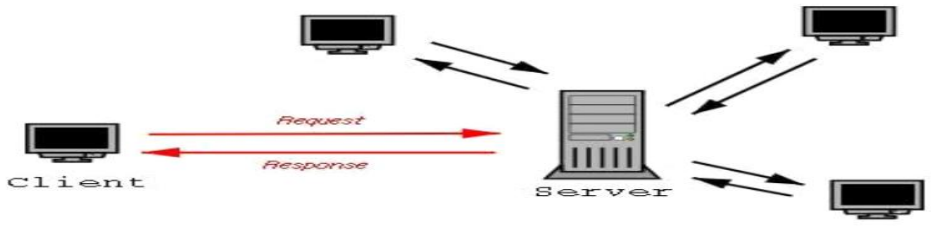
• The Internet carries large amount of information resources and services, such as the inter-linked hypertext documents of the World Wide Web (WWW) and the infrastructure to support email.

To connect you need

- An access device ***(computer)***
- A means of connection ***(phone line, cable, or wireless)***
- An ***Internet Service Provider (ISP):*** a commercial organization with permanent connection to the Internet that sells temporary connections to subscribers.

Client and Server model

- Servers
- Computers that **provide networking services** (e.g., sharing files, sharing Web pages) to other computers
- Clients
- Computers that **access/request and receive networking services** from servers



The World Wide Web

The World Wide Web (WWW) is a repository of information linked together all over the world. The WWW has a unique combination of flexibility, portability, and user-friendly features that distinguish it from other services provided by the Internet. The World Wide Web incorporates all the internet services listed above, and more, including the ability to view images, look at video, and hear sound recordings.

• The **World Wide Web,** or **Web,** consists of a worldwide collection of electronic documents (**Web pages)**

• A **Web site** is a collection of related web pages and associated items

• A **Web server** is a computer that delivers requested Web pages to your computer

• **Web 2.0** refers to Web sites that provide a means for users to interact

• A **Web browser,** or **browser,** allows users to access Web pages and Web 2.0 programs (Internet Explorer, Firefox , Opera, Safari, Google Chrome).

Web servers are computers (software and hardware) that are capable of providing information (e.g., documents, files, audio, video) to Web clients.

A Web server processes the requests and returns the requested documents, pictures, videos, audio, and files to the client.To be a Web server, a software called HTTP Daemon (HTTPD) or Web server software must be installed in a computer. Examples of HTTPD are **Apache** and **Internet Information Services (IIS).**

Web clients are computers (software and hardware) that are capable of requesting information (e.g., documents, files, audio, video) from Web servers A Web client requests the documents, pictures, videos, audio, and files that are located in the server.

To be a Web client, a software called Web browser must be installed in a computer. Examples of Web browser are **Internet Explorer** and **Mozilla Firefox.**

Internet vs. the Web

The Internet is a global system of **interconnected computer networks.**

In contrast, the **Web is one of the services** that run on the Internet.

The Web is a collection of interconnected documents and other resources, linked by hyperlinks and URLs. The Web is an application running on the Internet.

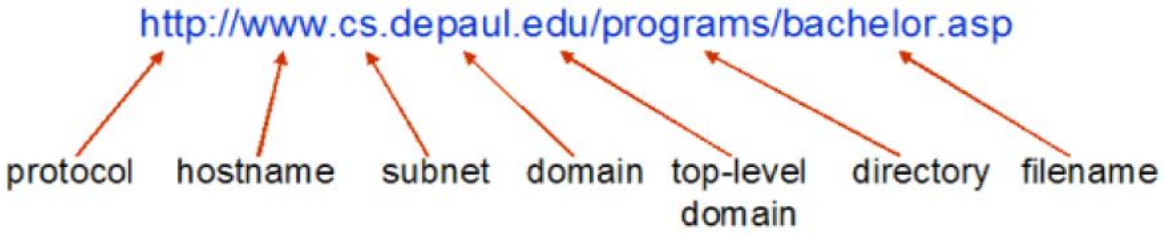
HTTPS stands for Hyper Text Transfer Protocol over SSL (Secure Socket Layer). It is a TCP/IP protocol used by Web servers to transfer and display Web content securely. The data transferred is encrypted so that it cannot be read by anyone except the recipient. HTTPS is used by any Web site that is collecting sensitive customer data such as banking information or purchasing information. If you are making a transaction online, you should make sure that it is done over HTTPS so that the data remains secure. You can tell when a page is using HTTPS in two ways:

1.There will be a lock icon in the browser window pane (usually at the bottom).

2.The URL will say "https://"

URL Uniform Resource Locator

- Address in a format that identifies an individual object (web page, image, sound file, etc.) on the Internet
- Analogy is a phone number
- URL is unique for each object
- Must be typed exactly (often case sensitive)
- Format: protocol://server name/path/file name
- **protocol** = rules for transferring the data (for example, http for a web page)
- **server** = fully qualified domain name (or IP address) of the host computer where object is located
- **path** = folder or directory in the host computer where object will be found
- **file** = file name of the object (web page, image, sound , etc.).



Lecture 3 MM Authoring

Multimedia is created by incorporating different elements - such as sound effects, text passages, video clips into one program. It is delivered by computer or other electronic means.

When the user is given interactive control of the process, they can be enchanted. Multimedia excites eyes, ears, fingertips, and most importantly – the mind.

When you allow an end user (the viewer of a multimedia project) to control what and when the elements are delivered, it is **interactive multimedia**. Interactivity gives the end users by letting them control the content and flow of information. When you provide a structure of linked elements through which the user can navigate, interactive multimedia becomes hypermedia.

Authoring a Movie

Many multimedia presentations also include ways the user can interact with them, providing a new dimension in the presentations. This whole process is known as **authoring a movie** and involves many stages. The "authoring" process is how a development team works through multiple stages and builds a working prototype to demonstrate how a movie will work.

Authoring Software

Authoring software can be used to create sound, video, text, graphics, and sophisticated animations from scratch. This software is also capable of providing the links that join these elements and make a multimedia movie interactive.

There are four categories of interactive programs: Presentations, Catalogs, Games, and Computer-Based Training. Your information, audience(الجمهور), and project goals help determine the most appropriate design model.

1. Presentations

Material can be presented in a linear or non-linear fashion. Like computer-based training programs, interactive presentations are really learning experiences for the user.

2. Catalogs

A catalog format is perfect for a direct access information design. The two distinctive characteristics found in an interactive catalog are a search engine and a transaction component. The search engine enables the user to access information from a text field or hypertext linked index. The transaction component provides the user with the tool to actually select and buy items.

3. Computer-Based Training (CBT)

Computer-based training covers any application that provides a very specific learning agenda for the user. Information is absorbed at the user's own page; advancing through new levels of information only after mastering previous levels, thereby qualifying that learning has taken place. There are two

characteristics that distinguish computer-based training: simulation of real-life events and scoring. The ability to simulate real-life events is one thing that makes computer-based training so valuable.

True CBT programs will include the ability to record user responses and measure user progress.

4 Computer Games

Computer games are the parents of today's multimedia industry, and computer games continues to add fuel to the popularity of computers. The objective is simple for the computer game designer: extended play value. As the user becomes proficient, the game should become more challenging. Also, note the similarities between games and CBT: Both types of programs transfer skills to the user during the course of "play." It might be wise to consider aspects of game design in the development of CBT as well as presentation projects.

Stages of authoring a Movies are created in many stages. Most often these development stages are very specific. At times it may be hard to see any separation of the stages, but you should never leave any stage out. There are six general stages for authoring a movie, starting with the concept and finishing with the distribution and delivery. As you go through the stages, you may find yourself going back to certain stages to reevaluate certain aspects or to make decisions based on other stages.

1. Concept

Creation of a multimedia movie requires an idea. The concept stage is sometimes referred to as the question and answer stage. There are three things to keep in mind when creating a movie: the target audience, the purpose of the product, and the product itself.

2. Planning

After the idea, purpose, and target audience is established, then you begin planning the movie. Deadlines, budgets, and available resources are big drivers in how complex a project may become. Planning any project without knowledge of the budget could add up to wasted time and resources.

You must also know when your customer wants the project completed. Many projects have been stopped dead in their tracks because of poor planning. If you have a short suspense but an extremely large budget, you may be able to use more resources in a shorter time. Conversely, you may have a long suspense and a limited budget forcing you to shop around for less expensive resources.

The next step in the planning stage of the movie is to gather the content. Resources needed to complete a program can include, but are not limited to: software, hardware, personnel man-hours, photo imagery, and illustration images. Additional buffer time should be figured into the schedule to cover unexpected problems. All of these are just a sample of the required resources or factors that can and will affect production. The planning of the program must be detailed and thought out carefully.

3. Design

The next stage is to produce a design to incorporate into the program. Before work on the multimedia elements begin, the editor-designer first prepares everything on paper – detailed plans that show exactly what text, still pictures, sounds, animations, and video clips are needed - and decides exactly where they belong.

Flowcharts are used to organize the content. An information flowchart is simply an outline presented as a box diagram, with lines that show the access routes among its parts, a navigational blueprint. It shows how you plan to take the user through the movie. The flowchart shows links between scenes.

The ideal flowchart is a clear, easy-to-follow specification of a program's topic categories, levels, and links.

4. Production

With the design work accepted and the concept in full view, it is time to begin production. The production stage combines all the planning and design efforts into an electronic media. Each person on the production team begins to gather the raw files and prepare them for production. The source files are brought together and placed where they can be used by all members of the team.

5. Testing

The testing of a movie is a never ending process and is done throughout every stage of development. All decisions should be tested and checked whether they are on paper or in the program. Proofreading the script, scamps and storyboards will help prevent embarrassing moments later. Find out what

system will be used for the presentation and use it to test the movie. A very popular method of testing is to have an independent third party test the project. You give the tester a finished prototype and basic instructions.

From this, the user should be able to understand and navigate through the movie. The third party testers are usually used to find bugs that are missed during production. If testing is successful, it is time to move to the final stage; distribution and delivery.

6. Distribution and Delivery

The final stage of authoring is distribution. Throughout the development of a movie, you must be aware of the process of creating the movie.

When determining methods to distribute a movie, it helps to understand a Flash player and Flash play movies. The Flash player is a system component that can play movies and animations in Web browsers and also outside browsers as stand-alone applications.

Lecture 4 Graphics in Multimedia

Graphics is the art of drawing, especially as used in mathematics, engineering……etc. Graphics are usually *editable image*.

- Input: Graphics are usually generated by a graphics editor program.
- Graphics input devices: keyboard (for text and cursor control), mouse and graphics tablet.
- Format: constructed by the composition of primitive objects such as lines, polygons, circles, curves and arcs.
- Do not take up a very high storage.

Computer Graphics refers to any computer device or program that makes a computer capable of displaying and manipulating pictures. For example,

1) ***Laser printers and plotters are graphics devices*** because they permit the computer to output pictures.

2) **A *graphics monitor*** is a display monitor that can display pictures.

3) **A *graphics board* (or *graphics card)*** is a printed circuit board that, when installed in a computer, permits the computer to display pictures.

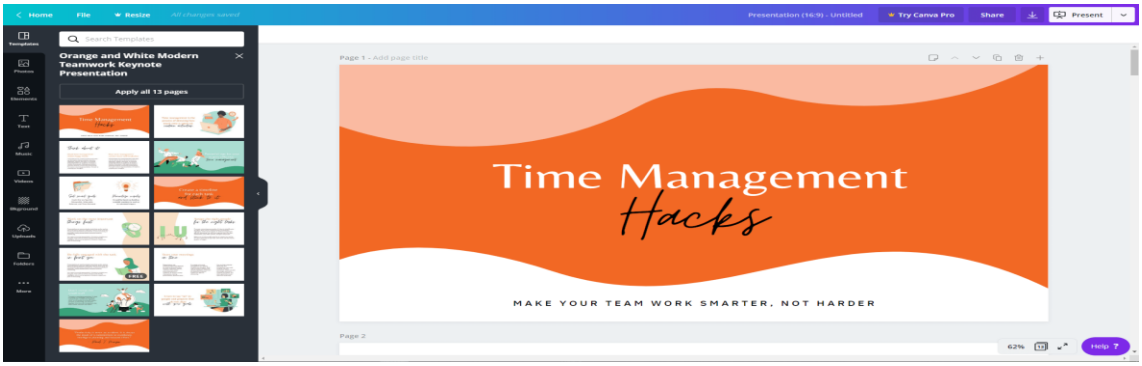
The following are also considered *graphics applications:*

1) **Paint programs :** Allow you to create rough freehand drawings. The images are stored as bit maps and can easily be edited.

2) **Illustration/design programs:** Supports more advanced features than paint programs, particularly for drawing curved lines. The images are usually stored in vector-based formats. Illustration/design programs are often called *draw programs.*

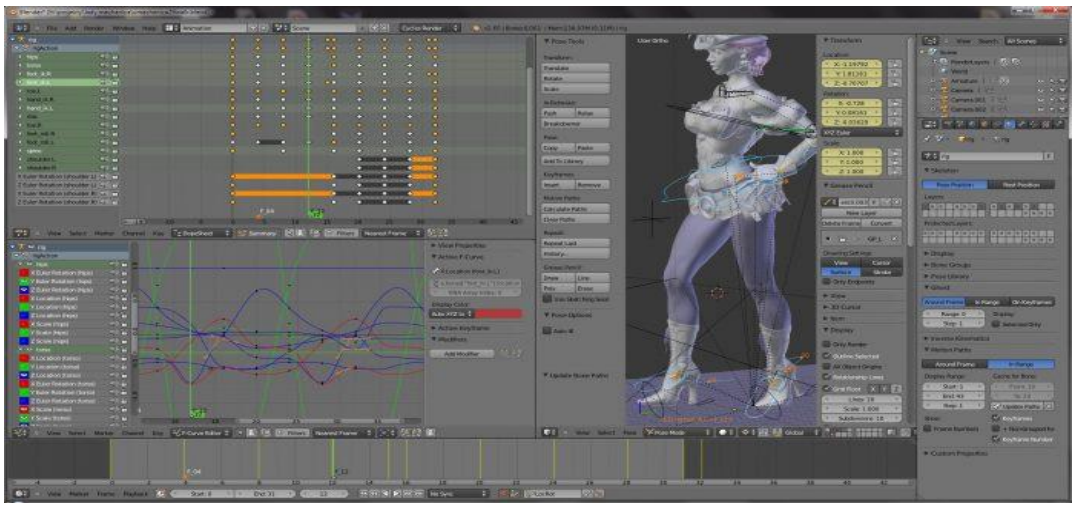
3) **Presentation graphics software:** Lets you create bar charts, pie charts, graphics, and other types of images for slide shows and reports. The charts can be based on data imported from spreadsheet applications.

Example https://www.canva.com/presentations/



4) Animation software: Enables you to chain and sequence a series of images to simulate movement. Each image is like a frame in a movie.

Example [blender.org - Home of the Blender project - Free and Open 3D Creation Software]



5) CAD software: Enables architects and engineers to draft designs.

6) Desktop publishing : Provides a full set of word-processing features as well as fine control over placement of text and graphics, so that you can create newsletters, advertisements, books, and other types of documents.

In general, applications that support graphics require a **powerful CPU** and a **large amount of memory.**

Most PC programs, for instance, require **VGA** (**Video Graphics Array)** graphics. If your computer does not have built-in support for a specific graphics system, you can insert a video adapter card. The quality of most graphics devices is determined by their ***resolution***-how many points per square inch they can represent-and their ***color*** capabilities.

Computer Graphics Modes

There are two extremely modes:

1. The passive (none interactive mode).

2. The interactive mode.

A typical system may be a hybrid of both modes.

1. The passive mode.

In this mode a system usually operate in a batch environment. The input is usually an already written program saved at a disk, the output devices are usually hard copy i.e. they provide a permanent pictures. Such as printers and plotters.

2. The interactive mode

In this mode the user and the computer interact or converse on-line. The input devices used with this mode are mouse, keyboard, joystick, while the output device must be a display monitor.

Interactive Graphics Display

The modern graphics display is extremely simple in construction. It consists of three components:

1- A digital memory, or frame buffer, in which the displayed image is stored as a matrix of intensity values.

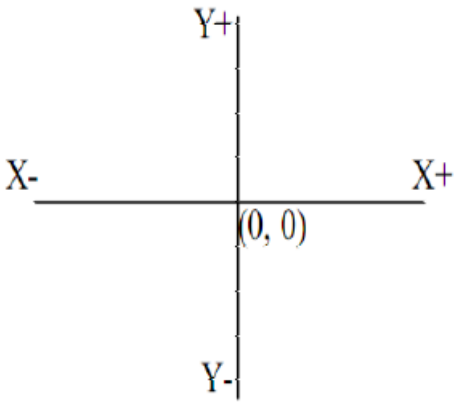
2- A display monitor.

3- A display controller, which is a simple interface that passes the contents of the frame buffer to the monitor.

Cartesian Coordinate System

A coordinate system provides a framework for translating geometric ideas into numerical expressions.

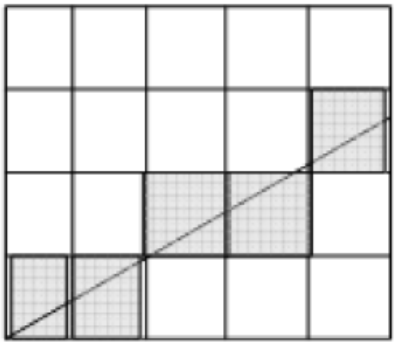
In a two-dimensional plane, we pick any point and single it out as a reference point called the origin. Through the origin we construct two perpendicular number lines called axes. These are labeled the X axis and the Y axis. Any point in two dimensions in this X-Y plane can be specified by a pair of numbers, the first number is for the X axis, and the second number is for the Y axis.

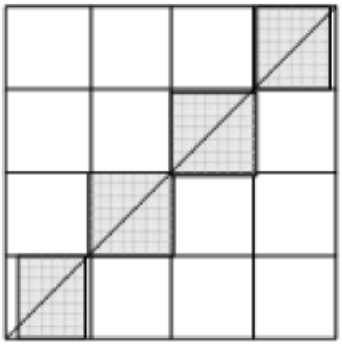


Raster scan refresh graphics display (device coordinate system)

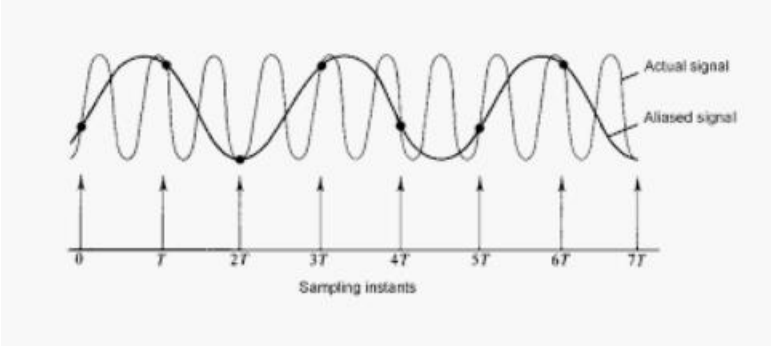
A raster CRT graphics devices can be considered a matrix of discrete cells each of which can be made bright. Thus it is a point plotting devices.

It is not possible except in special cases to directly draw a straight line from one addressable point, or pixel in the matrix to another addressable point, or pixel. The line can only approximated by a series of dots (pixels) close to the path of the line.





Only in the special cases of completely horizontal, vertical or 45 degree lines will a straight line result. All other lines will appear as a series of stair steps. *This is called aliasing*.



The most common method of implementing a raster CRT graphics device utilizes a frame buffer. A frame buffer is a large, contiguous piece of computer memory. As a minimum there is one memory bit for each location or pixel in the raster. This amount of memory is called a bit plane.

A 512 X 512 element square raster requires 2^18 memory bits in a single bit plane. The picture is built up in the frame buffer 1 bit at a time.

There are two types of graphics:

1) Draw-type graphics or vector graphics – represent an image as a geometric shape

2) Bitmap graphics – represents the image as an array of dots, called pixels

1) Draw Type Graphics

Draw type or vector graphics have some features such as:-

- Geometric shape stored as set of instructions
- Smaller than bitmap
- Resize, rotate, no distortion

2) Bitmap Graphics have some features:-

- Bitmaps – array of dots or pixels
- Color depth per pixel
- High quality pictures
- Larger than draw-type

Bitmap Graphics (BMP)

Graphics Programs for Normal image

Graphic Image Sources

Alternative image sources

- Clip art
- Stock photographs
- Video images
- Still images
- Scanned images
- Photo CD's
- Screen-capture program

Lecture 5 Text Processing

Text is words and symbols in any form, spoken or written, are the most common system of communication. Text is used in most Multimedia applications.

With multimedia technology, text can be combined with other media in a powerful and meaningful way to present information and express moods.

• Text has a dual nature:

1) Visual representation of language (content).

2) Graphic element (appearance).

Character Sets

• Abstract characters are grouped into alphabets.

• A character set is a mapping between the characters of some alphabet (its character repertoire) and bit patterns.

ASCII

• American Standard Code for Information Interchange.

• 7 bits for each code value, hence 128 code points.

• ISO standard ISO 646 is ASCII with national variants (accented letters, currency symbols).

8-bit Character Sets

• Easy to double the number of code points by using the eighth bit of a byte.

• Maintain backward compatibility by keeping lower half (0–127) identical with US-ASCII.

• Use code points 128–255 for accented letters, math symbols, extra punctuation.

• 256 code points still insufficient for all languages.

Fonts

• Visual representation of a character is called a **glyph,** as shown in this figure.

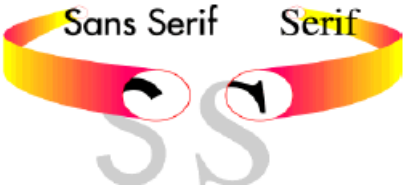
• Must replace characters with glyphs for display.

• Glyphs are arranged into collections called **fonts.**

Classification of Fonts

• Spacing: moonscape (fixed width)/proportional.

• Serif: serif/sans serif are the small strokes added to the ends of character shapes in conventional book fonts, as shown in this image.



• Shape: upright/italic/slanted.

• Weight: bold/normal/light

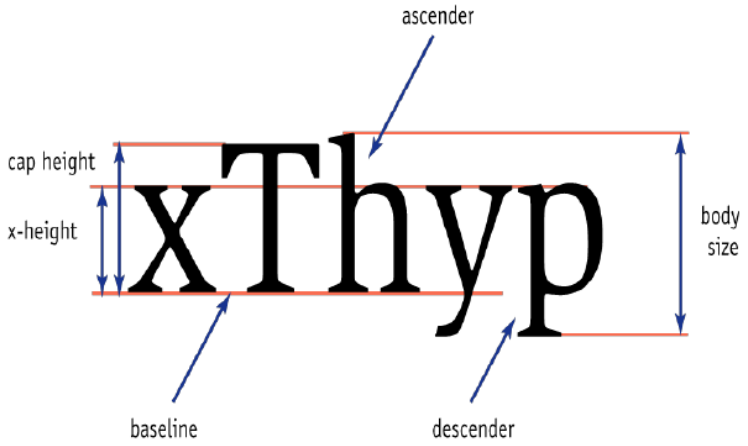
Font Terminology

• **Baseline:** The line on which the bases of characters are arranged

• **Leading:** The distance between successive baselines.

• **X-height:** The distance between the baseline and the top of a lower-case letter x.

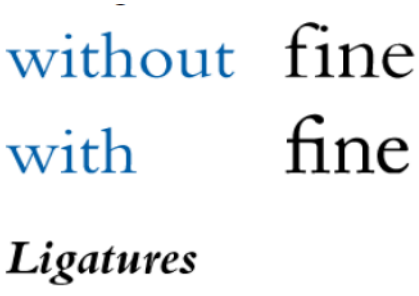
• **Ascenders/descenders:** Strokes that rise above the x-height/drop below the baseline.



Spacing

• **Kerning:** Adjustment of space between certain pairs of letters to make them look more uniform.

• **Ligatures:** (الحروف المركبة) Single composite characters used to replace pairs of letters that don't look right next to each other (e.g. fi).



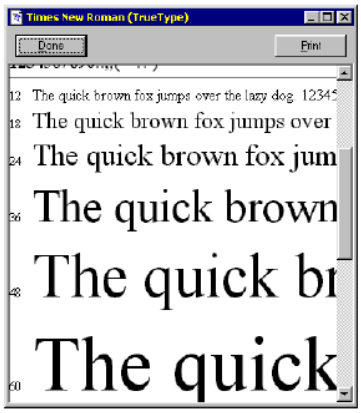
Digital Fonts

• Glyphs are just images, so we can have **bitmapped** or **vector** (outline) fonts.

• Bitmapped fonts don't scale well or reproduce at different resolutions.

A bitmapped font A vector font.

A bitmapped font



A vector font

Outline Fonts

• **PostScript, TrueType,** and **Open Type** are outline fonts allow text to be drawn at any size with smooth characters.

• **PostScript:**

PostScript is a method of describing an image in terms of mathematical constructs.

PostScript characters are scalable and can be drawn much faster.

• **TrueType:**

Apple and Microsoft developed the TrueType methodology.

TrueType is a system of scalable outline fonts and can draw characters at low resolution.

• **Open Type:**

Adobe and Microsoft developed Open Type, now the international standard.

It incorporates the best features of PostScript and true type.

Lecture 6 Image Processing

An image must be converted to numerical form before processing. This conversion process is called digitization, and a common form is illustrated in Figure (1).The image is divided into small regions called ***picture elements,*** or ***pixel*** for short. The most common subdivision schema is the rectangular sampling grid shown in Figure (1).The image is divided into horizontal lines made up of adjacent pixels. Each pixel has a location or address (Line or row number and sample or column number) and an integer value called gray level. This array of digital data is now a candidate for computer processing.

From above we can define Digital Image as a sampled, quantized function of two dimensions ***f(x,y),***which has been generated by optical means, sampled in an equally spaced rectangular grid pattern , and quantized in equal intervals of gray levels.

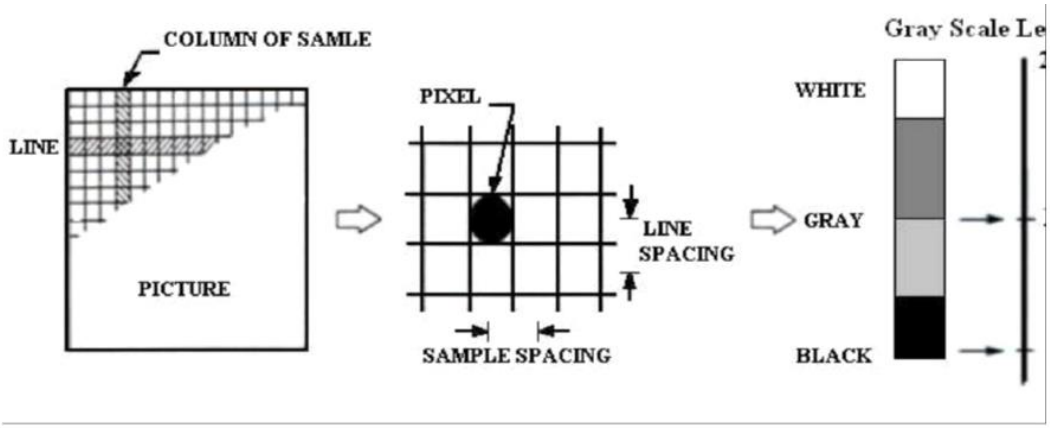


Figure (1) Digitizing an Image

Sampling

Sampling : is a process of measuring the value of the image function *f(x,y)* at discrete ***intervals in space.*** Each sample corresponds to a small square area of the image, known as a pixel. A digital image is a two- dimensional array of these pixels. Pixels are indexed by *x* and *y* coordinates, with *x* and *y* taking integer values.

In the figure below we see one line of a video signal being sampled (digitized) by instantaneously measuring the voltage of the signal at fixed intervals in time. The value of the voltage at each instant is converted into a number that is stored, corresponding to the brightness of the image at that point.

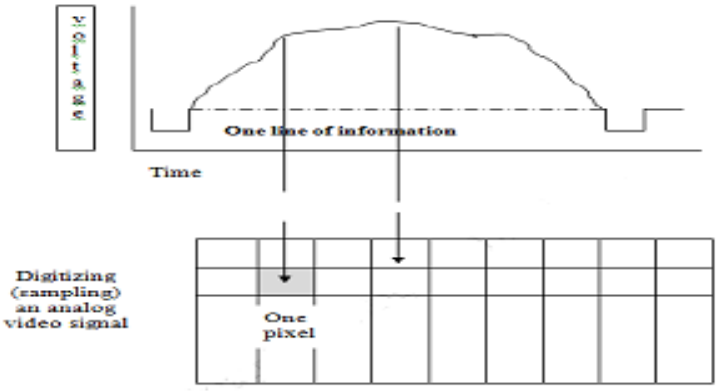


Figure (2) Digitizing (Sampling) an Analog Video Signal

Quantization

Quantization: is the representation of the brightness of each pixel by an integer value. Since digital computer process number, it is necessary to reduce

the continuous measurement value to discrete units and represent them by integer number. The digital image is 2D- array as:

$$\begin{pmatrix} I(0,0) & I(0,1) \ldots\ldots\ldots\ldots\ldots\ldots\ldots I(0,N-1) \\ I(1,0) & I(1,1) \ldots\ldots\ldots\ldots\ldots\ldots\ldots I(1,N-1) \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ I(N-1,0) & I(N-1,1) \ldots\ldots\ldots\ldots\ldots\ldots I(N-1,N-1) \end{pmatrix}$$

Image Representation

The digital image I (r, c) is represented as a two- dimensional array of data, where each pixel value corresponds to the brightness of the image at the point (r, c). in linear algebra terms , a two-dimensional array like our image model I(r, c) is referred to as a matrix , and one row (or column) is called a vector.

There are different types of images:

1. Binary Image

Binary images are the simplest type of images and can take on two values, typically black and white, or '0' and '1'. A binary image is referred to as a 1bit/pixel image because it takes only 1 binary digit to represent each pixel. These types of images are most frequently in computer vision application where the only information required for the task is general shapes, or outlines information. For example, to position a robotics gripper to grasp an object or in optical character recognition (OCR). Binary images are often created from

gray-scale images via a threshold value is turned white (‘1’), and those below it are turned black (‘0’).

Figure (3) Binary Images.

2. Gray Scale Image

Gray _scale images are referred to as monochrome, or one-color image. They contain brightness information only brightness information only, no color information. The number of different brightness level available. The typical image contains 8 bit/ pixel (data, which allows us to have (0-255) different brightness (gray) levels. The 8 bit representation is typically due to the fact that the byte, which corresponds to 8-bit of data, is the standard small unit in the world of digital computer.

Figure (4) Gray Scale Images.

3. Color Image

Color image can be modeled as three band monochrome image data, where each band of the data corresponds to a different color.

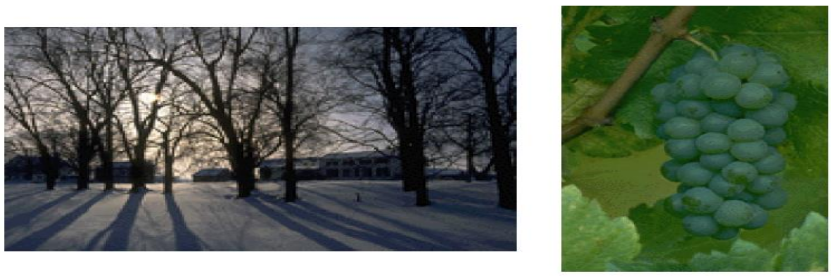


Figure (5) Color Images.

Typical color images are represented as red, green ,and blue or RGB images using the 8-bit monochrome standard as a model , the corresponding color image would have 24 bit/pixel – 8 bit for each color bands (red, green and blue). The following figure we see a representation of a typical RGB color image.

The following figure illustrate that in addition to referring to arrow or column as a vector, we can refer to a single pixel red ,green, and blue values as a color pixel vector –(R,G,B).

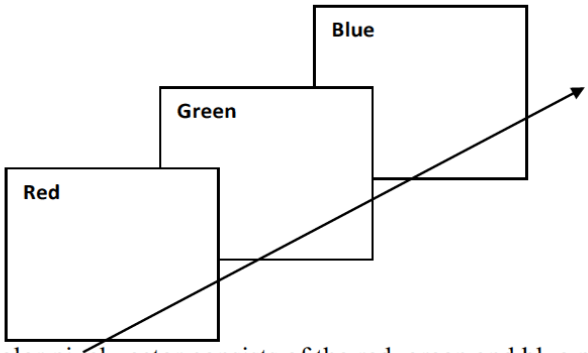


Figure (6) A color pixel vector consists of the red, green and blue pixel values (R, G, B) at one given row/column pixel coordinate(r , c) [1].

For many applications, RGB color information is transformed into mathematical space that that decouples the brightness information from the color information.

The hue/saturation /lightness (HSL) color transform allows us to describe colors in terms that we can more readily understand.

The lightness is the brightness of the color, and the hue is what we normally think of as “color” and the hue (ex: green, blue, red, and orange).

The saturation is a measure of how much white is in the color (ex: Pink is red with more white, so it is less saturated than a pure red).

Example: “a deep, bright orange” would have a large intensity (“bright”), a hue of “orange”, and a high value of saturation (“deep”).we can picture this color in our minds, but if we defined this color in terms of its RGB components, R=245, G=110 and B=20.

4. Multispectral Images

Multispectral images typically contain information outside the normal human perceptual range. This may **include** infrared, ultraviolet, X-ray, acoustic, radar data. These are not images in the usual sense because the information represented is not directly visible by the human system.

However, the information is often represented in visual form by mapping the different spectral bands to RGB components. If more than three bands of information are in the multispectral image, the dimensionality is reduced by applying a principal component's transform.

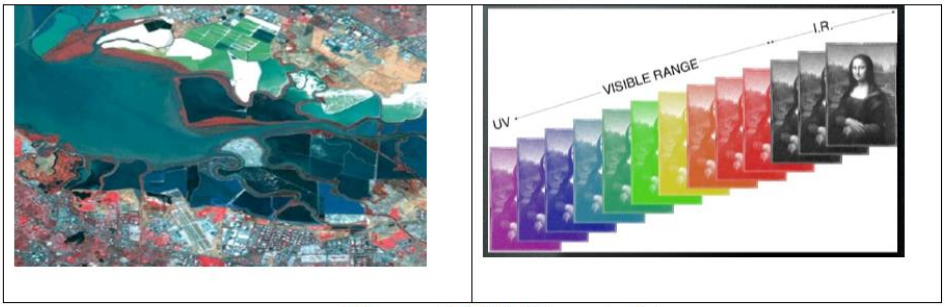


Figure (7) Multispectral images .

As the amount of data that needs to be transmitted, stored, and processed increases, the importance of topics such as compression becomes more and more apparent.

Popular File Formats

There are different file formats such as:-

1)Image File Format :

a) BMP format:

It is the format used by the windows, it's a compressed format and the data of image are located in the field of data while there are two fields , one for header (54 byte) that contains the image information such as (height ,width , no. of bits per pixel, no of bands , the file type).

The second field is the color map or color palette for gray level image, where its length is 0-255).

b) TIFF(Tagged Image File Format) and GIF(Graphics Interchange Format):

They are used on World Wide Web (WWW). TIFF can store many different types of image: 1-bit, grayscale, 8-bit color, 24-bit RGB, etc. GIF files are

limited to a maximum of 8 bits/pixel and allows for a type of compression called LZW. The GIF image header is 13 byte long & contains basic information.

c) JPEG (Joint photo Graphic Experts Group):

It is simply becoming standard that allows images compressed algorithms to be used in many different computer platforms. JPEG images compression is being used extensively on the WWW. It's, flexible, so it can create large files with excellent image equality.

d) Standing for **Portable Network Graphics** meant to supersede the GIF standard, and extends it in important ways.

• Special features of PNG files include:

1. Support for up to 48 bits of color information a large increase.

2. Files may contain gamma-correction information for correct display of color images, as well as alpha-channel information for such uses as control of transparency.

3. The display progressively displays pixels in a 2-dimensional fashion by showing a few pixels at a time over seven passes through each8×8 block of an image.

e) EXIF (Exchange Image File) is an image format for digital cameras:

1) Compressed EXIF files use the baseline JPEG format.

2) A variety of tags (many more than in TIFF) are available to facilitate higher quality printing, since information about the camera and picture-taking

conditions (flash, exposure, light source, white balance,type of scene, etc.) can be stored and used by printers for possible color correction algorithms.

3. The EXIF standard also includes specification of file format for audio that accompanies digital images. As well, it also support stags for information needed for conversion to Flash Pix(initially developed by Kodak).

2) Graphics Animation Files

A few dominant formats aimed at storing graphics animations (i.e., series of drawings or graphic illustrations) as opposed to video (i.e., series of images).

Difference: animations are considerably less demanding of resources than video files.

3) PS and PDF file format

Postscript is an important language for typesetting, and many high-end printers have a Postscript interpreter built into them.

Postscript is a vector-based picture language, rather than pixel-based: page element definitions are essentially in terms of vectors.

Another text + figures language has begun to supersede or at least pa parallel Postscript: Adobe Systems includes Portable Document Format (**PDF)** file format.

4) Microsoft Windows: WMF:

The native vector file format for the Microsoft Windows operating environment:

1. Consist of a collection of GDI (Graphics Device Interface) function calls, also native to the Windows environment.

2. When a WMF file is “played” (typically using the Windows PlayMetaFile() function) the described graphics is rendered.

3. WMF files are ostensibly device-independent and are unlimited in size.

5) Microsoft Windows: BMP:

The major system standard graphics file format for Microsoft Windows, used in Microsoft Paint and other programs. Many sub-variants within the BMP standard.

COLOR SPACE AND TRANSFORMATION

A number of color spaces or color models have been suggested and each one of them has a specific color coordinate system and each point in the color space represents only one specific color. Each color model may be useful for specific applications. Typical color images, particularly those generated by a digital imaging system, are represented as red, green, blue and are normally called RGB images. They are useful for color monitors, and video cameras.

An RGB color image, represented by 8 bits of R, G, and B pixels has 256^3 or 16,777,216 colors. There are a number of such color spaces like CMYK, HSV, HIS, or LUV, etc.

1) CMYK space

Another interesting color model utilizes CMYK (cyan, magenta, yellow, and black) and this model finds utility in color printers. Most of the output devices including color printers or copiers use CMY color model. Just **as** the primary additive colors are red, green and blue, the primary colors of pigments on the

other hand are magenta, cyan and yellow and the corresponding secondary colors are red, green and blue. The conversion from RGB to CMY may be performed as

2) NTSC or YlQ Color Space

In this color space (also known as YIQ color space), the luminance information Y represents the gray scale information, while hue *(I)* and saturation (Q) carry the color information. The conversion from RGB to YIQ is

$$\begin{bmatrix} Y \\ I \\ Q \end{bmatrix} = \begin{bmatrix} .299 & .587 & .114 \\ .596 & -.274 & -.322 \\ .211 & -.523 & .312 \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

The elements of the first row when added become unity and the elements in the second and third row sum to 0. Thus in a gray scale image, where R = G = B , the color components I and Q are zero. The NTSC color space is used in television.

***3)YCbCr* Cotor Space**

In this color space, *Y* is the luminous component while *Cb* and *Cr,* provide the color information. The color information is stored **as** two color difference components *Cb* and *Cr,*. This color space is used in digital video. The information from RGB to *YCbCr,* is as follows:

$$\begin{bmatrix} Y \\ C_b \\ C_r \end{bmatrix} = \begin{bmatrix} 16 \\ 128 \\ 128 \end{bmatrix} + \begin{bmatrix} 65.481 & 128.553 & 24.966 \\ -37.797 & -74.203 & 112.00 \\ 112.00 & -93.786 & -18.214 \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

Lecture 7 Digital audio

The sound heard by the ear (also called audio) is analog in nature and is a continuous waveform. Acoustic instruments produce analog sounds. A computer needs to transfer the analog sound wave into its digital representation, consisting of discrete numbers.

A microphone converts the sound waves into electrical signals. This signal is then amplified, filtered, and sent to an analog-to-digital converter. This information can then be retrieved and edited using a computer. If you want to output this data as sound, the stream of data is sent to the speakers via a digital-to-analog converter, a reconstruction filter, and the audio is amplified. This produces the analog sound wave that we hear.

SAMPLING

The audio input from a source is sampled several thousand times per second. Each sample is a snapshot of the original signal at a particular time.

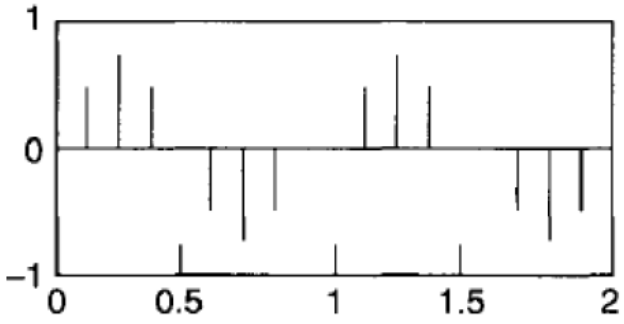


Figure 1:Sampled and digitized signal.

SAMPLING RATE

When sampling a sound, the computer processes snapshots of the waveform. The frequency of these snapshots is called the *sampling rate*. The rate can vary typically from 5000- 90,000 samples per second.

DIGITIZATION

Digitization is the process of assigning a discrete value to each of the sampled values. It is performed by an Integrated Chip (IC) called an A to D Converter. In the case of 8-bit digitization, this value is between 0 and 255 (or -128 and 127). In 16-bit digitization, this value is between 0 and 65,535 (or -32,768 and 32,767). An essential thing to remember is that a digitized signal can take only certain (discrete) values. The process of digitization introduces noise in a signal. This is related to the number of bits per sample. A higher number of bits used to store the sampled value leads to a more accurate sample, with less noise.

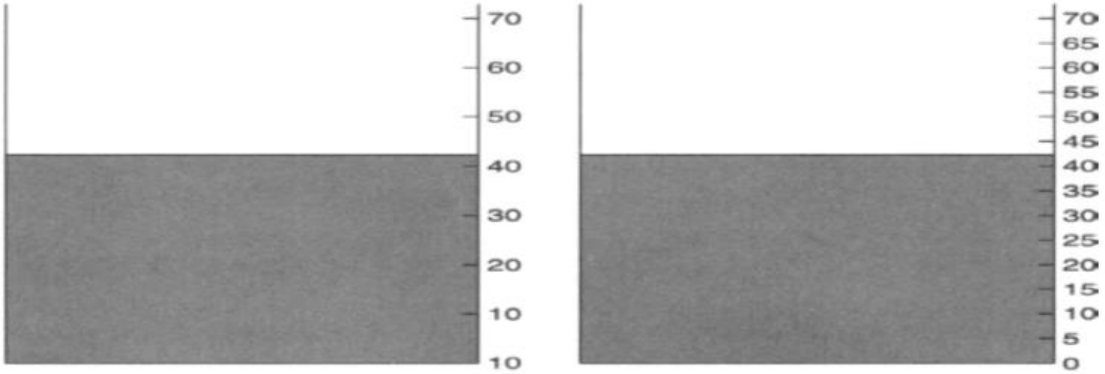


Figure 2:A smaller measure means more accurate reading.

There are two types of recording such as:-

1) Stereo recordings are made by recording on two channels, and are lifelike and realistic.

2) Mono sounds are less realistic, flat, and not as dramatic, but they have a smaller file size.

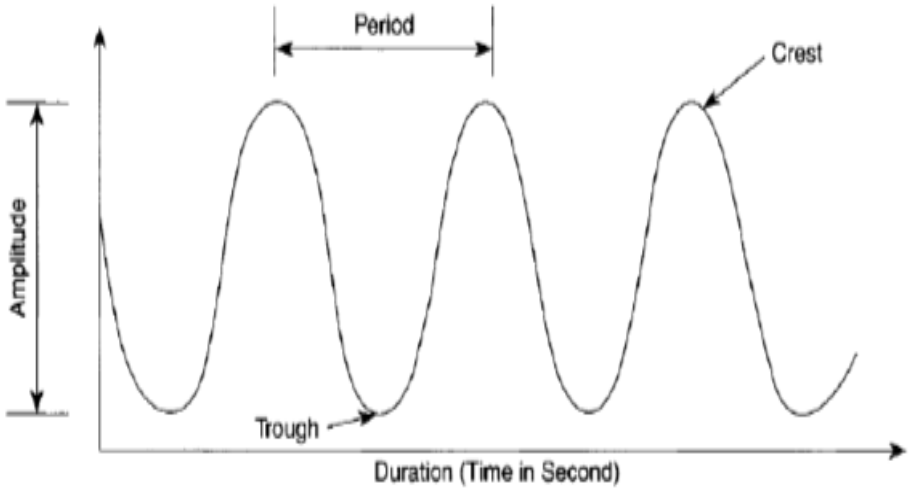
Stereo sounds require twice the space as compared to mono recordings. To calculate the storage space required, the following formula are used:

Mono Recording:

File size = Sampling rate x duration of recording in seconds x (bits per sample/8) x 1

Stereo Recording:

File size = Sampling rate x duration of recording in seconds x (bits per sample/8) x 2



Figur3:Sound of Wave

Sound File Attributes (صفات)

1) Hz?

Hz, pronounced “Hertz” is a kind of measurement. Hz measures cycles of something happening. If a sound wave goes up and down, that’s one Hz. Directly translated into sound, a Hz is one vibration. A standard music CD holds sound at a level of 44,100 Hz. This means that the sound can change, or vibrate, 44,100 times every second.

2) Bit Rate

“Bit” means binary digit, and is numerically represented by a zero or a one. Computers use zeros and ones to make up their whole language. When referring to sound, bits are used to tell the computer how much electricity to feed into your speakers to create a vibration. The level of electrical signal dictates the height of each wave. If you used two bits, you would be able to come up with four different levels to describe the signal strength of each sound wave (Hz):

00, 01, 11, 10

Standard music CD’s use 16 bit sound, which means that 16 zeros and ones are used to describe the level (height) of each sound wave.

Sound File Types

Sounds, like other computer files, can be saved in different formats. You’ll learn how to create sounds in each of the following formats.

1) WAV

WAV is a sound file developed by Microsoft for use on windows based machines. WAV is also the file format for standard music CDs. The WAV file uses interesting algorithms to compress raw sound without a loss in quality.

2) AIFF

Originally developed by Apple, the "Audio Interchange File Format" is mostly used by Silicon Graphics and Macintosh machines.

AIFF files are easily converted to other file formats, but can be quite large. One minute of 16-bit stereo audio sampled at 44.1kHz usually takes up about 10 megabytes. AIFF is often used in high end applications where storage space is not a consideration.

3) MP3

MP3 is a type of compression that can dramatically reduce file size without drastically reducing sound quality. MP3 works by, among other things, chopping off all sounds that are outside of the normal human range of hearing. You will need a sound player to listen to MP3's.

4) RealAudio

Developed by Progressive Networks, RealAudio was the first format to allow for real time streaming of music and sound over the web. Listeners are required to download the Real player to enjoy sound in RealAudio Format. The Real player can also stream video and is currently in use by millions of Internet users worldwide.

Multimedia System Sounds

You can use sound right off the bat on your computer because beep and warning sounds are available as soon as you install the operating system. Open the Sound Control Panel to listen to your system sounds, change them, or make a new, custom sound (see Figure 4).

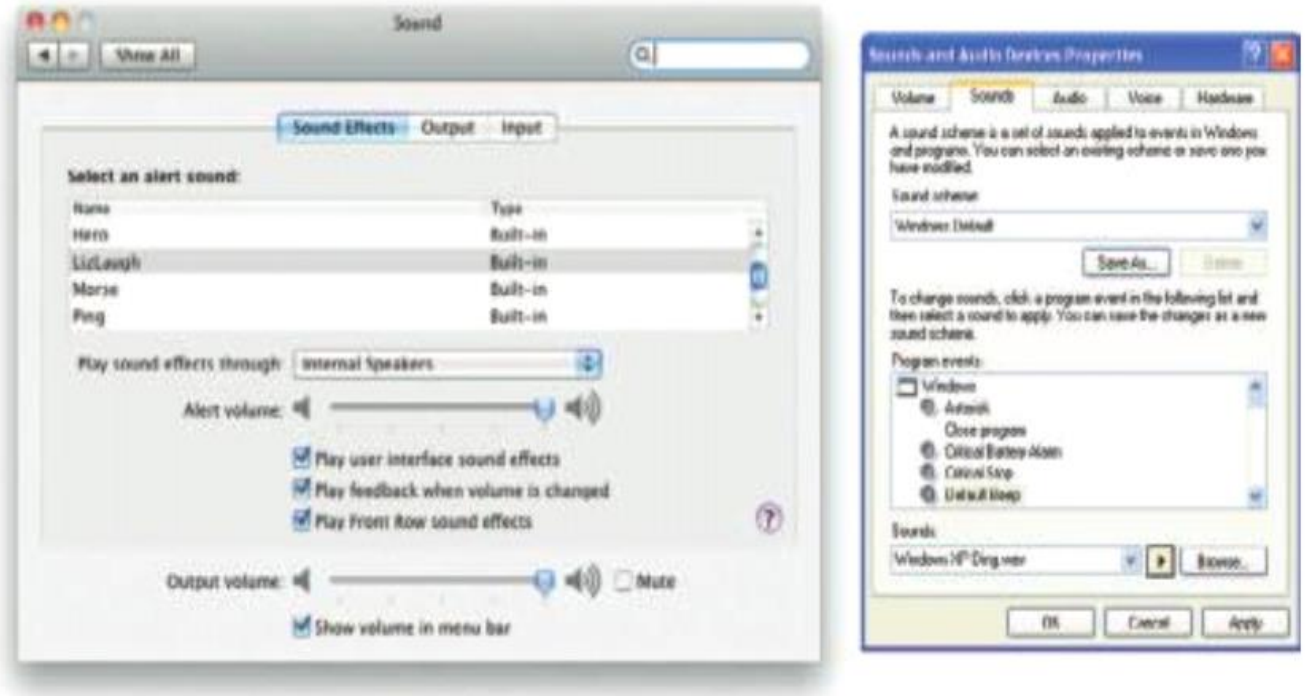


Figure 4: System Sounds

In Windows, system sounds are WAV files, and they reside in the Windows/Media subdirectory. System event sounds include start.wav, chimes.wav, chord.wav, ding.wav, logoff.wav, notify.wav, recycle.wav, tada.wav, and the Microsoft sound.wav that typically plays when Windows starts up.

As you can see in Figure 4, you can assign these sounds to system events such as Windows startup, warnings from other applications, or clicks outside of an open dialog box (which causes the default beep in Windows). And you can create schemes of sounds and select a particular scheme according to your mood. You can also add your own sound files and install them so they play when system events occur: place the WAV sound files into your ~\Windows\Media directory

and use the Sound Control Panel to select them.

In OS X on a Macintosh, you can only change your system alert sound. Put your custom sound file (in **AIF format)** into ~/System/Library/Sounds, and then select it in the Sound preference pane.

Lecture 8 Digital Video

Introduction

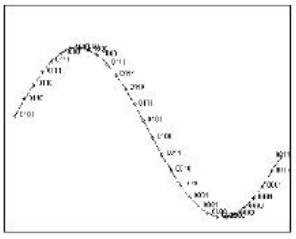
Video is the technology that captures moving images electronically. Those moving images are really just a series of still images that change so fast that it looks like the image is moving.

Video is an excellent tool for delivering multimedia because it contains all the components of multimedia (image, sound, and text). It is recorded from a live source.

Frame: A video sequence consists of a number of frames, each of which is a single image produced by digitizing the time-varying signal generated by the sensors in a video camera.

Analogue Video:

Analogue Video is Video information that is stored using television video signals, film, video tape or other non-computer media. Each frame is represented by a fluctuating voltage signal known as an analogue wave form or composite video.



- Composite analogue video has all the video components:
- brightness, colour and synchronization
- Then combined into one signal for delivery
- Example : traditional television
- Problems: colour blending, low clarity, high generation lost, difficult to edit.

Digital Video

Digital video refers to the capturing, manipulation, and storage of moving images that can be displaced on computer screens.



- Digitized video can be edited more easily.
- Digitized video files can be extremely large.
- Digital video is often used to capture content from movies and television to be used in multimedia.
- A video source (video camera ,VCR, TV or videodisc) is connected to a video capture card in a computer.

As the video source is played, the analog signal is sent to the video card and converted into a digital file (including sound from the video).

Digital video is the digitization of analogue video signals into numerical format.

Conversion from analogue to digital format requires the use on an ADC (Analogue to Digital Converter).

A Digital to Analogue Converter (DAC) can be used to output digital video on analogue equipment.

There are three standards worldwide for broadcasting analog video.

1) NTSC is a standard devised by the National Television System Committee and is used in the United States and Japan. This standard displays 30 (29.97 to be exact) frames per second. Each frame can contain 16 million different colors. Each full-screen frame is composed of 525 lines.

2) PAL stands for Phase Alternation by Line and is used in Europe and India. It displays 25 frames per second. Each full-screen frame is composed of 625 lines.

3) SECAM stands for Sequential Color Avec Memoire and is used in France. This standard displays 25 frames per second. Each full-screen frame is composed of 625 lines.

Digitization and Analog Video

The process of digitizing analog video (in PAL, NTSC, or SECAM formats) is called video capture. Video is generally captured using plug-in cards called video capture cards. Nowadays digital cameras are also available that directly store full-motion video in digital formats that can directly be copied onto a computer's hard disk. A video capture card accepts a video input from an input device such as a VCR or a video camera. Note that the audio has to be sampled through a separate cable which attaches to the sound card. The software with the video card synchronizes the two channels of audio and video.

There are some important considerations to keep in mind as you capture video. To understand these, think about what happens as you digitize video in real-time. The video player plays the video at the rate of 30 fps. Each of those frames has to be converted into digital format and stored on the hard disk. The computer is doing several jobs in a very short interval. Thus, it is a good idea to have as much RAM as possible so that the computer is fast enough to do this large amount of processing.

File Formats for Video

After a digital video is edited, it is time to save it in a particular file format. For the PC, the AVI format is used, and for the Macintosh, the Quick time format is used.

1) AVI (Audio Video Interleave)

The AVI format was developed by Microsoft to play videos in the Windows environment. The greatest advantage of this standard is the support provided by Microsoft. AVI supports color resolutions from 256 colors to millions of colors.

It can support sound from 5 kHz Mono to CD quality stereo sound. It can deliver video at rates as low as 0.03 MB/sec and as high as 0.3 MB/sec. An editing suite or conversion programs available on the Internet can be used to convert between .AVI and other video and graphics formats.

2) QuickTime

Quicktime was developed and supported by Apple Computers and was one of the first digital video formats for the Macintosh computers. This was the first format available for PCs and the Macintosh. It is similar to the AVI format. Both use similar strategies for compression and decompression of video information.

However, Quicktime is not limited to just the Macintosh platform and can be viewed on almost every platform available today.

Basic Concepts of Video:

Bit Rate: is amount of data that can be carried from one point to another in a given time period (usually a second). Bit rate is sometimes called data rate or transfer rate or bandwidth.

Aspect Ratio: This is the ratio of width to height video will be encoded. This information is present in the output video stream and used by the decoder to display the video at the correct aspect ratio. The computer display is designed for an aspect ratio of 1.33:1, which means that the width of the display area is only 1.33 times the height, almost *square.*

Frame Rate: is the number of video frames (complete pictures) that will be presented to the viewer each second.

Frame Buffer: is a special memory to hold the complete digital representation of the frame to be displayed on a computer screen.

Color Depth (Bit Depth): is the number of bits used to represent the color of a single pixel in a bitmapped image or video frame buffer. It is known as bits per pixel (bpp).

Image Size: a standard full screen resolution is 640x480 pixels . New high-definition televisions (HDTV) are capable of resolutions up to *1920×1080p60,* 1920 pixels per scan line by 1080 scan lines, progressive, at 60 frames per second.

File Size: Several elements determine file size:

• Frame rate

• Image size

• Color depth

Calculating Memory Requirements for Video

Obviously, the frame rate is only one factor that affects the quality of an animation or video. The size and quality of each picture (frame) in the video will greatly affect the quality, obviously the larger the picture higher resolution the image the better.

File size = Number of Frames x File size per frame

Number of Frames = Frame Rate x time

File Size = Horizontal x Vertical x Bit depth

Example

Calculate the size of a 90-minute movie at 24 frames per second, full screen (2048 x 872 pixels) in living color (32 bits per pixel)

Number of Frames = 24 frames x 90 minutes x 60 seconds = 129 600 frames

File Size for each frame = (2048 x 872 x 32) = 57147392 bits = 7143424 bytes = 6976 kb

File size for movie = 129600 x 6976 = 904 089 600 kb = 862.20703 Gigabytes

The average computer today (June 2004) is not going to be able to cope with file of this size. For this reason, compression algorithms like divx and xvid are common.

Lecture 9 Compression Techniques

An important aspect of communication is transfer of data from the creator to the recipient. Compression in computer terms means reducing the physical size of data such that it occupies less storage space and memory. Compressed files are, therefore, easier to transfer because there is a sizable amount of reduction in the size of data to be transferred. This results in a reduction in the time needed for file transfer as well as a reduction in the bandwidth utilization thus providing good sound quality even over a slow network.

As many applications exchange multimedia data using communication networks, the compatibility of compression is required. Standards like CCITT (International Consultative Committee for Telephone and Telegraph), ISO (International Standard Organization), and MPEG (Moving Picture Experts Group) are used to achieve this compatibility.

Compressions in multimedia systems are subjected to certain constraints. These constraints are:

1) The quality of the reproduced data should be adequate for applications.

2) The complexity of the technique used should be minimal, to make a cost effective compression technique.

3) The processing of the algorithm should not take too long.

4) Various audio data rates should be supported. Thus, depending on specific system conditions the data rates can be adjusted.

5) It should be possible to generate data on one multimedia system and reproduce data on another system. The compression technique should be compatible with various reproduction systems.

Common Compression Methods

An array of compression techniques has been set by the CCITT Group an international organization that develops communication standards known as "Recommendations" for all digitally controlled forms of communication.

There are two types of compression:

1) Lossless Compression

2) Lossy Compression

1) Lossless Compression

In lossless compression, data are not altered or lost in the process of compression or decompression. Decompression produces a replica of the compressed object. This compression technique is used for text documents, databases, and text-related objects. The following are some of the commonly used lossless standards:

1) Pack bits encoding (**run-length encoding)**

2) **CCITT Group 3 1-D** (compression standard based on run-length encoding scheme)

3) **CCITT Group 3 2-D** (compression standard based on run-length encoding scheme modified by two-dimensional encoding)

4) **CCITT Group 4** (compression standards based on two-dimensional compression)

5) **Lempel-Ziv and Welch algorithm LZW**

2) Lossy Compression

There is loss of some information when lossy compression is used. The loss of this data is such that the object looks more or less like the original. This method is used where absolute data accuracy is not essential. Lossy compression is the most commonly used compression type. This compression technique is used for image documents, audio, and video objects.

The following are some of the commonly used lossy standards:

1) Joint Photographic Experts Group (JPEG)

2) Motion Picture Experts Group (MPEG)

3) Adaptive Differential Pulse Code Modulation (ADPCM)

4) CCITT Video Coding Algorithm

5) Intel DVI (Digital Video Interactive)

Image Compression

Involve reducing the typically massive amount of data needed to represent an image. This done by eliminating data that are visually unnecessary and by taking advantage of the redundancy that is inherent in most images. Image processing systems are used in many and various types of environments, such as:

1. Medical community

2. Computer – Aided Design

3. Virtual Reality

4. Image Processing.

a. Image before compression (92) KB

b. Image after compression (6.59)KB

Image Compression Techniques

Using appropriate compression technologies is important in the context of digital graphics. This is especially true for graphics used on the Internet, since download time goes up drastically with increasing file size. Again, it is important that while the image is compressed, the quality of the image does not suffer. While many compression algorithms are available, there are two types of common compression methods that are widely used on the Internet such as JPEG and GIF .Both JPEG and GIF support an interesting feature that is especially useful when they are used in Web pages. For example, GIFs can be saved so that they appear "interlaced."

1) JPEG (Joint Photographic Experts Group)

JPEG compression works well with 24-bits image. JPEG is desirable, and for cartoons containing at most 256 colors.

Strengths of JPEG Compression

1) It provides support for full 24-bit color images. In contrast, GIF only supports 8-bit images.

2) The compressed image size and image quality trade-off can be user determined.

3) It is ideally suited to images of real-world scenes or complex computer-generated images.

4) It is platform independent for displaying 24-bit images.

5) It is quite good for compressing photographs.

Weaknesses of JPEG Compression

1) JPEG compression is a trade-off between degree of compression, resultant image quality, and time required for compression/decompression.

2) Bad quality is obtained when compressing an image with sharp edges or lines (as in text).

3) It is not suitable for 2-bit black and white images.

4) The degree of compression is greater for full color images than it is for gray scale images.

5) It is not intended for moving images/video.

2) GIF (Graphics Interchange Format)

GIF is a format that only supports 8 bits of color information. Thus for images that contain many colors (such as photographs).

Strengths of GIF Compression

1) It is lossless for 8-bit images.

2) It is ideally suited to images such as line drawings, those containing a limited number of colors, and for images containing text.

3) It is preferred for Vector Graphics over the Internet.

4) Animated GIFs are easy to make by using GIF constructing packages such as Animation Shop (this comes packaged with Paint Shop Pro).

Weaknesses of GIF Compression

1) GIF is not suitable for 24-bit images. When compressing such images, such of the color information is lost due to the reduction of color depth.

2) The compression ratios are low.

Audio Compression Requirements

In the case of audio, processing data in a multimedia system leads to storage requirements in the range of several megabytes.

Schemes of Audio Compression

The most commonly used compression schemes for audio are:

1) ADPCM (Adaptive Differential Pulse Code Modulation)

ADPCM stands for Adaptive Differential Pulse Code Modulation. It is a family of speech compression and decompression algorithms. Using this

technique one can achieve about 40-80% compression. Audio signals are waves, which are smooth in nature. Complex sounds, such as music, consist of a series of overlaid waves at different frequencies. These wave patterns have amplitudes of the signal that change with time. Digital encoding of the signal is achieved by sampling the audio signal at different frequencies.

2) MPEG (Motion Picture Experts Group)

MPEG stands for Motion Picture Experts Group. In 1987, a very powerful algorithm was developed that was standardized as ISO-MPEG Audio. Using MPEG audio coding you can compress the original audio on a CD by a factor of 12 without losing the sound quality. Factors of 24 or even more are also possible, but these are achieved only by getting a sound output of reduced sampling rate and reduced resolution of the samples.

Video Compression

Since digital video files are extremely large, these not only take a large amount of disk space, but also require high data transfer rates (from hard disk to screen) for playback. It is, therefore, recommended that during video capture, some lossless compression technique be used. As a compressed video file is played, it is decompressed.

Compression and decompression is even more important if the movie is to play off of a CD-ROM drive, since the reading of data is comparatively slower from a CD than from the hard drive.

Several compression/decompression (codec) algorithms are available for compressing digital videos. Codec can be software-based, hardware-based, or both. Hardware-based compression is significantly faster than software compression, because the hardware is dedicated to compression. The codec you choose affects the visual quality of the movie as well as the speed with which it plays on the monitor.

An important feature of codec is whether they are Asymmetric or Symmetric.

1) **A Symmetric codec** takes approximately the same time to compress as it takes to decompress data.

2) **An Asymmetric codec** usually takes longer to encode video than it does to decode. An Asymmetric codec generally delivers significantly better playback performance than a symmetric codec.

Schemes of video Compression(Windows-Based Compressors)

The following software compressors come packaged with MS-Video for Windows (VfW):

1) **Microsoft Video1 codec—This** compressor is best used in converting analog video into digital format. This is a lossy compressor and supports color depth of 8 bits (256 colors) or 16 bits (65,536 colors).

2) **Microsoft RLE codec—This** compressor is used often for compressing animation and computer-generated images. It supports only 256 colors.

3) **Cinepak codec.**This compressor is used for compressing 24 bits (or 16 million colors) for playback from the CD-ROM disk. This codec attains

higher compression ratio, better image quality, and faster playback speeds than Microsoft Video 1 codecs.

Third-Parity Compressors

For many applications, it may be desirable to use specialized codecs, which are mostly hardware based. Some of these are:

1) **MJPEG—Motion JPEG (MJPEG),** a digital video compressor, is an extension of the JPEG standard. It is used for compressing digital videos.

2) **MPEG-1—MPEG-**1 is a standard set by the Motion Picture Experts Group and is primarily used for CD-ROM video playback. It uses an extension of the lossy compression techniques involved in JPEG by predicting interface motion.