

Video representation

Digital video comprises a series of orthogonal bitmap digital images displayed in rapid succession at a constant rate. In the context of video these images are called frames. We measure the rate at which frames are displayed in frames per second (FPS).

Since every frame is an orthogonal bitmap digital image it comprises a raster of pixels. If it has a width of W pixels and a height of H pixels we say that the frame size is WxH.

Pixels have only one property, their color. The color of a pixel is represented by a fixed number of bits. The more bits the more subtle variations of colors can be reproduced. This is called the color depth (CD) of the video.

An example video can have a duration (T) of 1 hour (3600sec), a frame size of 640 x 480 (W x H) at a color depth of 24 bits and a frame rate of 25fps. This example video has the following properties:

- pixels per frame = $640 * 480 = 307,200$
- bits per frame = $307,200 * 24 = 7,372,800 = 7.37\text{Mbits}$
- bit rate (BR) = $7.37 * 25 = 184.25\text{Mbits / sec}$
- video size (VS) = $184\text{Mbits / sec} * 3600\text{sec} = 662,400\text{Mbits} = 82,800\text{Mbytes} = 82.8\text{Gbytes}$

Video Compression

Video compression is the process of encoding a video file in such a way that it consumes less space than the original file and is easier to transmit over the network/Internet.

It is a type of compression technique that reduces the size of video file formats by eliminating redundant and non-functional data from the original video file.

MPEG standards

MPEG standards (Moving Picture Experts Group)

The MPEG standards are an evolving set of standards for video and audio compression and for multimedia delivery developed by the Moving Picture Experts Group (MPEG).

MPEG-1 was designed for coding progressive video at a transmission rate of about 1.5 million bits per second. It was designed specifically for Video-CD and CD-i media. MPEG-1 audio layer-3 (MP3) has also evolved from early MPEG work.

MPEG-2 was designed for coding interlaced images at transmission rates above 4 million bits per second. MPEG-2 is used for digital TV broadcast and DVD. An MPEG-2 player can handle MPEG-1 data as well.

A proposed MPEG-3 standard, intended for High Definition TV (HDTV), was merged with the MPEG-2 standard when it became apparent that the MPEG-2 standard met the HDTV requirements.

MPEG Standard Video Streaming on net

A video streaming protocol is a standardized delivery method for breaking up video into chunks, sending it to the viewer, and reassembling it.

Dynamic Adaptive Streaming over HTTP (MPEG-DASH)

At the opposite end of the spectrum, we have MPEG-DASH: one of the newest protocols on the scene. While not widely used, this protocol has some big advantages. First, it supports adaptive bitrate streaming. That means viewers will always be delivered the best video quality that their current internet connection speed can support. This can fluctuate second-to-second, and DASH can keep up.

MPEG-DASH fixes some longstanding technical issues with delivery and compression. Another advantage is that MPEG-DASH is “codec agnostic”—it can be used with almost any encoding format. It also supports Encrypted Media Extensions (EME) and Media Source Extension (MSE) which are standards-based APIs for browser-based digital rights management (DRM).

Video Conferencing

Videoconferencing (or video conference) means to conduct a conference between two or more participants at different sites by using computer networks to transmit audio and video data. For example, a point-to-point (two-person) video conferencing system works much like a video telephone. Each participant has a video camera, microphone, and speakers mounted on his or her computer. As the two participants speak to one another, their voices are carried over the network and delivered to the other's speakers, and whatever images appear in front of the video camera appear in a window on the other participant's monitor.

Multipoint videoconferencing allows three or more participants to sit in a virtual conference room and communicate as if they were sitting right next to each other.

Advantages of Video Conferencing

1. Lesser Travels,
2. Anytime Conference
3. Better Communication
4. Time and Money Saver
5. Increases Productivity
6. Increased Return

Disadvantages of Video Conferencing

1. No Personal Interaction
2. Technical Problems
3. Costly Set Up
4. More Working Hours
5. Delay in Response
6. Coverage of the Camera

Multimedia Broadcast Services

The Third-Generation Partnership Project (3GPP) defined multimedia broadcast/multicast service in 2005 to optimize the distribution of broadcast and multicast services in GERAN (GSM/EDGE) or UMTS mobile networks. This standard covers the terminal, radio, core network, and user service aspects. This MBMS standard has evolved into enhanced MBMS (eMBMS) that builds on top of the 3GPP Long Term Evolution (LTE) standard. eMBMS evolution brings improved performance thanks to higher and more flexible LTE bit rates, single frequency network operations, and carrier configuration flexibility.

In MBMS, there are two different kinds of services defined. A broadcast service in which every user can receive the information within the service area and a multicast service in which only users who have subscribed to the service can receive the information. Multicast

users have a return channel which gives the possibility for interactive services. This return channel can also be used to subscribe to the desired service.

Retrieval from Video Databases

Building a Digital Library of Broadcast Videos

Digital libraries of broadcast videos allows one to archive television content for later viewing and reference. The importance and significance of such a library is similar to building a digital library for all books. The collection in the library is built by recording TV. Since it is difficult to record and store all channels simultaneously, a schedule is chosen to record programmes across various channels. An UI allows users to choose the schedule to be recorded for later viewing.

The videos are stored over multiple nodes that act as a storage cluster. An explicit file system structure is maintained for storing the videos.

Indexing Broadcast News

Broadcast news is a class of multimedia that is of importance to both the scientific community and the general public. In broadcast news, the requirement is to provide content-level search and retrieval, which is very challenging. Though many broadcast news datasets are available, there is no collection pertaining to news in the Indian context. We built a system to automatically record and build a repository of Indian news broadcasts

Searching News Using Overlaid Text (Without Character Recognition)

There have been several approaches to video indexing and retrieval, based on spatio-temporal visual features. However, they are not always reliable and do not allow for easy querying. News video have many clues regarding the content of the video, in the form of overlaid text.

Recent development in multimedia e-learning technologies

Multimedia and networking technologies have significantly impacted on our daily activities, particularly in terms of how we learn. Nowadays, classroom teaching no longer simply relies on chalk and blackboard as the prime medium for course dissemination. E-learning technologies have made it possible to provide a virtual classroom environment on the Web through supporting teacher-student and student-student communications, course material distribution as well as online student assessments. They provide students with more control over their learning schedule and pace. On top of this, multimedia technologies further offer students different forms of media to match their learning styles, leading to enhancements of their learning effectiveness. This extended introduction discusses the latest e-learning specific multimedia technologies, their research challenges and future trends from both pedagogical and technological perspectives.