ROSE BRUFORD COLLEGE
SOUND & IMAGE DESIGN

Desktop Publishing Unit

SORENSON VIDEO COMPRESSION

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Introduction

As we all know, the dialect which accompanies all areas of multimedia can at first, appear somewhat daunting.

With digital video providing its fair share of confusion, terms such as ‘codec’ and ‘architecture’ can appear daunting.

This document will attempt to paint a clearer picture.

Codecs

With the capabilities of the personal computer advancing in leaps and bounds, desktop video editing has become a feasible possibility.

However, as video places the greatest demands upon a computer’s system resources, it is often still a slow and laborious task. Therefore, it requires an enormous bandwidth to play via networks or the Internet.

In addition to this, uncompressed video requires extensive amounts of hard disk space - approximately 27 MB per second - giving a CD-ROM the storage space for a mere 24 seconds!

It is for this reason that compression / decompression algorithms (codecs) were created, drastically reducing file size, and allowing more realistic manipulation of video.

> *The function of a codec is to compress both video and audio during the ‘encoding’ process, and then decompress them during playback.*

As most images and sounds contain more aspects than we can discern, one form of compression, ‘**Lossy**’, works by the elimination of redundant video and audio data.

This often produces a high quality video, with a vastly reduced file size, making it suitable for the web or CD-ROM distribution.

Greater compression can be attained with more data removal. However, this will certainly result in sound and image degradation.

An alternative form of compression to ‘**Lossy**’ is ‘**Lossless**’. ‘**Lossless**’ takes another approach, attempting to compress all data, without removal.

Therefore, the finished product is of the same quality as it was to begin with. This method of compression yields exceedingly high quality audio and video, yet demands a lot of storage space, and is therefore, inefficient for CD-ROM or web delivery.

However, this is a suitable format for television broadcast.

A technique by which compression is applied to one single frame of data is known as '**Spatial Compression**'.

The frame is compressed independently from other surrounding frames. This compression can be either lossy or lossless.

A frame which has been spatially compressed is often referred to as an "**intraframe**."

Whereas, an alternate compression method, '**Temporal Compression**' stores only the differences between frames.

Areas which have remained unchanged are simply repeated from the previous frame, or frames. A frame which has been temporally compressed is often referred to as an "**interframe**."

Needless to say, every codec has its good and bad points. With some specialising in CD-ROM distribution, others with the web, (often incorporating 'streaming' capabilities), and others with digital television broadcasts.

Which Codec?

Choosing the right codec for your purposes is very important. You must take into consideration your hardware/software limitations, and the capabilities of your end user's system.

For example, some codecs, '**asymmetrical**', compress at a very slow rate, and yet decompress very fast.

Whereas, '**symmetrical**' codecs compress and decompress at the same rate.

Further file size reduction can be achieved with codecs, by exploiting the physical nature of human vision.
The human eye reacts to luminance (brightness) better than to chrominance (colour).

With the storage of colour data in 4x4 sections, (commonly known as '**YUV-9 colorspace**'), file size is drastically decreased.

Movies produce a superior display when viewed at native frame rates. However, if it should be essential for the frame rate to be reduced for reasons such as hardware deficiency, it is desirable to divide the frame rate by whole numbers.

This maintains an even duration for each frame, and thereby impedes the tendency to display in a juddering fashion.
Therefore, in order for compression of PAL video (25 fps), the frame rate should be divided by 2, 3, 4, 5 etc, to maintain an even playback.
This would produce frame rates of 12.5, 8.3, 6.2, 5 etc.

An alternative to previously mentioned codecs, are hardware codecs. They are supported with interface cards. These cards both compress the files, and play them back. Although such hardware codecs often yield higher quality products, the end user must also possess the necessary hardware to playback the file.

For general use, a software codec is the most sensible option. With no specific interface card requirements, distribution is made simple.

Internet Codecs

Cinepak - fair quality - able to run on older PCs

Sorenson Video - high quality

MPEG-4 - high quality

RealVideo G2 - widely used ‘streaming’ codec

CD-ROM Codecs

Sorenson Video - high quality - requires Pentium processor

Cinepak - fair quality - able to run on older PCs

Indeo Video 4/5 - high quality - requires Pentium processor

Eidos Escape - high quality - requires rapid data rates

MPEG-1 - high quality - requires Pentium processor
MPEG-2 - high quality - DVD-ROM video

Cinepak

Amongst popular codecs, two of the leading contenders are ‘**Sorenson Video**’ and ‘**Cinepak**’.

Cinepak (manufactured by Apple), could claim that it was virtually the industry standard in video delivery.
It was primarily developed to play small videos on approximately 25Mhz machines, utilising a single speed CD-ROM drive.

One of its most desirable features is the extremely low demand that it places upon the CPU. Although it now suffers when compared against newer codecs, the quality/data rate that Cinepak offered when first released, was quite revolutionary.

Even today, Cinepak, with its ability to play videos on an extremely wide range of computers may still be a wise choice of codec.

Sorenson

As you can see from the list of codecs (page 3), 'Sorenson Video' yields very high quality products, suitable for delivery over the web or via a CD-ROM.

It is considered by many to be the leader in multimedia video compression. In many cases, codecs are often included within video applications such as QuickTime.

Sorenson Video along with many other software codecs are contained with QuickTime Movie Player, allowing the widest possible distribution of files compressed with Sorenson technology.

The full registered version of QuickTime also caters for Sorenson encoding.

Sorenson Video generates superb highly compressed video, suitable for web and CD-ROM, at a fraction of conventional data rates.

It is best suited to the capabilities of computers running at or above 120 MHz, e.g. Pentium.

Sorenson Video uses '**Temporal Compression**' (often referred to as '**Interframe Compression**').

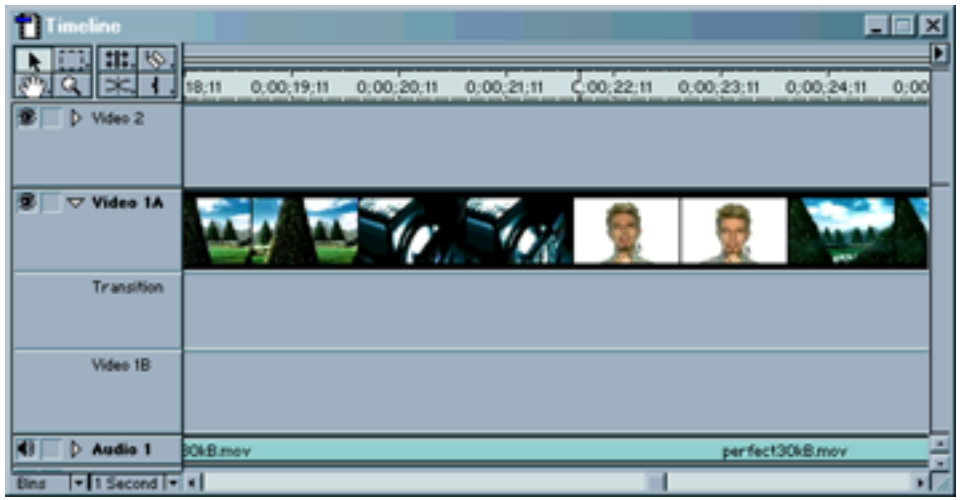
Put simply, many frames are modelled upon the preceding frame(s), with unmodified information being repeated - e.g. in this movie, the uniform white background is merely reproduced from earlier frames.

This efficient use of temporal compression, enables Sorenson video to produce movies which require a much lower data rate than most other codecs.

Keyframes

With Sorenson, the initial frame of any movie will always be a ‘keyframe’. These are intraframes, and are used as reference points for the subsequent interframes.

Sorenson Video compresses a fresh keyframe when the following frame(s) are found to contain notable differences. The difference threshold can be altered manually.



Above: The ‘Timeline’ from Adobe Premiere 5.01

Audio

With the advent of such powerful codecs, the moving image aspect of video is often no longer the most demanding on system resources. Audio is more often than not, the overriding
factor when dealing with file size etc.

In answer to this problem, several audio exclusive codecs have been developed. As with video codecs, they all have their strengths and weaknesses, and deal with different areas of sound.

e.g. ‘**PureVoice**’ is an exceptional codec for compression of the spoken word - (but with limited uses outside of this).

A safe choice for most Sorenson Video needs is ‘**QDesign Music**’, incorporating astounding sound quality with unbeatable compression.

Cinepak Advantages

- Plays well on the majority of 486 PCs or 68040 Macs.
- It is frequently the best choice for 2 speed CD-ROM data rates.
- It is featured in both video for Windows and QuickTime. Therefore, files can be transcoded between the differing architecture, thus avoiding the necessity of recompression.

Cinepak Disadvantages

- Video quality may be inferior to that of newer codecs at similar data rates.
- Its web performance is poor at data rates lower than 30KBps.
- It uses a minimum compression of 10:1, therefore, limiting its uses for higher data rates.

Sorenson Advantages

- When compared with its rival Cinepak, Sorenson regularly offers images of double the quality and half the file size.
- It performs well at data rates between 2 - 200 KBps.
- It offers variable bit rate encoding. This enables it to provides the optimum quality at any data rate.
- Sorenson Video also has a couple of notable features. In a rather successful attempt to curb Sorenson's demands on slower machines, 'Temporal Scalability' was introduced, greatly reducing the jerky effect seen with other codecs.
  Temporal Scalability allows a video to playback at a high frame rate (e.g. 30fps) on more recent computers, and gently reduce the frame rate for use on less able machines (e.g.15fps).

Sorenson Disadvantages

- It needs a faster computer than Cinepak, for the playback of CD-ROM based video.
- Whilst it offers outstanding quality on high-end machines, it performs poorly on computers of a lower specification. This particularly applies to videos larger than 320x240, or those running at data rates above 100 KBps. Therefore, One must be aware as to the capabilities of the end-user machine before One could safely chose this codec.
- It suffers from "bleeding" and blockiness relating to highly saturated colours.

Undefined Terms

Architecture - A system extension, plug-in, etc. Examples of this are: QuickTime, RealMedia, & Vivo, which enable the viewing of video media.

Streaming - The ability to both display and load media simultaneously.

End User - This term refers to the capabilities of the intended computer system.

Bibliography

Books

Gibson, J etc. *Digital Compression for Multimedia.* US. Publisher: Morgan Kaufmann Publisher. 1998.

Internet

Terran Interactive, *Codec Central.*
URL: http://www.terran.com/CodecCentral/index.html

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How MPEG Video Compression Works.
URL: http://home.earthlink.net/~radse/page10.html

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Sorenson Vision Inc, *Sorenson Video.*
URL: http://www.s-vision.com/