2020

Introduction to Multimedia

Fourth Stage

Lecture One

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1. Introduction

The term multimedia constituents of two words, “multi” and “medium”. Multi refers to many i.e. at least two. Media is the plural of medium. Medium refers to storage, transmission, communication, representation, input interaction and perception. Therefore multimedia is as an integration of many types of media (i.e. text, graphics, images, audio, animation, video etc.) on a single medium in the same information unit.

Multimedia provides important information in an interactive way with the usage of images, graphics, animation, video and audios. For this reason, it is gaining popularity as a powerful educational tool. There are various multimedia software that are used in the field of education. CDs and DVDs are used to store information in different multimedia formats.

Example: A PowerPoint presentation involving text and graphics is a multimedia presentation.

2. Definitions

The Columbia Encyclopedia has defined multimedia as “in personal computing, software and applications that combines text, high quality sound, two and three dimensional graphics, animation, images, and full motion video.”

Newton defines multimedia as “the combination of different types of media in the communication of information between two users and their computers. The format in which the information for communication exists differs, but it usually includes voice communication, sound processing and image processing.

Multimedia means that convergence of the technologies from the different industries into a communication medium that presents the synthesis of interactive computers, highly fidelity video and sound. Multimedia is thus the combination of standard data processing with text, graphics, animation, sound and video”.

The following figure illustrate the main components of Multimedia elements.

3. Importance

Multimedia has become an inevitable part of any presentation. It has found a variety of applications right from entertainment to education. The evolution of internet has also increased the demand for multimedia content.

The exponential growth of multimedia technologies and applications has presented the computerized society with opportunities and challenges that in many cases are unprecedented. It is becoming more and more popular because of the effectiveness of its applications in all aspects of human life.

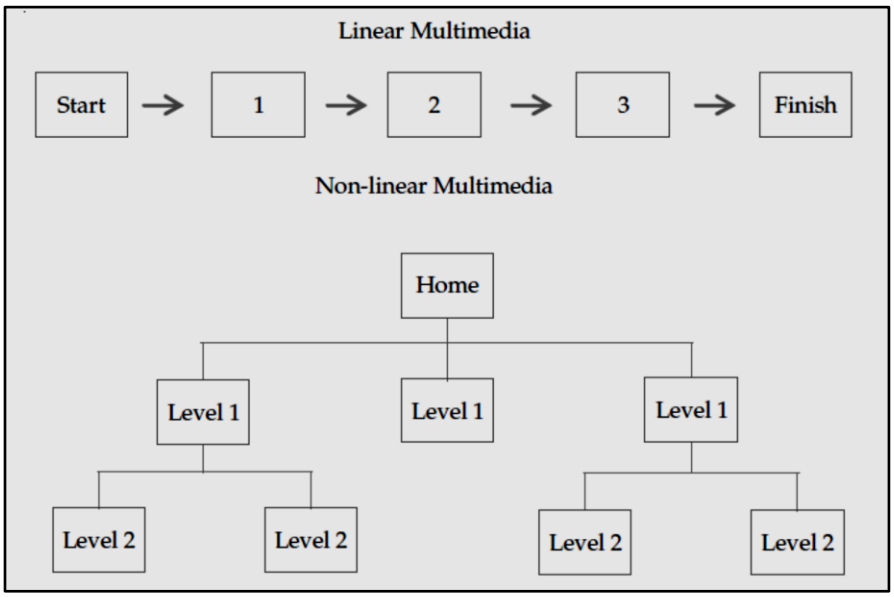
4. Multimedia categories

Based on how multimedia programs are used, multimedia can be divided into two forms – linear multimedia and non-linear multimedia.

In linear multimedia, information is read or viewed in a continuous sequence. Usually, these presentations begin at a predetermined starting point and end at a predetermined end point. They can be automated so that each screen comes after a fixed time interval. PowerPoint presentation is one of the most common examples of linear multimedia.

On the other hand, non-linear multimedia information is not presented in sequential or chronological manner. Non-linear multimedia programs are usually

interactive and require audience interaction. The Web is the most common example of non-linear Multimedia. The following figure showing the difference between the two forms of Multimedia.



Multimedia presentations can be live or recorded. A recorded presentation may allow interactivity via a navigation system. A live multimedia presentation may allow interactivity via interaction with the presenter or performer.

5. Multimedia Applications

Multimedia can be used in a variety of ways in myriad fields. A multimedia presentation can be put together in varied formats. Some of the most common applications are given below:

- ***Business:*** Multimedia is used for advertising and selling products on the Internet. Some businesses use multimedia tools such as CD-ROMs, DVDs or online tutorials for training or educating staff members about things the employer want them to learn or know.
- ***Research and Medicine:*** Multimedia is increasingly used in research in the fields of science, medicine and mathematics. It is mostly used for modelling and simulation. For instance, a scientist can look at a molecular model of a particular substance and work on it to arrive at a new substance. In Medicine, doctors acquire training by watching a virtual surgery or they can simulate how the human body is affected by diseases spread by germs and then develop techniques to prevent it.

- ***Entertainment:*** Multimedia is used to create special effects in films, TV serials, radio shows, games and animations. Multimedia games are popular software programs that available online as well as on DVDs and CD-ROMs. Use of special technologies such as virtual reality turn these games into real life experiences.
- ***Education:*** Multimedia is used as a source of information in the field of education. Pupils can research on various topics such as solar system or information technology using different multimedia presentations. To make teaching more interesting and fun for pupils, teachers can make multimedia presentations of chapters. Visual images, animation, diagrams, etc., have more effect on pupils.

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Hypertext and Hypermedia

Fourth Stage

Lecture Two

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1. Hypertext

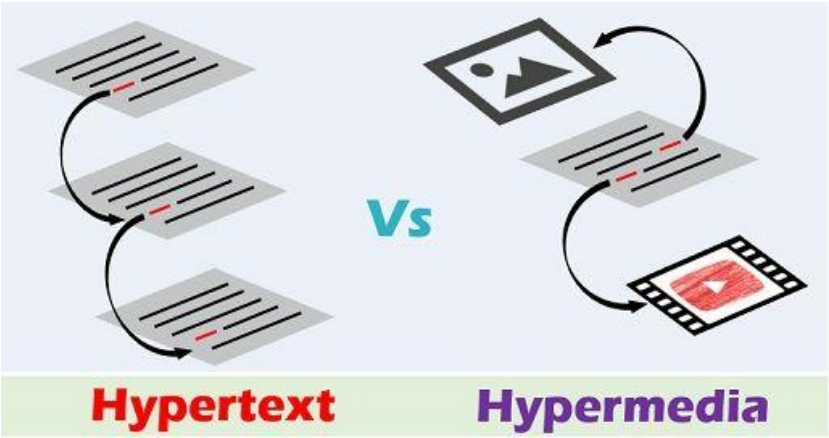
Hypertext is text that links to other information. By clicking on a link in a hypertext document, a user can quickly jump to different content. Though hypertext is usually associated with Web pages, the technology has been around since the 1960s. Software programs that include dictionaries and encyclopedias have long used hypertext in their definitions so that readers can quickly find out more about specific words or topics.

Example: Each unit of information in a network will be considered as a node, and these nodes are pointing to the other nodes, which is called a link or pointer. This concept is used on websites in which the hypertext written over a webpage contains a hyperlink to the other text in that webpage only or to the other webpage also.

2. Hypermedia

Hypermedia is one step ahead of hypertext as it includes not only text but audio, images, video or any graphics. It is not bounded within the text, which means we can create a link to or over an image and direct it to a video. There are no boundaries for creating a hyperlink, it opens the door for lots of options. It increases the visibility of the document as it contains various graphics rather than just monotonous text.

Example: One the best example of the hypermedia is the YouTube in which the text is usually linked to the videos.



3. Comparison between Hypertext and Hypermedia

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.

There is main difference between Multimedia and Hypermedia which is the Multimedia involves the various ways of representing the electronic document such as image, audio, graphics, video, etcetera over the electronic devices using any network medium. On the other hand, the Hypermedia is the collection of multimedia placed linked over the internet in a non-linear way, or we can say that this is a non-linear form of data representation. The following table represents these differences between Multimedia and Hypermedia.

BASIS FOR COMPARISON	MUTLIMEDIA	HYPERMEDIA
Basic	Involves the multiple forms of representing information.	Non-linear linking of multimedia.
Hardware requirement	Needs multimedia delivery systems	Enhance the ability by providing clickable links.
Types	Linear and non-linear	Non-linear
Based on	Interaction and interactivity	Interconnectivity and cross-referencing

4. Components of Multimedia

Now let us consider the Components (Hardware and Software) required for a Multimedia System, the following components are hardware components:

4.1. Capture devices: Video Camera, Video Recorder, Audio Microphone, Keyboards, mouse, graphics tablets, 3D input devices, etc.

4.2. Storage Devices: Hard disks, CD-ROMs, DVD-ROM, etc.

4.3. Communication Networks: Local Networks, Intranets, Internet, Multimedia or other special high speed networks.

4.4. Computer Systems: Multimedia Desktop machines, Workstations.

4.5. Display Devices: CD-quality speakers, HDTV, Hi-Res monitors, Color printers etc.

While the software components of Multimedia System are Text, Audio, Graphics, Video and Animation. All these components work together to represent information in an effective and easy manner.

4.6. Text

Text is the most common medium of representing the information. In multimedia, text is mostly use for titles, headlines, menu etc. The most commonly used software for viewing text files are Microsoft Word, Notepad, Word pad etc. Mostly the text files are formatted with, DOC, TXT etc. extension.

4.7. Audio

In multimedia audio means related with recording, playing etc. Audio is an important components of multimedia because this component increase the understandability and improves the clarity of the concept. Audio includes speech, music etc. The commonly used software for playing audio files are:

- Quick Time
- Real player
- Windows Media Player

4.8. Graphics

Every multimedia presentation is based on graphics. The used of graphics in multimedia makes the concept more effective and presentable. The commonly used software for viewing graphics are windows Picture, Internet Explorer etc. The commonly used graphics editing software is Adobe Photoshop through which graphics can be edited easily and can be make effective and attractive.

4.9.Video

Video means moving pictures with sound. It is the best way to communicate with each other. In multimedia it is used to makes the information more presentable and it saves a large amount of time. The commonly used software for viewing videos are:

- Quick Time
- Window Media Player
- Real Player

4.10. Animation

In computer animation is used to make changes to the images so that the sequence of the images appears to be moving pictures. An animated sequence shows a number of frames per second to produce an effect of motion in the user's eye. Some of the commonly used software for viewing animation are:

- Internet Explorer
- Windows Pictures
- Fax Viewer

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Multimedia on the Web

Fourth Stage

Lecture Three

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1. Introduction

The World Wide Web is the largest and most commonly used hypermedia application. Its popularity is due to:

- The amount of information available from web servers.
- The capacity to post such information.
- The ease of navigating such information with a web browser.

WWW technology is maintained and developed by the *World Wide Web Consortium* (W3C). The W3C has listed the following three goals for the WWW:

- Universal access of web resources (by everyone and everywhere).
- Effectiveness of navigating available information.
- Responsible of posted material.

1.1.HyperText Transfer Protocol (HTTP)

HTTP is a protocol that was originally designed for transmitting hypermedia, but it also supports transmission of any file type. HTTP is a "stateless" request/response protocol, in the sense that a client typically opens a connection to the HTTP server, requests information, the server responds, and the connection is terminated - no information is carried over for the next request. The *Uniform Resource Identifier* (URI) identifies the resource accessed, such as the host name, always preceded by the token "http://".

1.2.HyperText Markup Language (HTML)

HTML is a language for publishing hypermedia on the World Wide Web. It is defined using *Standard Generalized Markup Language* (SGML) and derives elements that describe generic document structure and formatting. Since it uses ASCII, it is portable to all different (even binary-incompatible) computer hardware, which allows for global exchange of information.

1.3.Extensible Markup Language (XML)

There is a need for a markup language for the WWW that has modularity of data, structure, and view. That is, we would like a user or an application to be able to define the tags (structure) allowed in a document and their relationship to each other,

in one place, then define data using these tags in another place (the XML file) and, finally, define in yet another document how to render the tags.

2. Multimedia Data Basics

Multimedia systems/applications have to deal with:

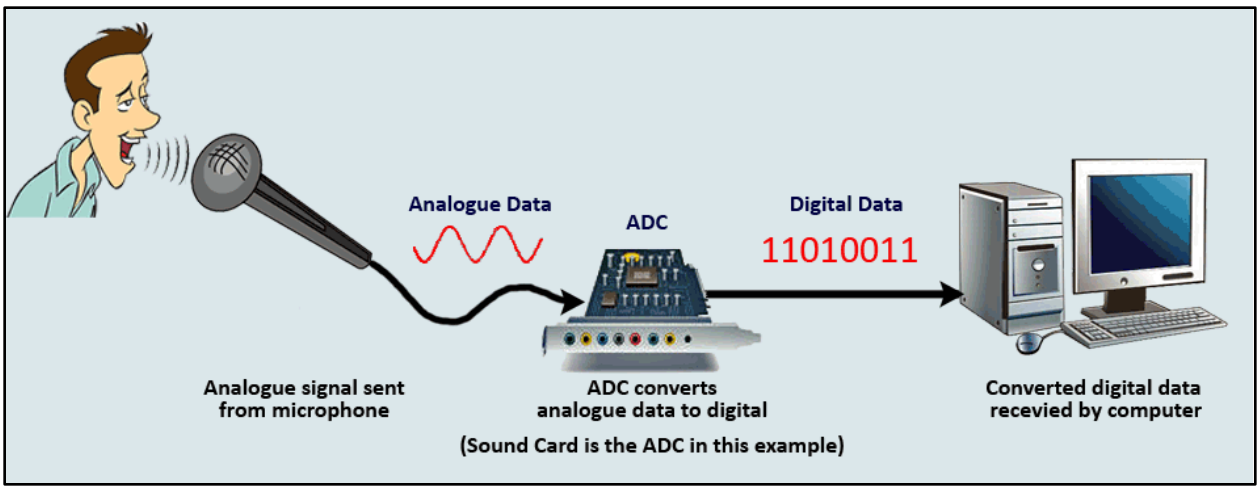
- Generation of data
- Manipulation of data
- Storage of data
- Presentation of data
- Communication of information/data

- ***Static or Discrete Media:*** Some media is time independent: Normal data, text, single images and graphics are examples.
- ***Continuous Media:*** Time dependent Media: Video, animation and audio are examples.

2.1. Analog and Digital Signal Conversion

The world we sense is full of analog signals: Electrical sensors convert the medium they sense into electrical signals.

- ***Analog:*** continuous signals must be converted to discrete signals (digital) for computer processing.
- ***Digital:*** discrete digital signals that computer can readily deal with. Special hardware devices: Analog-to-Digital Playback {a converse operation to Analog-to-Digital converters. E.g. Audio: Take analog signals from analog sensor (e.g. microphone). The following figure illustrates Analog to Digital Converter (ADC).



3. Multimedia Data: Input and Format

How to capture and store each Media format?

- Note that text and graphics (and some images) are mainly generated directly by computer/device (e.g. drawing/painting programs) and do not require digitising: They are generated directly in some (usually binary) format.
- Printed text and some handwritten text can be scanned via Optical Character Recognition (OCR).
- Handwritten text could also be digitised by electronic pen sensing.
- Printed imagery/graphics can be scanned directly to image formats.

3.1. Text and Static Data

- *Source:* keyboard, speech input, optical character recognition, data stored on disk.
- Stored and input character by character.
- *Storage:* 1 byte per character (text or format character), e.g. ASCII; more bytes for Unicode. For other forms of data (e.g. spread sheet les).
- *Formatted Text:* Raw text or formatted text e.g. HTML, Rich Text Format (RTF), Word or a program language source (Java, Python, MATLAB etc.)
- *Compression:* convenient to bundle les for archiving and transmission of larger les. E.g. Zip, RAR, 7-zip.

3.2.Graphics

- *Format:* constructed by the composition of primitive objects such as lines, polygons, circles, curves and arcs.
- *Input:* Graphics are usually generated by a graphics editor program (e.g. illustrator, Freehand) or automatically by a program (e.g. Postscript).
- *Graphics input devices:* keyboard (for text and cursor control), mouse, trackball or graphics tablet.
- Graphics are usually selectable and editable or revisable (unlike images).
- Graphics usually store the primitive assembly.
- Do not take up a very high storage overhead.
- *Graphics standards:* Open Graphics Library, a standard specification defining a cross-language, cross-platform API for writing applications that produce 2D/3D graphics.
- *Animation:* can be generated via a sequence of slightly changed graphics.
- 2D animation: e.g. Flash | Key frame interpolation.
- Change of shape/texture/position, lighting, camera Graphics animation is compact
- Suitable for network transmission (e.g. Flash).

3.3.Images

Still pictures which (uncompressed) are represented as a bitmap (a grid of pixels).

- *Input:* scanned for photographs or pictures using a digital scanner or from a digital camera. Images May also be generated by programs similar to graphics or animation programs.
- Analog sources will require digitising.
- Compression is commonly applied.
- Can usually only edit individual or groups of pixels in an image editing application, e.g. Photoshop.

3.4.Audio

- Audio signals are continuous analog signals.
- *Input:* microphones and then digitised and stored.
- CD Quality Audio requires 16-bit sampling at 44.1 KHz.
- Usually compressed (E.g. MP3, AAC).

3.5.Video

- *Input:* Analog Video is usually captured by a video camera and then digitised, although digital video cameras now essentially perform both tasks.
- There are a variety of video (analog and digital) formats.
- Raw video can be regarded as being a series of single images. There are typically 25, 30 or 50 frames per second.

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Graphics and Image Data Representation

Fourth Stage

Lecture Four

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1. Graphics/Image Data Types

The number of file formats used in multimedia continues to proliferate. For example, the following table shows a list of some file formats used in the popular product Adobe Premiere.

Image	Sound	Video
BMP,GIF,JPG,EPS,PNG, PICT,PSD,TIF,TGA	AIFF,AAC,AC3,MP3, M4A,MOV,WMA,MPG	AVI,MOV,DV,FLV,MPG ,WMA,SWF,M4V,MFX MP4

The general representation images is 2D matrix, each element in the matrix called "Picture Elements" for short called "Pixel". Each pixel can be formed by two integers *f(x,y)*, *x* is rows and *y* is columns. The following figure illustrate the image representation.

$$f(x,y) = \begin{bmatrix} f(0,0) & f(0,1) & f(0,2) & \dots & f(0,N-1) \\ f(1,0) & f(1,1) & f(1,2) & \dots & f(1,N-1) \\ \vdots & \vdots & \vdots & & \vdots \\ f(M-1,0) & f(M-1,1) & f(M-1,2) & \dots & f(M-1,N-1) \end{bmatrix}$$

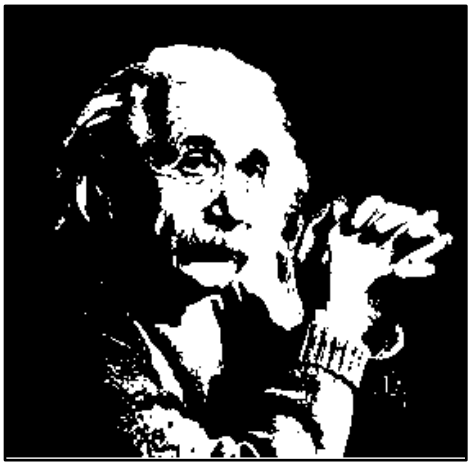
2. Types of Images

There are four types of the images, which are:

2.1.Binary Images

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 referred to as a 1-bit image because it takes only 1 binary digit to represent each pixel. These types of images are frequently used in applications where the only information required is general shape or outline, for example Optical Character Recognition (OCR).

Binary images are often created from the gray-scale images via a threshold operation, where every pixel above the threshold value is turned white "1", and those below it are turned black "0". The following image is example of binary images.



Binary images can be used for pictures containing only simple graphics and text. Moreover, fax machines use 1-bit data, so in fact 1-bit images are still important, even though storage capacities have increased enough to permit the use of imaging that carries more information.

2.2.Gray-scale Images

Each pixel has a gray-value between 0 and 255. Each pixel is represented by a single byte, a darkest pixel will have a value of 0, and a brightest one might be 255 and pixel having intermediate value will be having shades of black and white.

The entire image can be considered as a two-dimensional array of pixel values. We refer to such an array as a *bitmap* which is a representation of the graphics/image data that similar the manner in which it is stored in video memory.

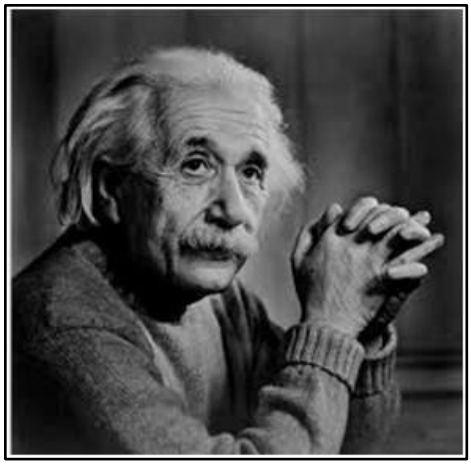
Image resolution refers to the number of pixels in a digital image (higher resolution always yields better quality).

Fairly high resolution for such an image might be 1, 600 × 1, 200, whereas lower resolution might be 640 × 480.

The array of pixels must be stored in hardware; we call this hardware a *frame buffer*. Special (relatively expensive) hardware called a "*video card*" (or a *graphics card*) is used for this purpose. The resolution of the video card does not have to

match the desired resolution of the image, but if not enough video card memory is available, the data have to be shifted around in RAM for display.

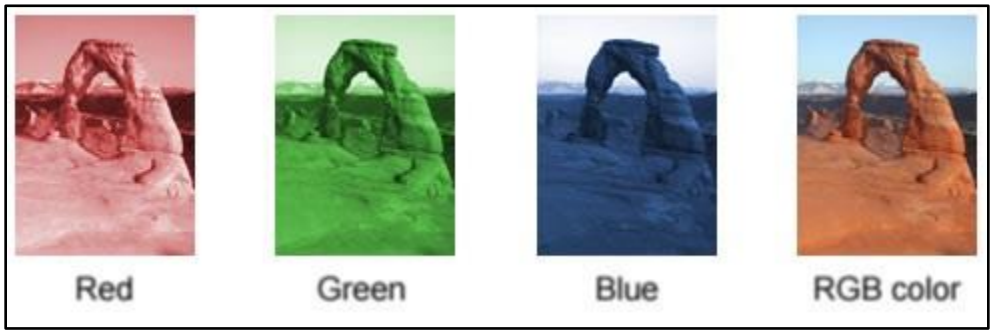
The following image illustrates the 8-bit image for the same example with 1-bit image.



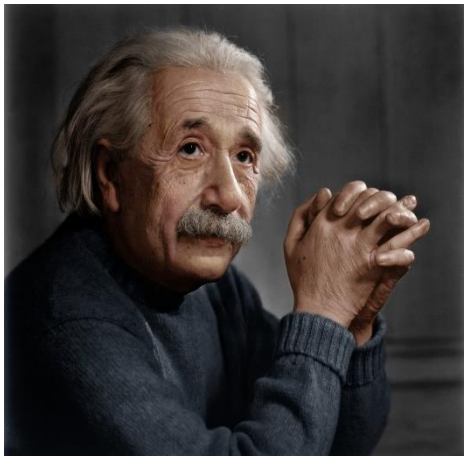
2.3.Color Images

Color images can be modeled as three-band monochrome image data, where each band of data corresponding to a different color. The actual information stored in the digital image data is the gray-level information in each spectral band.

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



The following image is an example of color images



2.4.Multispectral Images

Multispectral images typically contain information outside the normal human perceptual range. This may include infrared, ultraviolet, X-ray, acoustic, or 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 band to RGB components.

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Graphics and Image Data Representation (2)

Fourth Stage

Lecture Five

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1. Image representation

There are two kinds of computer graphics - raster (composed of pixels) and vector (composed of paths). Raster images are more commonly called bitmap images.

1.1.Raster or Bitmap Images

A bitmap represents an image by treating the image area as a rectangle, and dividing up the rectangle into a two-dimensional array of tiny pixels. For example, an image produced by a high-resolution phone camera may have dimensions of 4128 pixels horizontally and 3096 pixels vertically, requiring 4128×3096 = 12,780,288 pixels for the entire image. (Bitmap images usually involve large numbers of pixels, but computers are really good at handling large numbers of items!) Each pixel specifies a single color value for the image at that point. The resulting image is displayed simply by copying the array of pixels to the screen, with each pixel showing its defined color.

Some of the smallest bitmap images you'll see are the icons used for programs and other items in computer user interfaces. The size of these bitmaps can be as small as 16×16 pixels, which provides very little detail, but is sufficient for images that will always be viewed in tiny sizes.

- *Advantages*:

- Complex scenes can be depicted as easily as simple scenes.
- Significant compression is usually possible, at the expense of loss of quality.
- Rendering is computationally easy; requires minimal computing power.

- *Disadvantages:*

- Size: Files tend to be large.
- Not scalable: attempting to magnify an image causes degradation.

- *Raster Graphics Strengths*

- Raster files handle the subtleties of photographs very well as a general rule.
- Raster can handle other effects such as adding textures or blur effects very well.

Note: *Rendering* is the process of generating an image from a model, by means of a software program. The model is a description of three dimensional objects in a strictly defined language or data structure. Rendering is also used to describe the process of calculating effects in a video editing file to produce final video output.

1.2. Vector Images

Vector graphic is artwork made up of points, lines, and curves that are based upon mathematical equations, rather than a solid colored square pixels.

This means that no matter how large or small or how close you zoom in on the image, the lines, curves, and points remain smooth. There will never be jagged lines or blurriness with this kind of image, no matter how much it is enlarged.

➢ *Advantages*:

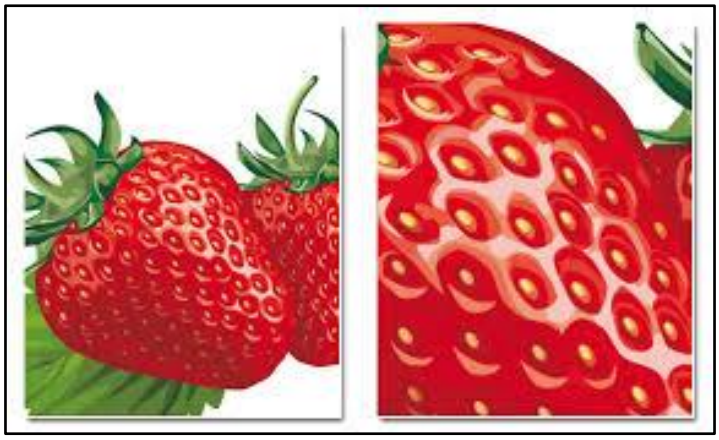
- Compact: Files tend to be small.
- Scalable: images can be displayed at any resolution without degradation.
- Vector graphics are the best choice for business identity print work, logos, promotional posters, and major illustrations.

➢ *Disadvantages:*

- Complex scenes are difficult to encode, which tends to create very large files.
- Rendering is computationally intensive; requires significant computing power.

➢ *Vector Graphic Strengths*

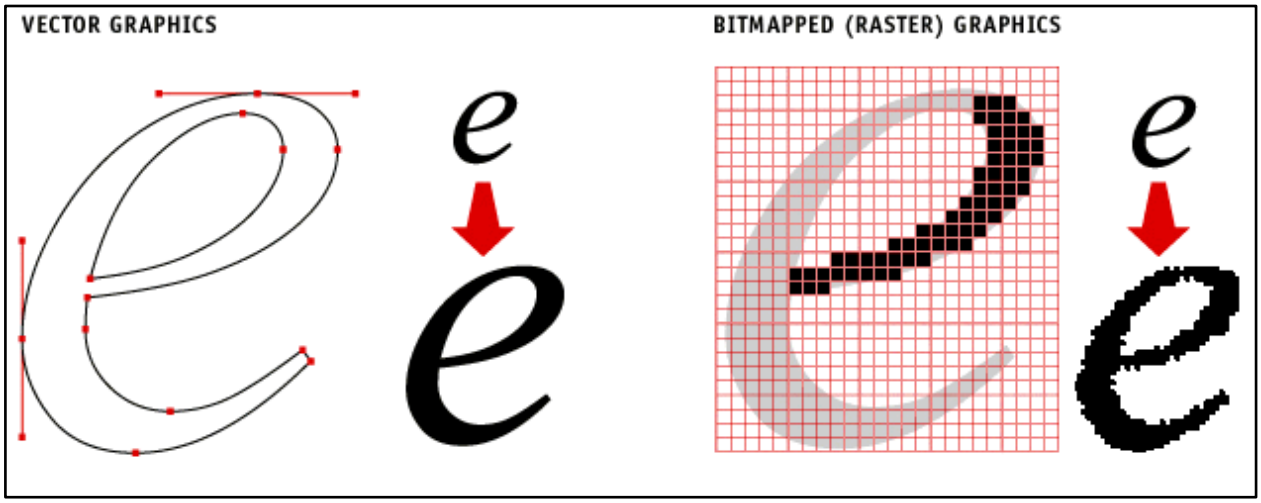
- Vector graphic files sizes are usually much smaller than raster files making them easier to store and share.
- It is easy to convert a vector graphic to raster if needed.
- Vector Graphics are resolution independent. You can make them larger or smaller without a loss of image quality.



1.3.Differences between Raster and Vector

The main difference between vector and raster graphics is that raster graphics are composed of pixels, while vector graphics are composed of paths. A raster graphic, such as a gif or jpeg, is an array of pixels of various colors, which together form an image.

Raster Graphics	Vector Graphics
They are composed of pixels.	They are composed of paths.
In Raster Graphics, refresh process is independent of the complexity of the image.	Vector displays flicker when the number of primitives in the image become too large.
Graphic primitives are specified in terms of end points and must be scan converted into corresponding pixels.	Scan conversion is not required.
Raster graphics can draw mathematical curves, polygons and boundaries of curved primitives only by pixel approximation.	Vector graphics draw continuous and smooth lines.
Raster graphics cost less.	Vector graphics cost more as compared to raster graphics.
They occupy more space which depends on image quality.	They occupy less space.
File extensions: .BMP, .TIF, .GIF, .JPG	File Extensions: .SVG, .EPS, .PDF, .AI, .DXF


VECTOR GRAPHICS
BITMAPPED (RASTER) GRAPHICS

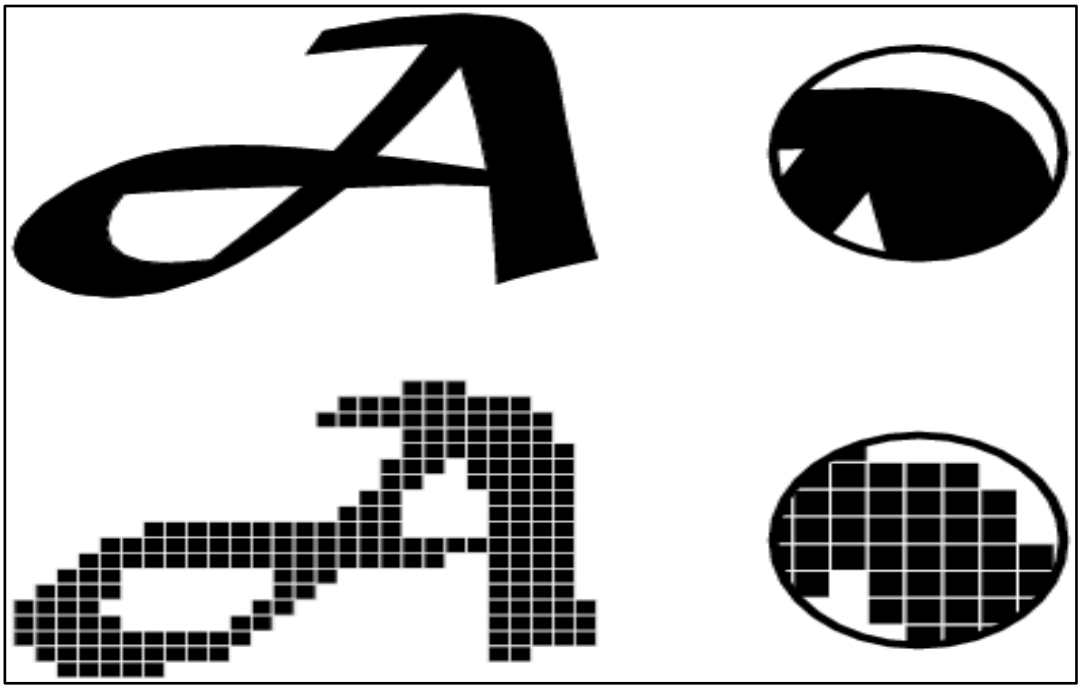


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Image Digitalization

Fourth Stage

Lecture Six

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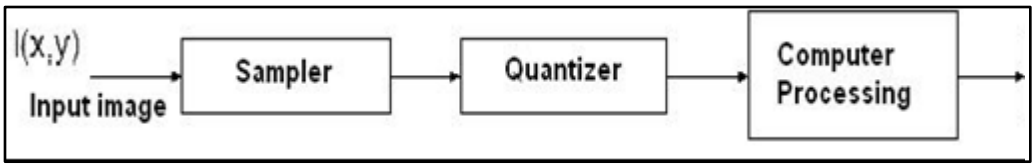
1. Image Digitalization

In Digital Image Processing, signals captured from the physical world need to be translated into digital form by "Digitalization" Process. In order to become suitable for digital processing, an image function f(x,y) must be digitized both spatially and in amplitude. This digitization process involves two main processes called:

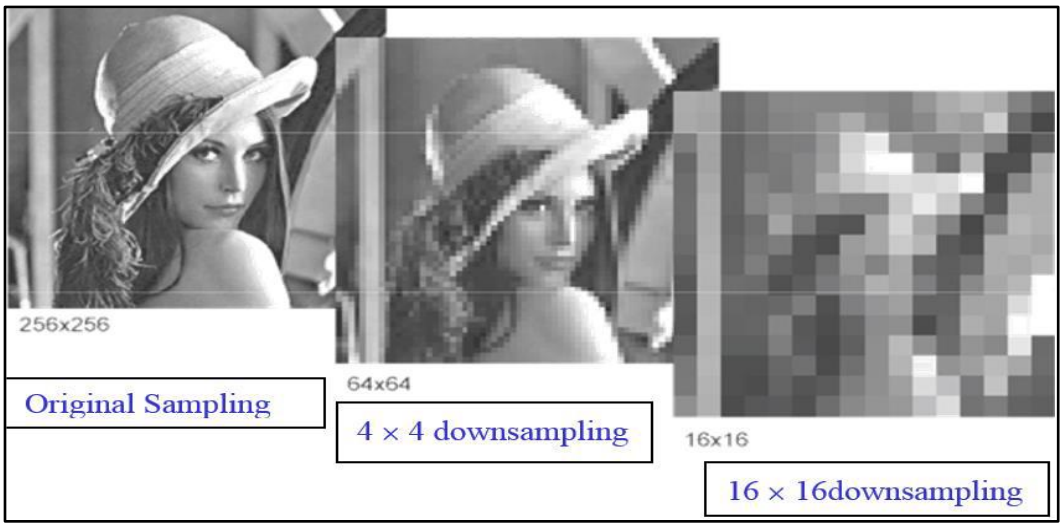
- **Sampling:** Digitizing the co-ordinate value is called sampling.
- **Quantization:** Digitizing the amplitude value is called quantization



The sampling rate determines the spatial resolution of the digitized image, while the quantization level determines the number of gray levels in the digitized image. A magnitude of the sampled image is expressed as a digital value in image processing. The transition between continuous values of the image function and its digital equivalent is called quantization.

1.1. Sampling

It is the 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. Two-dimensional pattern to represent the measurements (light intensity or color) that are made in the form of an image numerically.

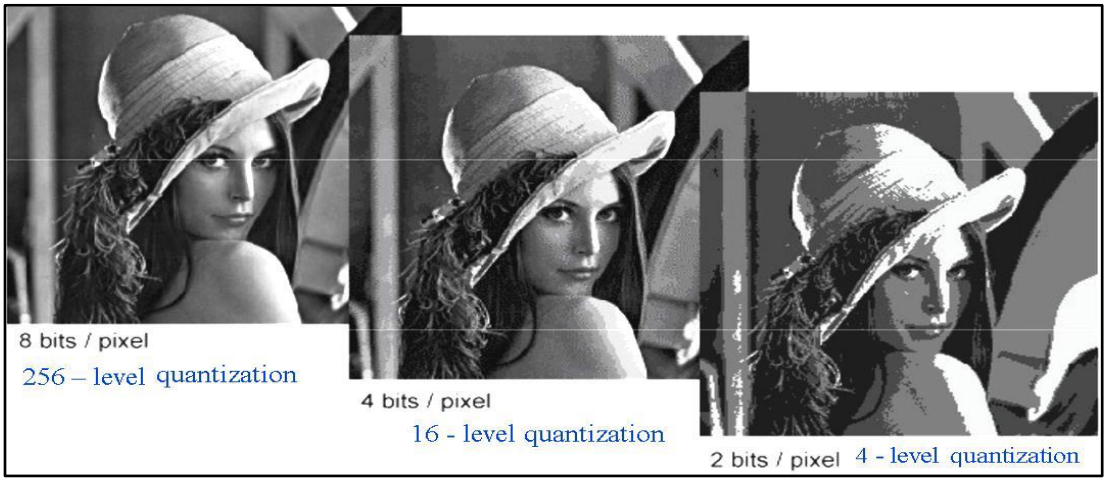


In previous figure, we have represented the image "Lena" sampled with two different sampling structures. The image on the left is the reference image (spatial dimensions: (256*256) pixels). The second image is sampled with a sampling frequency four times lower for each of the two spatial dimensions. This means it is (64*64) pixels. For display purposes, it has been brought to the same size as the original using a zoom. This is in fact an interpolation of zero- order (each pixel is duplicated 4*4 times, so that on the screen it displays a square of (4*4) identical pixels).

1.2. Quantization

It is the process of converting a continuous range of values into a finite range of discreet values. The accuracy with which variations in f (x, y) are represented is determined by the number of quantization levels that we use: the more levels we use, the better the approximation.

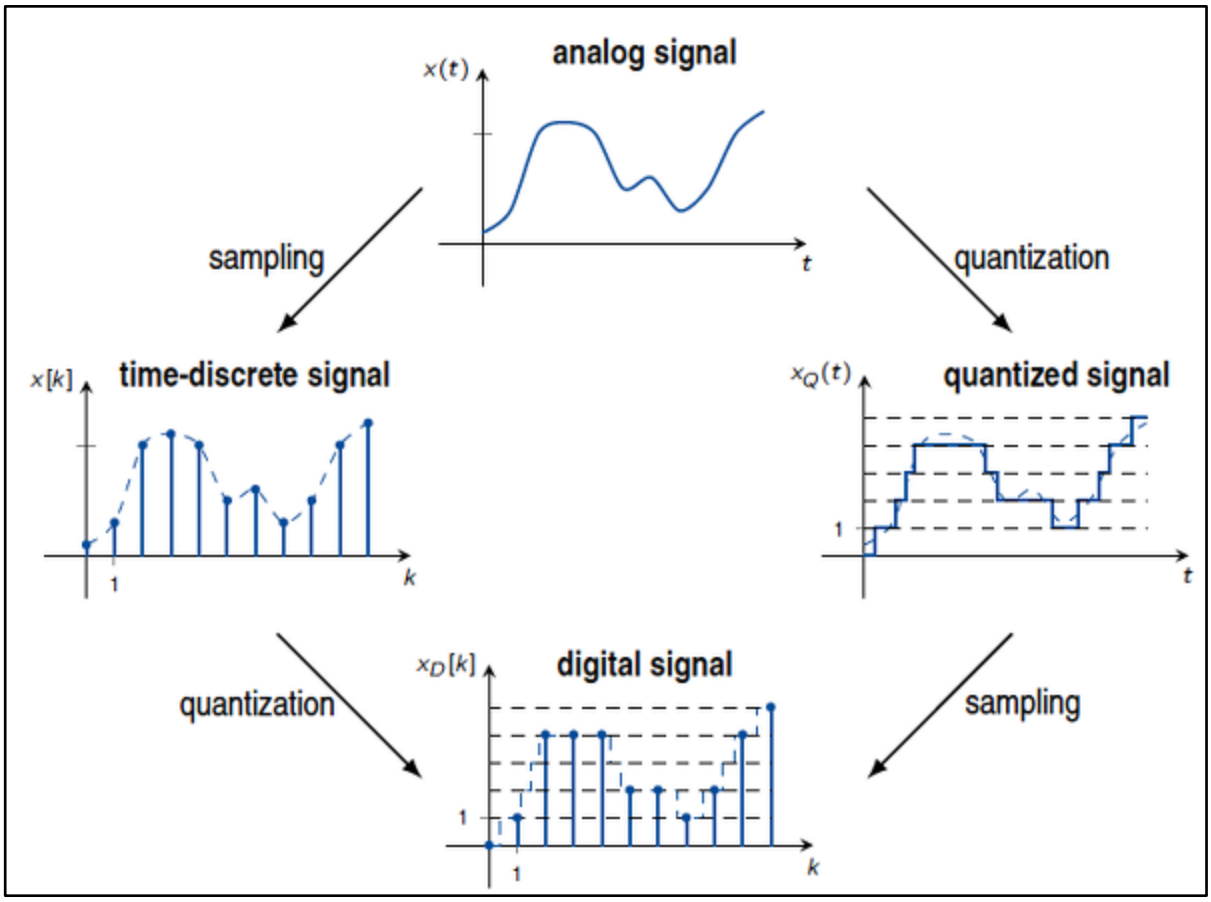
As number of bits to represent a pixel intensity is quantized. Suppose 8 bit is used for a pixel, its equivalent value ranges from 0 to 255 (discrete values). 0 is assigned to pure Black, and 255 is assigned to pure White. Intermediate values are assigned to gray scales as shown in this image.



This illustration shows examples of a quantization carried out on the image: For the image on the left: quantization is followed by a natural binary coding with 8 bits per pixel. There are $2^8 = 256$ reconstruction levels to represent the magnitude of each pixel. It is the typical case of a monochrome image (only in gray scales).

For the middle image: quantization is carried out with a 4 bits per pixel coding, giving $2^4 = 16$ reconstruction levels. Contours are well rendered but textures are imprecise in some cases. These are areas in the signal with a weak spatial variation, which suffer more visually due to the appearance of false contours (loss on the face and the shoulder).

For the image on the right: quantization is carried out with a 2 bits per pixel coding, so we have $2^2 = 4$ reconstruction levels. The deterioration seen on the previous image is even more flagrant here.



2. Spatial resolution and quantization

Resolution can be defined as:
Resolution = width x height
Where the image size is:
Image Size = width x height x No. of bit per pixel

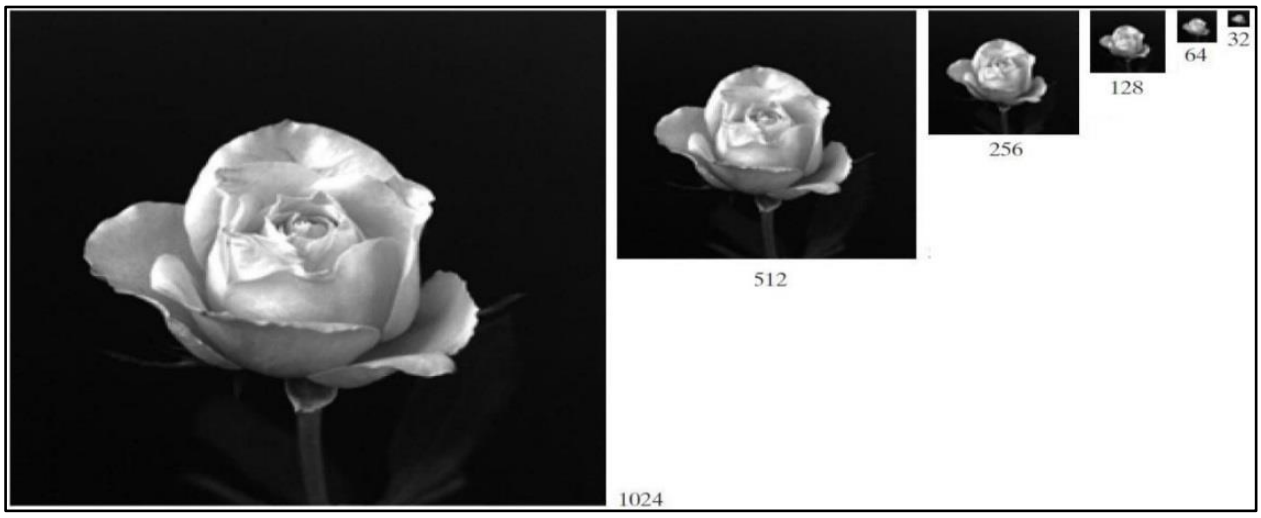
Spatial resolution can be defined as the smallest discernible detail in an image. In short, what spatial resolution refers to is that we cannot compare two different types of images to see that which one is clear or which one is not. If we have to compare the two images, to see which one is clearer or which has a more spatial resolution, we have to compare two images of the same size.

Spatial resolution is determined by the ***sampling process***. The spatial resolution of a digital image reflects the amount of details that one can see in the image (i.e. the ratio of pixel "area" to the area of the image display). If an image is spatially sampled at *X* pixels, then the larger *X* the finer the observed details. Or in other way we can define spatial resolution as the number of independent pixels per inch (PPI).

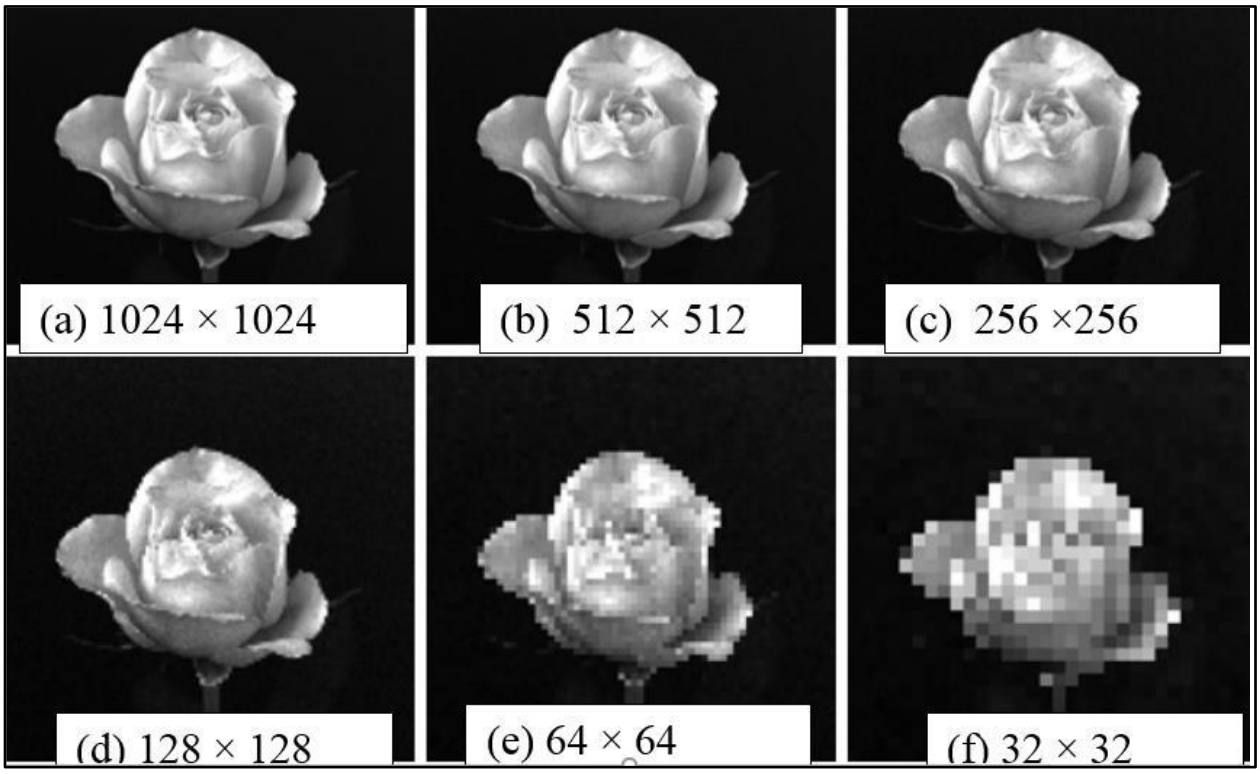
2.1.Effect of reducing the spatial resolution

Decreasing spatial resolution of a digital image, within the same area, may result in what is known as checkerboard pattern. Also image details are lost when the spatial resolution is reduced.

To demonstrate the checkerboard pattern effect, we subsample the 1024×1024 image shown in the following Figure to obtain the image of size 512×512 pixels. The 512×512 is then subsampled to 256×256 image, and so on until 32×32 image. The subsampling process means deleting the appropriate number of rows and columns from the original image. The number of allowed gray levels was kept at 256 in all the images.



To see the effects resulting from the reduction in the number of samples, we bring all the subsampled images up to size 1024×1024 by row and column pixel replication. The resulted images are shown in the following Figure.



Compare Figure (a) with the 512×512 image in Figure (b), we find that the level of detail lost is simply too fine to be seen on the printed page at the scale in which these images are shown. Next, the 256×256 image in Figure (c) shows a very slight fine checkerboard pattern in the borders between flower petals and the black background. A slightly more pronounced graininess throughout the image also is beginning to appear. These effects are much more visible in the 128×128 image in Figure (d), and they become pronounced in the 64×64 and 32×32 images in Figures (e) and (f), respectively.

2020

Image File Formats

Fourth Stage

Lecture Seven

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1. Introduction

Earlier when people thought print something on paper, they were constrained by few choices such as the size, quality and the dimensions of the paper. Nowadays and according to the explosion of knowledge and the availability of huge data on the web, there are new choices appear such as the type of project, the amount of time and cost.

The image format is depending on the compression techniques that used and there are important issue which is some technology companies are creating a special format uniquely distinguish that company.

Depending on the previous reasons, there are many image file formats. The following are major formats for image in multimedia.

2. Joint Photographic Experts Group (JPEG or JPG)

The JPEG format was developed by the Joint Photographic Experts Group. JPEG files are bitmapped images. It store information as 24-bit color. This is the format of choice for nearly all photograph images on the internet. Digital cameras save images in a JPEG format by default. It has become the main graphics file format for the World Wide Web and any browser can support it without plug-ins. In order to make the file small, JPEG uses lossy compression. It works well on photographs, artwork and similar materials but not so well on lettering, simple cartoons or line drawings.

In general, there is no big difference between JPG and JPEG images. In fact, the extensions are used interchangeably, this difference stems from the inability of older Windows versions to support file extensions that are different from a three-letter format. While Mac computers and newer Windows computers can handle files with the .jpeg extension, computers with an older Windows operating system needed the shortened, .jpg extension. By now, most image processing programs save JPG files with the .jpg extension on all kinds of operating systems just to avoid confusion.

3. Graphics Interchange Formats (GIF)

The GIF format was created by Compuserve. It supports 256 colors. GIF format is the most popular on the Internet because of its compact size. It is ideal for small icons used for navigational purpose and simple diagrams. GIF creates a table of up to 256 colors from a pool of 16 million. If the image has less than 256 colors, GIF can easily render the image without any loss of quality. When the image contains more colors, GIF uses algorithms to match the colors of the image with the palette of optimum set of 256 colors available. Better algorithms search the image to find and the optimum set of 256 colors.

Thus GIF format is lossless only for the image with 256 colors or less. In case of a rich, true color image GIF may lose 99.998% of the colors. GIF files can be saved with a maximum of 256 colors. This makes it is a poor format for photographic images.

GIFs can be animated, which is another reason they became so successful. Most animated banner ads are GIFs. GIFs allow single bit transparency that is when you are creating your image, you can specify which color is to be transparent. This provision allows the background colors of the web page to be shown through the image.

4. Portable Network Graphics (PNG)

PNG is the only lossless format that web browsers support. PNG supports 8 bit, 24 bits, 32 bits and 48 bits data types. One version of the format PNG-8 is similar to the GIF format. But PNG is the superior to the GIF. It produces smaller files and with more options for colors. It supports partial transparency also. PNG-24 is another flavor of PNG, with 24-bit color supports, allowing ranges of color akin to high color JPEG. PNG-24 is in no way a replacement format for JPEG because it is a lossless compression format. This means that file size can be rather big against a comparable JPEG. Also PNG supports for up to 48 bits of color information.

5. Tagged Image File Format (TIFF)

The TIFF format was developed by the Aldus Corporation in the 1980 and was later supported by Microsoft. TIFF file format is widely used bitmapped file format. It is supported by many image editing applications, software used by scanners and photo retouching programs.

TIFF can store many different types of image ranging from 1 bit image, grayscale image, 8 bit color image, 24 bit RGB image etc. TIFF files originally use lossless compression. Today TIFF files also use lossy compression according to the requirement. Therefore, it is a very flexible format. This file format is suitable when the output is printed. Multi-page documents can be stored as a single TIFF file and that is way this file format is so popular. The TIFF format is now used and controlled by Adobe.

6. Bitmap (BMP)

The bitmap file format (BMP) is a very basic format supported by most Windows applications. BMP can store many different type of image: 1 bit image, grayscale image, 8 bit color image, 24 bit RGB image etc. BMP files are uncompressed. Therefore, these are not suitable for the internet. BMP files can be compressed using lossless data compression algorithms.

7. Portable Document Format (PDF)

PDF format is vector graphics with embedded pixel graphics with many compression options. When your document is ready to be shared with others or for publication. This is only format that is platform independent. If you have Adobe Acrobat you can print from any document to a PDF file. From illustrator you can save as .PDF.

8. Windows MetaFile (WMF)

WMF is the vector file format for the MS-Windows operating environment. It consists of a collection of graphics device interface function calls to the MS-Windows graphics drawing library. Metafiles are both small and flexible, these images can be displayed properly by their proprietary software only.