005:

VIDEOS

DIGITISING IMAGE&VIDEO, STORAGE REQUIREMENTS, DIGITISED MEDIA, DESKTOP EDITING OF DIGITISED VIDEO CASSETTE RECORDERS (VCR), VIDEO SHOOTING ESSENTIALS (SHOOTING PICTURES, MOVING OBJECTS, MOVING CAMERA IN ACTION, OBJECTS SCRIPT, EQUIPMENT, SCENE, SHOOTING RIGHTS, CAPTURING PICTURES, PLAYBACK, COMPARATIVE DESKTOP VIDEO SOFTWARE) , QUICKTIME FOR WINDOWS, QUICKTIME PRO, MPEG, INDEO, CINEPAK

TuK

Bachelor Information Technology/Communications and Computing
Networks Year 4 Semester 1

MULTIMEDIA APPLICATIONS / SYSTEMS AND APPLICATIONS

SUBJECT CODE: ECCI/ECII 4102

OVERVIEW

1. Introduction & Attendance Registration
2. Lecture Aims & Objectives
3. Lecture Outline
4. Chapter from Recommended Reading List
5. Lecture 5 Topic
6. Q&A

LECTURE
AIMS & OBJECTIVES

1) To introduce students to Video theories.
2) To equip students with the knowledge to develop and use video skills
3) To develop students' expertise in the area of video tools and techniques

LECTURE OUTLINE

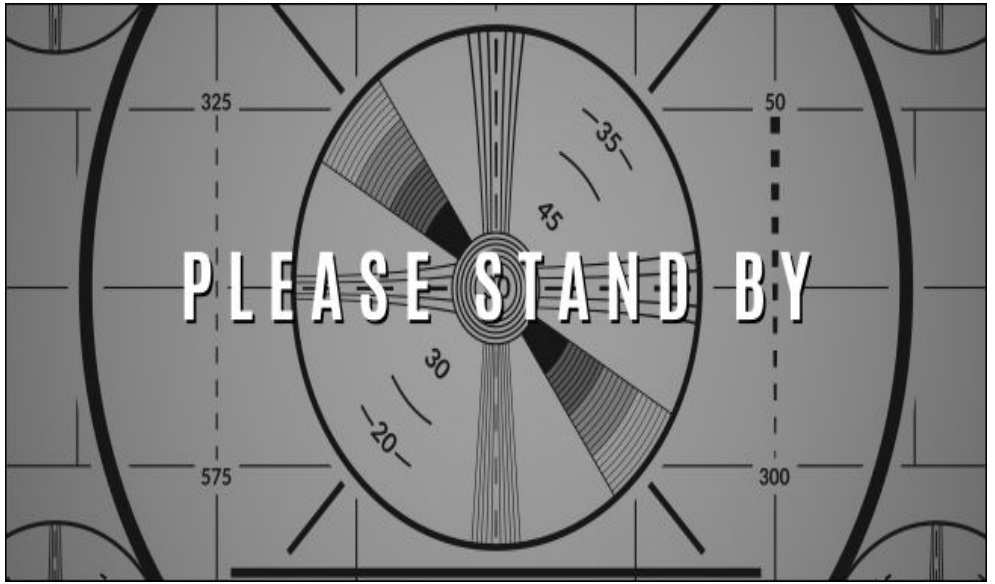
5. Videos:
    1. Digitised Media: Digitising images and video
    2. Storage requirements
    3. Desktop editing of digitised video cassette recorders (VCR)
    4. Video shooting essentials (Shooting pictures/moving objects/moving camera in action (the objects, script, equipment, scene, shooting rights, capturing pictures, playback, comparative desktop video software)
    5. Quicktime for Windows, Quicktime Pro, MPEG, Indeo, Cinepak

CHAPTER FROM RECOMMENDED READING LIST

CHAPTER 5. "Video",

from "Fundamentals of Multimedia"

Li, Nian-Ze, Drew, Mark S



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MOVING OBJECTS/CAMERA IN ACTION, OBJECTS, SCRIPT, EQUIPMENT, SCENE, SHOOTING RIGHTS, CAPTURING PICTURES, PLAYBACK, COMPARATIVE DESKTOP VIDEO S/W)

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MULTIMEDIA VIDEO

- Defined as **real image recording**
- Variety of **analog and digital** formats e.g. PAL, SECAM, NTSC, H.D.
- Can display a **series of single images at @25fps/30fps/50fps (**frames per second**)**
- File types include MPEG (Lossy) and Quicktime, AVI (Lossless)

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MULTIMEDIA VIDEO

- Rely on the phenomenon of persistence of vision to create an illusion of continuous visual sensation
- Fusion frequency is the speed of change needed to achieve persistence of vision (40 images per second)
- Below 40i/s leads to flickering

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MULTIMEDIA VIDEO

- Film/movie projectors interrupt/elevating the projection by displaying each frame twice (48 fps=>80i/s)

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ANALOG VIDEO SIGNAL

$= f(t)\, I(x, y, t),$

- Analog video is a continuous time-varying signal
- Represented by continuous space and time dimensions.
- (x, y) denote continuous space coordinates
- t denotes continuous time,

- Tv and Monitors represent video as a 1D electrical signal V(t).
- Prior to display a 1D signal is obtained by scanning
- Scanning is sampling I(x,)1, t) along the vertical (y) space direction and I(x,)1, t) along the time (t) direction.

- Result is a series of time samples/space samples/scan lines

(complete pictures or frames)

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ANALOG VIDEO

- Works by sampling time-varying images/pictures (frames)
- Uses CRT to beam light against the backside of TV/monitor screen.
- CRT quickly beams light down from top of a screen.

- Image at top screen starts to fade before CRT beams reach bottom screen
- Beams can't fill up entire screen at once
- Therefore images must be "interlaced" i.e. beam skip every other line on a screen to fill up image

INTRODUCTION MULTIMEDIA: BASIC MULTIMEDIA CONCEPTS, TEXT, GRAPHICS, SOUND, VIDEO & ANIMATION IN A SINGLE APPLICATION

INTERACTIVE VIDEO

- Video is processed in "real time," i.e. the result of processing appear "instantaneously"

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INTERACTIVE VIDEO

- Usually require data **compression & decompression (**CODEC**)** to allow a **smaller file** to play

- 20 minutes of video 40i/s is **8GB**

- **Typical PAL digital video (720 x 576 pixels per colour frame)**

- HD video Bluray (1920 x 1080= 2 megapixels per frame)

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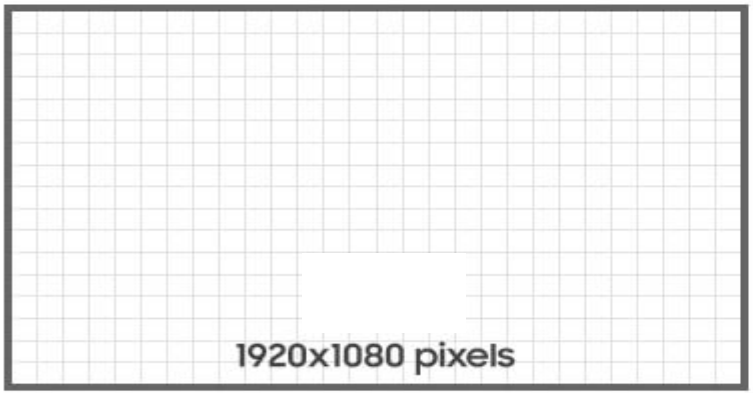
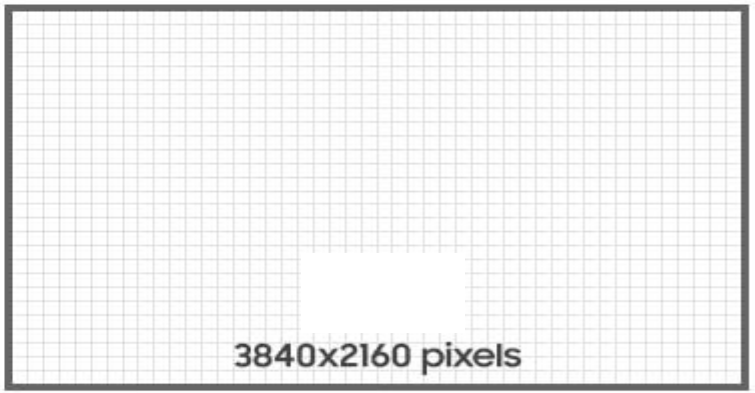
MULTIMEDIA VIDEO PIXEL/RESOLUTION MEASUREMENTS





- Screen resolution are usually measured from l-r i.e. **vertical** width to **horizontal height**, counting the number of pixels horizontally first then vertically (width and height).
- **vertical pixels** is used to describe the resolution and definition.

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MULTIMEDIA VIDEO FORMATS

- Americans use NTSC(national TV system committee), everyone else uses PAL(phase alternate format)
- NTSC is an analog TV b&w, color system used in North America, Central America and parts of South America and consumes 60Hz electric power
- PAL is an analog TV color system used in Europe, Australia, parts of Asia, parts of Africa, and parts of South America and consumes 50Hz electric power.
- PAL was meant to fix NTSC problems

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ANALOG VIDEO INTERLACING

- Interlacing presents image in a manner consistent to the human eye.
- Interlaced 60 Hz NTSC runs 29.97 FPS and interlaced 50 Hz PAL run 25 FPS

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ANALOG VIDEO INTERLACING

- Interlaced 60 Hz NTSC (29.97 FPS) has an extra 4.97 fps compared to interlaced 50Hz PAL (25 FPS)

- NTSC shows only b&w resolution, displays 525 interlaced lines, operates on low-bandwidth frequencies and is generally unreliable

- PAL shows only colour, displays 625 interlaced lines, operated on high bandwidth frequencies, and is more reliable

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PAL & NTSC DIGITAL VIDEO

- NTSC and PAL are **in use in cable TV and broadcast TV operating at 30 or 60 fps**
- Modern digital TVs support both NTSC and PAL formats, this solves the compatibility and geographic location problem of using old video sources (NTSC) with new TV (PAL)
- Some TVs might only support one of the two formats (compatibility problems) depending on country you are located in (geographic location problems)
- TVs have to be able to decode video signals transmitted with an analog cable, or broadcast even if it means using NTSC/PAL compatible HDMI converter boxes

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VIDEO RESOLUTION

- Resolution defines how densely individual pixels are close together in a given area
- The higher the pixel count in a given area the higher the resolution (PPI)
- Higher PPI (Pixels Per Inch) means higher pixel density.
- Typically, PPI should be at least 50 or more in order to enjoy various kinds of video content.
- Pixels are smaller in high-resolution TVs than in a lower-resolution TV (same size)

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VIDEO RESOLUTION

- High resolution provides a more immersive experience without restrictions on viewing distance i.e. watch up close without noticing individual pixels.

- Two types of digital multimedia video resolution:-
  - High Definition (HD)
  - Ultra High Definition (UHD)
- Higher resolution means more pixels make up the screen allowing sophisticated and realistic image representation increasing sense of immersion when watched

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FHD VS UHD RESOLUTION

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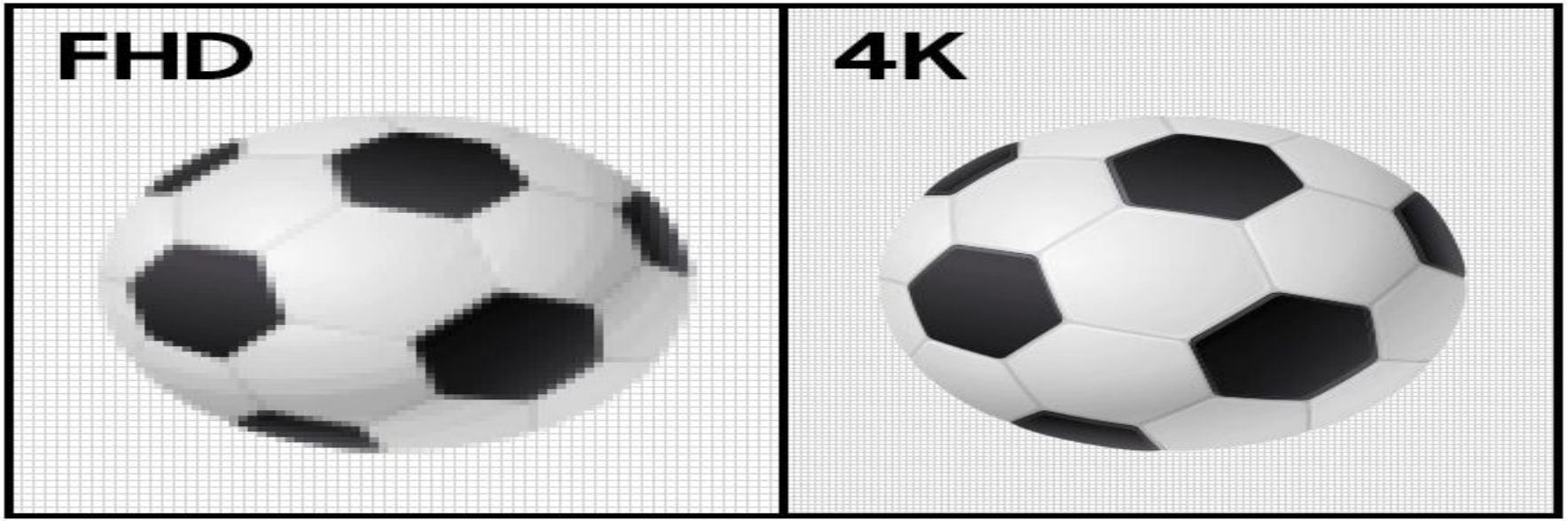
MULTIMEDIA VIDEO PIXEL K RESOLUTIONS



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HD FAMILY RESOLUTION

Types of Definition Resolution:

- SD
- HD
- FHD
- UHD

- Standard Definition is 640 x 480 pixels
-

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HD FAMILY RESOLUTION

- "K" in HD resolution stands for (1000),
- HD means a horizontal resolution of 1,000 pixels.
- High definition is **1,280 x 720 pixels**
- Standard FHD resolution is 1920 x 1080 pixels.

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UHD RESOLUTION

- 2 types of UHD resolution:- 4K and 8K
- "K" stands for Kilo (1000)

4K

- 4K UHD means a horizontal resolution of 4,000 pixels i.e.four times more pixels than FHD
- 4K UHD picture quality more vivid and detailed (greater pixel density)

- Difference between FHD and UHD more obvious in big screens
- 4&8K content: 4/8K broadcasting, 4/8K streaming services, 4/8K Blu-ray, 4/8K cameras, 4/8K smartphones
- 4K VoD services e.g. Netflix, Amazon Prime, Vudu and Rakuten offer a wide range of 4K movies and TV series.

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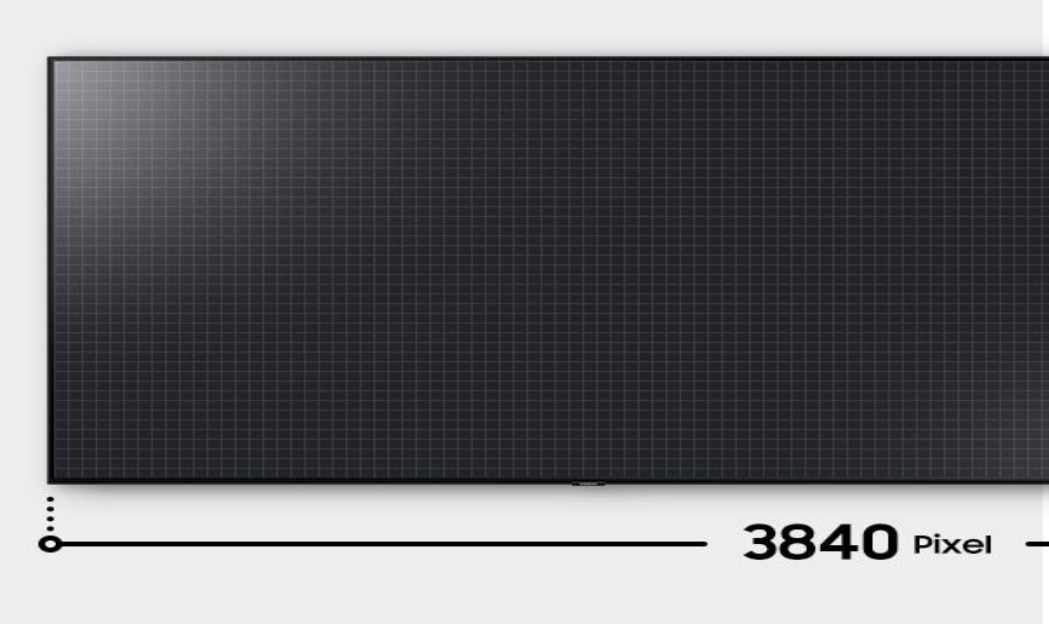
MULTIMEDIA VIDEO PIXEL 4K RESOLUTIONS



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UHD RESOLUTION

8K

- 8K UHD is a resolution with 7,680 horizontal and 4,320 vertical pixels (Pixels are so small they cannot be distinguished even from close up,)
- Total approximately 33 million pixels.
- 8Kilo (1000) means a horizontal resolution of about 8,000 pixels
- Four times more pixels than 4K TV
- Sharper and more detailed picture quality.
- Highly detailed images

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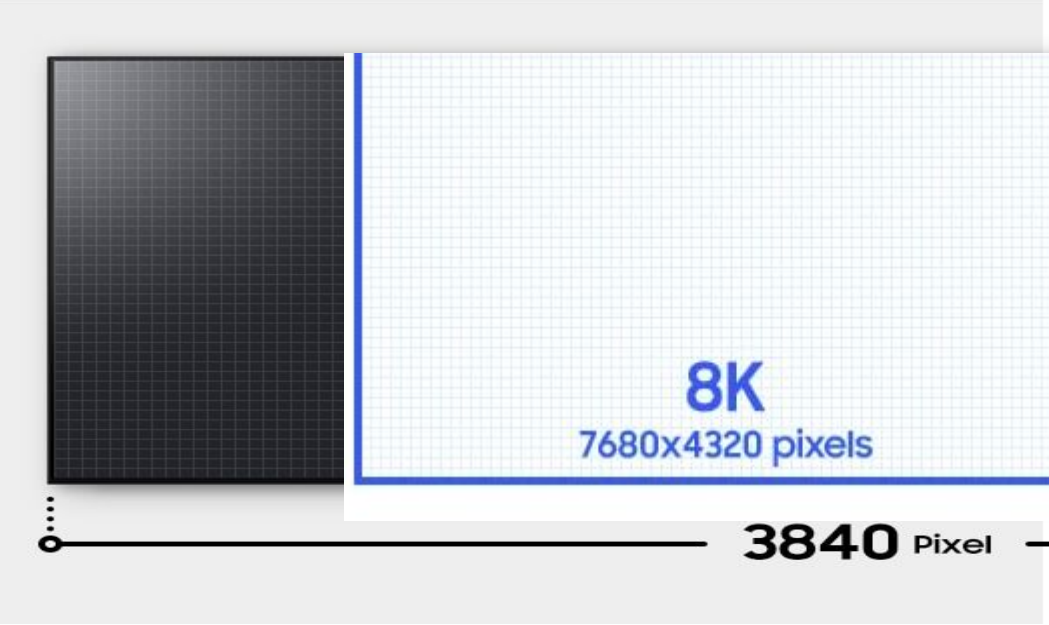
MULTIMEDIA VIDEO PIXEL 4K vs 8K RESOLUTIONS



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FHD -4/8K RESOLUTION UPSCALING

- Upscaling is when you watch lower-quality FHD content on a FHD display which automatically increases, converts and optimizes the resolution to fit a 4/8K display.
- It doesn't stretch it upgrades the image to 4/8K display.

- Upscaling automatically analyzes resolution
- Reduces noise, improves details, provides optimum contrast and color to view content in 4/8K quality.

AI Upscaling.

- AI Upscaling collects and learns a variety of content characteristics by type, stores them in a database, uses it to process similar image types

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INTERLACING-SCANNING

- Results in odd and even fields
- Interlacing was invented because it was difficult to transmit amount of information in a full frame quickly enough to avoid flicker.
- Double number for fields presented to the eye reduces perceived flicker
- Interlacing displaces odd and even lines in time from each other, (generally not acceptable except when fast action is taking place on screen

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INTERLACING-SCANNING

- Frames are made up of 2 fields- odd numbered and even numbered lines
- There are 2 types of sampling methods: -progressive scanning & interlaced scanning
- Analog video uses progressive scanning which traces a complete frame row-wise for each time interval.

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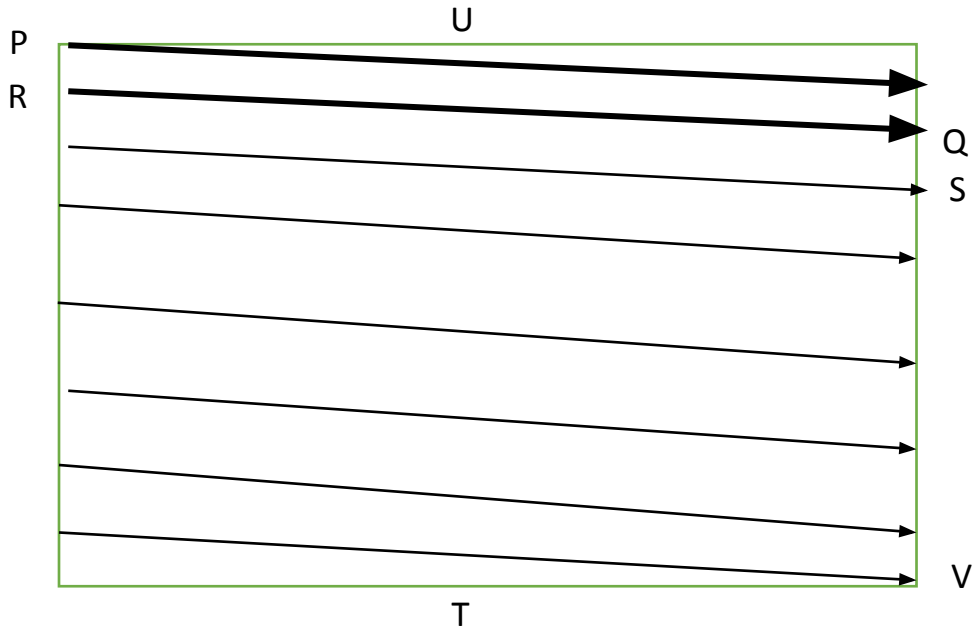
INTERLACING-SCANNING

- Scan lines are not horizontal (a small voltage is applied, which moves electron beams down over time)
- High resolution computer monitors typically use time interval of 1/72s



Interlaced Raster Scan

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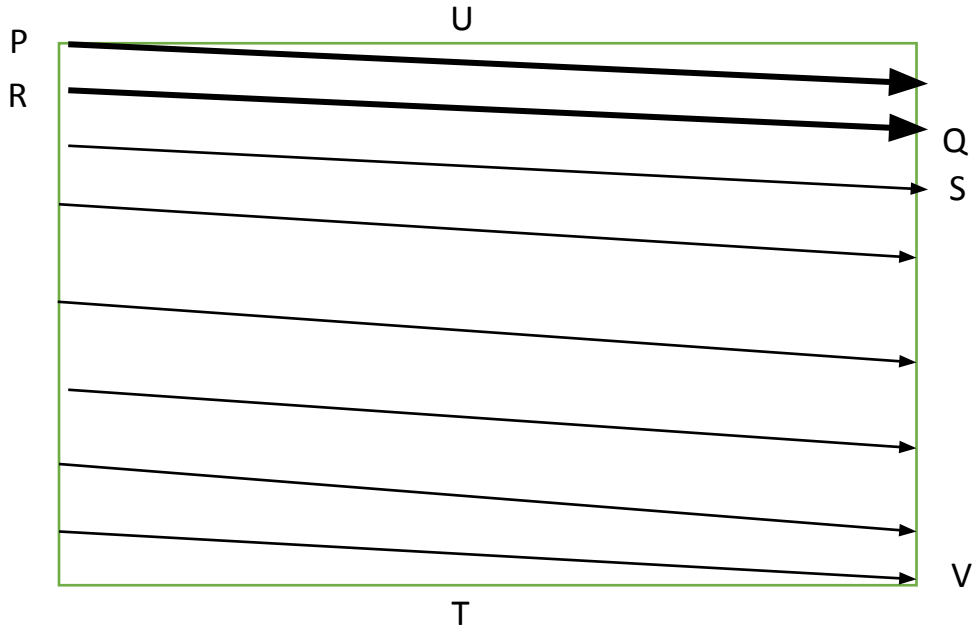
INTERLACING-SCANNING

- First the solid (odd) lines are traced-P to Q, then R to S, and so on, ending at T
- then the even field starts at U and ends at V.
- The scan lines are not horizontal because a small voltage is applied, moving the electron beam down over time



Interlaced Raster Scan

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DIGITISING IMAGES, VIDEO & MEDIA

- Video equipment digitises time-varying signals from sensors to generate bitmapped images
- 1 second of uncompressed video@30fps occupies 26Mb, and 1 minute of uncompressed video@30fps occupies 1.6Gb
- Fast compression is required for multimedia and low-end equipment

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DIGITISING IMAGES, VIDEO & MEDIA

- Dedicated h/w required for real time video digitisation
- Digital video may be captured directly from a camera which digitizes and compresses video signal inside the camera then sent to the computer)

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DIGITISING IMAGES, VIDEO & MEDIA

- Digital video can also be captured indirectly from broadcast signal
- The video must be compressed before storage/transmission
- Advantages of Digitizing video
  - Analogue video cable transmission over short and long distances suffers from corruption

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DIGITISING IMAGES, VIDEO & MEDIA

- Advantages of Digitizing video
  - Noise corrupts analogue signals stored on magnetic tape
  - Composite video signals (domestic) suffer distortion because of interference between colour & brightness information
  - All these affect effectiveness of compression approach and efficiency of compression process (both inter and intra frame)

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VIDEO STORAGE REQUIREMENTS

- Video places considerable strain on current processing/storage and data transmission capabilities of computer systems
- Video for consumer equipment plays-back at reduced frame rates in small windows with compression artefacts
- To accommodate low-end PC limitations, considerable compromises over quality must be made, resulting in dancing postage stamps
- At 24-bit colour, each frame of NTSC video occupies 640x480x3bytes = 900Kb

VIDEO:DIGITISING IMAGES, VIDEO & MEDIA: DESKTOP EDITING OF DIGITISED VIDEO CASSETTE RECORDERS (VCR), VIDEO SHOOTING ESSENTIALS (SHOOTING PICTURES, MOVING OBJECTS/CAMERA IN ACTION, OBJECTS, SCRIPT, EQUIPMENT, SCENE, SHOOTING RIGHTS, CAPTURING PICTURES, PLAYBACK, COMPARATIVE DESKTOP VIDEO S/W)
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QUICKTIME FOR WINDOWS, QUICKTIME PRO, MPEG, INDEO, CINEPAK

VIDEO STORAGE REQUIREMENTS

- V1 second of uncompressed video@30fps occupies 26Mb
- 1 minute of uncompressed video@30fps occupies 1.6Gb
- Storing such large amounts of data on CD-ROMS or DVD is not currently feasible (only film&TV studios can afford at present to do so)
- Transmission of such amounts is only possible on the fastest network (not internet)
- Disk arrays using SCSI standards can store entire films

HARDWARE RESOURCE CONFLICTS

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Video Processing

SAMPLING (method used to digitise sound) has 3 characteristics:

- ***Frame rate:*** the number of frames per second

To calculate the file size for video:

1. calculate the number of frames
2. calculate the file size for each frame

File size for video = Number of frames x file size for each frame

Number of frames = frame rate x time in seconds

$$\text{File size for each frame} = \frac{\text{Horizontal x Vertical x Bit Depth}}{8 \text{ x } 1024 \text{ bits (= 1 Kb)}}$$

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Example:

Calculate the file size in Kb of a 90 minute movie at 24 frames per second. Each frame is 2048 by 872 pixels with 32 bits for each pixel.

Number of frames = frame rate x time in seconds

Number of frames = 24 x 90 x 60

Number of frames = 129,600 frames

$$\textbf{File size for each frame} = \frac{2048 \times 872 \times 32}{8 \times 1024}$$

File size for each frame = 6976 Kb

File size for video = Number of frames x file size for each frame

File size for video = 129,600 x 6976

File size for video = 904,089,600 Kb

File size for video = 862.207 Gb (1 Gb = 1,048,576 Kb)

QUESTION AND ANSWER SESSION

ANY

QUESTIONS

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