



ICS 2303 MULTIMEDIA SYSTEMS

Chapter 2 3: Video and Animation

Presentation



Introduction

- ▶ Video includes short sequences of moving images (also called video clips) and complete movies/films.
- ▶ Video deals with the recording and display of a sequence of images at a reasonable speed to create an impression of movement.
- ▶ Each individual image of a sequence of images is called a **frame**.



Introduction

- ▶ Video is an important component of multimedia because it is very useful for illustrating concepts that involve movement.
- ▶ Although, both animation and video deal with the display of a sequence of images to generate an effect of motion, video typically deals with recording of a real-life event produced by a device, such as a digital video recorder.



Introduction

- Video information travels in natural medium in the form of light waves, which are analog in nature.
- For computer usage of video information, light waves must be converted from analog to digital form.
- Video camera is a transducer, which is commonly used to convert light waves into electrical signals.



Introduction

- A **transducer** is a device capable of changing signals from one form to another
- E.g. Microphone is an example of a transducer, which converts sound waves into electrical signals.
- Conversely, a loudspeaker is an example of a transducer, which converts electrical signals into sound waves.



Introduction

- ▶ Conversely, a monitor is a transducer, which is commonly used to convert electrical signals into light waves.
- ▶ Like audio, in case of video, also the transformation between analog and digital signals is achieved by ADC and DAC conversions.



Introduction

- Video features in a range of multimedia applications:
 - Entertainment.
 - Broadcast TV and VCR/DVD recording.
 - Interpersonal.
 - Video telephony and video conferencing.
 - Interactive
 - Windows containing short video clips.



Introduction

- However, the quality of video varies considerably from one type of application to another.
- E.g. for video telephony, a small screen of a PC is acceptable while for a movie, a large screen format is preferable.
- Therefore in practice, there is no single standard associated with video but rather a set of standards, each targeted at a particular application domain.
- All standards are based on principles of broadcast television.



Visual representation of video

- Both video and animation give us a sense of motion.
- They exploit some properties of human eye's ability of viewing pictures.
- Motion video is the element of multimedia that can hold the interest of viewers in a presentation.



Visual representation

- The visual effect of motion is due to a biological phenomenon known as *persistence of vision* - *An object seen by the human eye remains mapped on the eye's retina for a brief time after viewing (approximately 25 ms).*
- The human eye always retains images for a fraction of a second (around 0.04 second).
- This means that everything we see is a subtle blend of what is happening now and what happened a fraction of a second ago.



Visual Representation

- ▶ Another phenomenon contributing to the vision of motion is known as *phi phenomenon* - *When two light sources are close by and they are illuminated in quick succession, what we see is not two lights but a single light moving between the two points.*
- ▶ *This is an optical illusion is based in the principle that the human eye is capable of perceiving movement from pieces of information, for example, a succession of images. In other words, from a slideshow of a group of frozen images at a certain speed of images per second, we are going to observe constant movement*
- ▶ Due to the two phenomena of our vision system, a discrete sequence of individual pictures can be perceived as a continuous sequence.



Temporal Illumination

- To represent visual reality, two conditions must be met:
 - The rate of repetition of the images must be high enough to guarantee smooth motion from frame to frame.
 - The rate must be high enough so that the persistence of vision extends over the interval between flashes.



Visual Illumination

- The frequency at which the flicking light source must be repeated before it appears continuous is known as the *fusion frequency*.
 - This depends on the brightness of the light source.
 - The brighter the light source the higher the fusion frequency.
- It is known that humans perceive a continuous motion to happen at any frame rate faster than **15 frames per second**.



Video file formats

- AVI (Audio Video Interleaved)
 - Format was defined by Microsoft for its Video for Windows systems
 - It supports video playback at up to 30 frames per second on a small window (typical size 300 x 200 with 8 or 16 bit colour)
 - It is a software-only system.
 - It supports a number of compression algorithms



Video File Formats

- **QuickTime**

- Was originally developed by Apple for storing audio and video in Macintosh systems
- It supports video playback at up to 30 frames per second on a small window (typical size 300 x 200 with 8 or 16 bit colour)
- It is a software-only system
- It supports a number of compression algorithms



Video File Formats

- **MPEG (Motion Picture Expert Group)**
 - Is a working group under ISO
 - There are several versions of mpeg standard.
 - The most commonly used now is mpeg-1
 - It requires hardware support for encoding and decoding (on slow systems)
 - The maximum data rate is 1.5Megabit/sec
 - The next generation mpeg-2 is now getting popular
 - Mpeg-2 improves mpeg-1 by increasing the maximum data rate to 15Mbit/sec.
 - It can interleave audio and video.



Animation

- To *animate* something is, literally, to bring it to life.
- An animation covers all changes that have a visual effect
- Visual effect can be of two major kinds:
 - *motion dynamic*— time varying positions
 - *update dynamic*— time varying shape, colour, texture, or even lighting, camera position, etc.
- The visual effects is the result of exploiting the properties of human vision system as described above (in the section about video)



Animation

- A computer animation is an animation performed by a computer using graphical tools to provide visual effects.
- The steps in producing a computer animation are:
 - Input process.
 - Composition.
 - Inbetween.



Input process

- In this process *Key frames* have to be created and input into the computer
- *Key frames* are the frames in which the objects being animated are at extreme or characteristic positions.
- They can be drawn using traditional artistic tools, such as pen and brush, and then digitised.
- The digital images may need to be cleaned up.
- They can also be created using drawing or painting tools directly.



Composition Process

- The foreground and background figures are combined to generate the individual frames.



Inbetween Process

- The animation of movement from one position to another needs a composition of frames with intermediate positions in between the key frames.
- The process of *inbetweening* is performed in computer animation through *interpolation*.
- The system is given the starting and ending positions and it calculates the positions in between.



Types of interpolation

- Linear.
 - The animation progresses at a constant rate of the segment duration.
 - For example, if a key-frame segment transitions from 0 to 10 over a duration of 5 seconds, the animation produces the following values at the specified times.

Time	0	1	2	3	4	4.25	4.5	5
Value	0	2	4	6	8	8.5	9	10

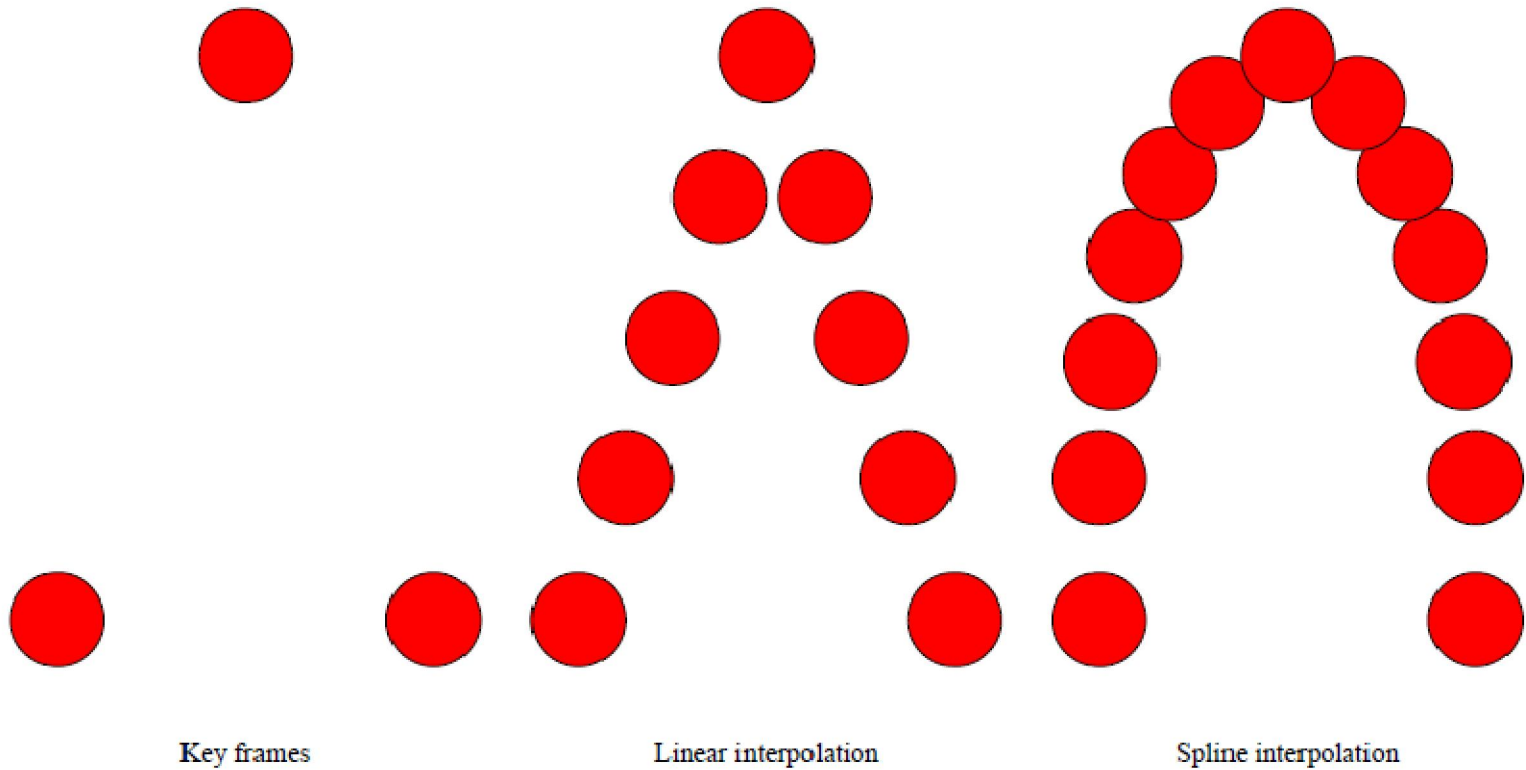


Types of Interpolation

- Splined
 - Splined interpolation can be used to achieve more realistic timing effects.
 - Because animations are so often used to imitate effects that occur in the real world, you might need fine control of the acceleration and deceleration of objects, and close manipulation of timing segments.
 - Spline key frames enable you to animate with splined interpolation.
 - With other key frames, you specify a Value and KeyTime.
 - With a spline key frame, you also specify a KeySpline



Interpolation methods





Inbetween

- Inbetweening also involves interpolating the shapes of objects.
- Some animation involves changing the colour of objects.
- This is usually done using Colour Look-up Table (CLUT).
- By cycling through the colours in the CLUT, the objects' colours will change
- *Morphing* is a popular effect in which one image transforms into another



Controlling Animation

- Full explicit control
 - The animator provides a description of everything that occurs in the animation either by:
 - specifying simple changes, such as scaling, transformation or
 - by providing key frames.
- Procedural control
 - using a program to calculate the position, angle, etc. of the objects.
 - In physical systems, the position of one object may influence the motion of another.



Controlling Animation

- Constraint-based systems:
 - Movement of objects that are in contact with each other is constraint by physical laws.
 - An animation can be specified by these constraints
- Tracking live action
 - People or animals act out the parts of the characters in the animation.
 - The animator trace out the characters.



Displaying Animation

- ▶ There are basically three common ways to display animation:
 - Generate a digital video clip
 - Many Animation tools will export an animation in common digital video format, e.g., QuickTime
 - Create a package including runtime system of the animation tool
 - For example, Director can create a projector including all casts.
 - The projector can then be distributed and play the animation.
 - Show the animation in the animation tool



Animation Tools

- Macromedia Director and Flash
 - It is one of the most popular interactive animation tool for generating interactive multimedia applications
- MetaCreations Poser
 - It understands human motion and inverse kinematics, e.g., move an arm the shoulders will follow.
- Discreet 3D Studio Max
 - Very popular for creating 3D animations
- Animation language—VRML (Virtual Reality Modelling Language)



The End