

Introduction to Digital Video

Significance of the topic

With the increasing accessibility of technology for everyday people, things are starting to get digitalized: digital camera, digital cable, digital sound, and digital video. It is no longer the case where a video production is only possible for specialized studios. The availability of various user-friendly, inexpensive tools is pushing motion pictures into individual computer owners.

Discussion

What is digital video?

Digital video refers to the capturing, manipulation, and storage of moving images that can be displayed on computer screens (The Lycos Tech Glossary, 1999). This requires that the moving images be digitally handled by the computer. The word digital refers to a system based on discontinuous events, as opposed to analog, a continuous event.

Computers are digital systems; they do not process images the way the human eye does.

So how does it work?

Before the Digital Era, to display analog video images on a computer monitor, the video signal had to first be converted from analog to digital form. A special video digitalizing overlay board or hardware on the motherboard had to be installed in your computer to take the video signal and convert it to digital information (Vaughan, 1998). To do this, however, required a very powerful computer to be able to read and digitalize every frame repetitively. So the next step in digital video evolution was to eliminate the analog videotape. Thus, the entire procedure, including the capturing of video, is in digital form.

First, a camera and a microphone capture the picture and sounds of a video session and send analog signals to a video-capture adapter board. The board only captures half of the number of frames per second that movies use in order to reduce the amount of data to be processed. Second, there is an analog-to-digital converter chip on the video-capture adapter card, and it converts the analog signals (waves) to digital patterns (0s and 1s). Third, a compression/decompression chip or software reduces the data to a minimum necessary for recreating the video signals (White, 1999). In this procedure, no analog was involved, making the process more efficient.

Advantages

What is it about digital video that makes it so attractive? Isn't videotape good enough? Here are three of many reasons that explain why digital videos are becoming more popular than ever.

Ease of manipulation. The difference between analog and digital is like comparing a typewriter with a word processor. Just like the cut and paste function is much easier and faster with a word processor, editing is easier and faster with a digital video. Also, many effects that were exclusive for specialized post production houses are now easily achieved by bringing in files from Photoshop, Flash, and Sound Edit as components in a video mix (Seecharan, 1999). In addition, the ability to separate sound from image enables editing one without affecting the other.

Preservation of data. It is not true that DV is better simply because it is digital. Big screen films are not digital and are still highly esteemed as quality images. However, it is easier to maintain the quality of a digital video. Traditional tapes are subject to wear and tear more so than DVD or hard drive disks. Also, once done, a digital video can be copied over and over without losing its original information. Analog signals can be easily distorted and will lose much of the original data after a few transfers.

Internet. A digital video can be sent via the Internet to countless end users without having to make a copy for every viewer. It is easy to store, retrieve, and publish.

Compression

Digital video files can be very large. For example, one single frame from a television image with a resolution of 720 x 576 pixels and a color depth of 16 bits has a size of 1.35 MB (Fisher & Schroeder, 1999). Multiply that by 25 frame per second and then by the duration of a movie! It is not practical—sometimes impossible—to have videos of this size. Thus compression, the process of reducing file size by eliminating unnecessary data for reconstruction purposes, is a must.

There are two types of compression, “lossless” and “lossy”. The lossless compression retains the original data so that the individual image sequences remain the same. It saves space by removing image areas that use the same color. The compression rate is usually no better than 3:1 (Fisher & Schroeder.). The low rate makes most lossless compression less desirable. The “lossy” compression methods remove image and sound information that is unlikely to be noticed by the viewer. Some information is lost, but since it is not differentiated by the human perception, the quality perceived is still the same, while the volume is dramatically decreased.

There are many compression formats. Here are the few most widely used.

MPEG(pronounced em-peg) stands for Moving Picture Experts Group. The term is generally used to name the set of digital video compression standards and file formats developed by this group. MPEG uses lossy compression, and achieves a high compression rate by storing only the changes from one frame to another (the delta), and not the entire frame. There are two major standards. MPEG-1 provides a 352 x 240 resolution at 30 frames per second. The product quality is a little below VCR videos. The MPEG-2 provides a 720 x480 and 1280 x 720 resolutions at 60 frames per second,

with full CD-quality audio. It can compress a two hour video into a few gigabytes. MPEG-2 is sufficient for all major TV standards and DVD-ROM (Fisher & Schroeder). MPEG-4 is in development (there is no MPEG-3), and will provide multiple views and multiple soundtracks of a scene, as well as stereoscopic and 3-D views (Vaughan, 1998).

AVI stands for Audio Video Interlaced. It is one of the oldest formats. It was created by Microsoft to go with Windows 3.1 and it's "Video for Windows" application. Even though it is widely used due to the number of editing systems and software that use AVI by default, this format has many restrictions, specially the compatibility with operations systems and other interface boards (Fisher & Schroeder).

MOV format, created by Macintosh, is the proprietary format of the QuickTime application. It can also run on PCs. Being able to store both video and sound simultaneously, the format was once superior to AVI. The latest version of QuickTime also has streaming capabilities for internet video. However, with the new MPEG-2 format, the MOV format started to lose its popularity (Fisher & Schroeder, 1999), until it was decided that the MPEG-4 is to use the QuickTime format as the basis of its standards.

Digital video via Internet

Due to the size of some large video files and the limited bandwidth, transmission of video and audio data via the Internet is only possible using streaming technology. The current big players in the streaming media business are Real Networks and Microsoft. But, it was big communication companies such as CNN who first offered this technology. Now Real Network's Real Audio and Real video streaming formats are the pseudo standards (Fisher & Schroeder).

Integrating digital video into a Web Page

There are some pros and cons in putting a video on a web page. For one, it could be very compelling and could really enhance the interest level of the site, thus attract people to view the page. On the other hand, poorly designed video (or animation, for that matter), can distract viewers. If your video is too large, it will take a long time to load, and the viewer will grow impatient waiting on a blank screen and will move on to another web site. A good rule of thumb is to not let video be the only way to access information.

Offer alternatives: preview clips with lower resolution and shorter duration, a still picture with some captions, exported sound files, movies of smaller size windows (Waters, 1997). For example, if you have four videos on a page, by showing a still image of each with a sentence or two describing the video you would allow the viewer to decide which they wanted to take the time to watch and would not need to start streaming the ones in which they are not interested.

Because of the limited bandwidth and the traffic load on the net, it is important to compress a digital video file as much as feasible in order to deliver good quality video. However, do not take a movie that's already compressed for CD ROM and re-compress it for the web. *Compress the originally captured files with light or no compression and re-edit and compress those, to ensure quality* (Stern & Lettieri, 1998). Another tip is if the video you plan to use on a page uses a smaller window than the original, reduce the window before you compress it to get a smaller file. As far as color, if the compressor lets you choose the number of colors, choose the greatest number. Lowering the number of colors generally doesn't lower your final file size enough, but you might lose the quality of colors and lighting in the final product. Nevertheless, if you know that your video uses 256 colors, there is no need to go beyond that (Stern & Lettieri).

To post the video on a web page, you need to make sure the server is configured for the format you are using. For example, if you use a QuickTime movie, the server needs to have a listing for QuickTime files in its configuration files. Many times this step is automated, sometimes in default format and you need not worry about it. Then, to attach the video by using HTML, include an EMBED tag in your code when and where you want the video to appear:

```
<HTML>  
<BODY>  
<EMBED SRC= "my_video.mov" WIDTH=320 HEIGHT=256>  
</BODY>  
</HTML>
```

You may be using web authoring tools that enable you to skip the codes and use other mechanisms (icons, for example), to “attach” the video to your web design. This is only the beginning of posting a video to a page. There are many other features—some of them highly advanced—that can be added to a digital video online either through the HTML codes or through the video production application program (Stern & Lettieri), which are beyond the scope of this paper.

Summary

Digital video are becoming more popular and accessible through the various media technology advances which enable users to capture, manipulate and store video data in efficient and inexpensive ways. With the increasingly efficient compression formats and easiness of integrating videos in web pages, more people are able to enjoy producing and publishing movies in the digital world.

Reference and related web sites:

<http://www.apple.com/quicktime/download>

Fisher, B. and Schroeder, U. (1999). <http://www7.tomshardware.com/video>

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