

Contents

Overview 2

Video Processing 2

Audio Processing 4

Work Flow 4

Options 5

TV System and Shape 5

NTSC Output 5

PAL Output 5

Brightness Control 6

Encoder Presets 6

Post Processing 6

Auto-Mask 6

Filter Popup 6

Median Filter 6

Anti-Alias Filter 6

Nominal Frame Rate 6

23.976 (Natural Rate) 7

24 FPS Exactly 7

Lock Movie Scale to Video 7

Force Black and White 7

MPEG Telecine 8

Force Anamorphic 8

Frame Rerater 8

Using QuickTime MPEG Encoder for Film 10

Overview 10

NTSC Ouput Step by Step 10

PAL Output Step by Step 10

Using BitVice for Film 12

Overview 12

NTSC Output Step by Step 12

PAL Output Step by Step 12

Using TMPGEnc for Film 14

Overview 14

NTSC Output Step by Step 14

PAL Output Step by Step 15

Using ProCoder for Film 16

Overview 16

NTSC Step by Step 16

PAL Output Step by Step 18

DVD Film Transformer Technical Bits 20

Altivec 20

Video Scaling 20

Audio Scaling 20

Inverse Telecine 20

Median Filter 20

Anti-Alias Filter 20

DVD Film Transformer

A QuickTime Export Filter

DVD Film Transformer is a simple way to convert between video formats based on progressive sources. Transform NTSC video derived from film sources back to the original 24 FPS progressive frames of the film and make them ready for optimal DVD production. Use progressive PAL video for NTSC presentation and progressive NTSC for PAL formats. Convert 4:3 video to anamorphic format at will.

DVD Film Transformer does not, however, process interlaced video into progressive video. That 'deinterlacing' operation, something that is either quick and dirty or good and slow, must be performed in some other application.

Removing duplicate fields from telecined NTSC video before input to the MPEG encoder allows it to use all the bits available to encode unique frames in the source, improving quality or extending the maximum time that will fit on a disc.

If you use progressive PAL DV as a film substitute, you can quickly transform it for presentation on NTSC systems.

In addition, DVD Film Transformer offers several options that can improve the appearance and encoding efficiency of less than perfect video.

DVD Film Transformer is a new kind of export component that acts as a filter between the source video format and the destination video format.

It performs its task on the source video and then encodes the result using the method of your choice, this allows it to write almost any kind of file supported by QuickTime, without an intermediate encoding.

Quick Start:

Capture the source video at 720x480 or 486 at the best quality you can manage.

Trim (but do not edit further) the video to remove non-film elements.

Open the result in the QuickTime Player and select Export.

Select the DVD Film Transformer option from the pop-up and click Options.

Select QuickTime Movie as the destination and press the options button next to the selection. Choose a high quality video output codec. Set the highest quality and single field mode if available. Choose audio out as 48 KHz 16-bit Stereo, with no compression.

OK each of the options dialogs, select a filename and save the exported file in a location with adequate space.

Encode the file with your MPEG Encoder. Encode the audio with A.Pack

Author, build and burn the DVD.

Overview

Video Processing

How your video is processed depends on its source. If your video is NTSC and has been telecine processed (with 3:2 pulldown added) then preparation of video that originated on film for DVD begins with the recovery of the original progressive frames from the video using a process called inverse telecine. Inverse telecine reverses the original telecine process where the original 24 FPS source is padded with duplicate fields to a 30 FPS rate.

If your video is in a 24 fps progressive format or a

PAL (25 fps) format, the inverse telecine step is not required.

Once the progressive frames are available, DVD Film Transformer offers several optional post processing steps:

1. Correct illegal video levels produced by some video sources, particularly DV cameras. These cameras often produce levels that are outside the limits of the DV specification. Some encoders respond very poorly to these illegal values.

Here you have three choices:

a. Unmodified

Allow illegal values to pass through the export filter.

b. Clamp to legal range

This causes any black level below the minimum value to be converted to the minimum value and any white level greater than the maximum to be converted to the maximum value.

c. Scale into the legal range

This causes the pixels that are outside the legal range to be scaled into it. To avoid changing the mid-range values that contain most of the visual information, this scaling is done with an S-shaped curve that compresses the illegal blacks into the dark range and the illegal whites into the brightest range while leaving the mid-range unaltered.

If your video is legal (you can check this with Final Cut Pro or Premiere), then leave it unmodified.

2. You can clean up the black letterbox bars above and below the active video of wide screen movies. This is desirable because when you capture video from an analog source, those bars will not be truly black, but dark gray with speckles.

Note: This function is only available when performing inverse telecine on NTSC video.

If not cleaned up this dark gray area with speckles will use a large part of your MPEG encoding bandwidth, for no gain.

DVD Film Transformer will perform this task when you select Auto-Mask (during inverse telecine only). It will monitor the location of the active video and fill the area that is consistently black with solid, noise-free digital black.

3. You can filter the video itself to reduce noise for the encoding process. Video from analog sources often has impulse noise that both degrades the final picture and uses up scarce MPEG encoding bandwidth.

DVD Film Transformer offers two such filters (only one can be applied at a time):

a. Median Filter

Applying the Median Filter causes the image to be processed so that each final pixel is the median value of the 9 pixels in a 3x3 array that it is at the center of.

This type of filter is very effective at reducing point noise and smoothing the result, but it can aggravate aliasing (flickering) that occurs with thin horizontal lines in the video.

b. Anti-Alias Filter

Applying the Anti-Alias Filter to the video causes DVD Film Transformer to perform a full screen anti-aliasing algorithm to the video that reduces the stair-step effect of diagonal lines and provides a small amount of smoothing. It provides less smoothing than the Median Filter, but improves the representation of small horizontal lines.

Which filter (if either) you choose will depend on the nature and quality of the input video. Some experimentation may be required.

You can also choose 'None' to perform no filtering.

4. You can mask off the right and left edges to remove then soft (and usually invisible) edges that can occur when video is digitized. This limits the active width to 704 pixels and replaces those outside with black.

5. For conversion of old black and white movies, select Force B&W. This removes all color information from the output video which eliminates false colors that can appear during capture or processing. It also can reduce encoder bits spent encoding color information due to invisible variances in the black and white

footage.

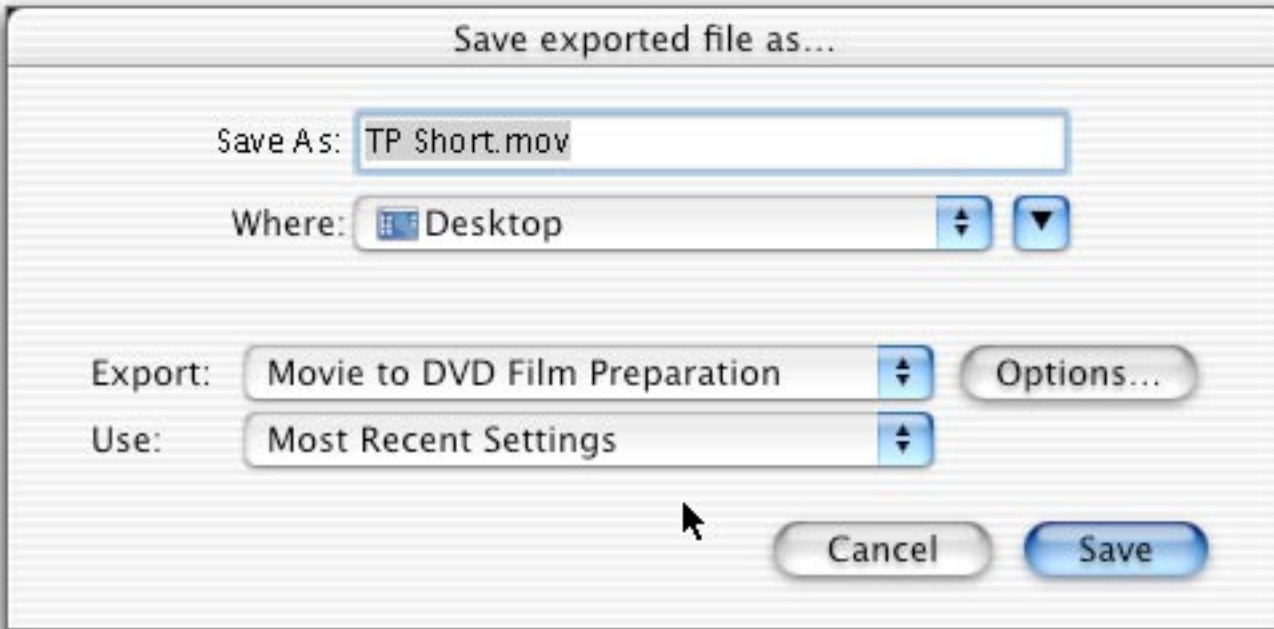
You must select two options before you proceed. First, specify what video format you want from DVD Film Transformer. You have four choices:

a. NTSC 4:3 (standard)

that of the video that it outputs.

You can choose to direct the audio either to an audio track of the output movie or to a separate file for encoding with A.Pack.

You can also choose to ignore the audio and export it later from the original source video, perhaps performing your own scaling.



b. NTSC **Select Movie to DVD Film Transformer as the Export type, then click options**

16:9 (widescreen or anamorphic)

c. PAL 4:3 (standard)

d. PAL 16:9 (widescreen or anamorphic)

You should also check the 'from' setting. This will be either 4:3 or 16:9, depending on your input footage. DVD Film Transformer will set this if the video includes the proper QuickTime extensions, but many video sources do not. If the wrong value is selected, your video will be oddly scaled and probably not what you intended. Set this based on what is, not what you want.

Audio Processing

DVD Film Transformer also assists in managing the audio that accompanies the video. In circumstances where the running time of the video is changed, such as in conversion to or from PAL, DVD Film Transformer will adjust the duration of the audio to match

the 48 kHz rate if possible.

2. Trim the captured footage using QuickTime player or other low overhead video editor to remove logos and warnings that are not derived from the original film. Save a reference movie (allow dependencies).

3. Export the trimmed reference movie using the Movie to DVD Film Transformer selection. Using the QuickTime Movie option, choose the highest quality output codec that you have space for. If your source is DV, DV NTSC (PAL if you are targeting PAL) is a good choice. For source in YUV formats, Component Video, Photo JPEG or MJPEG-A/B are good choices at the highest settings. If the audio is not already at 48 kHz, enable sound for the output movie at that rate.

4. Perform any edits to the 24 FPS video that may be necessary.

5. Encode the resulting movie with an MPEG encoder that supports 24 FPS (25 FPS for PAL) output.

Work Flow

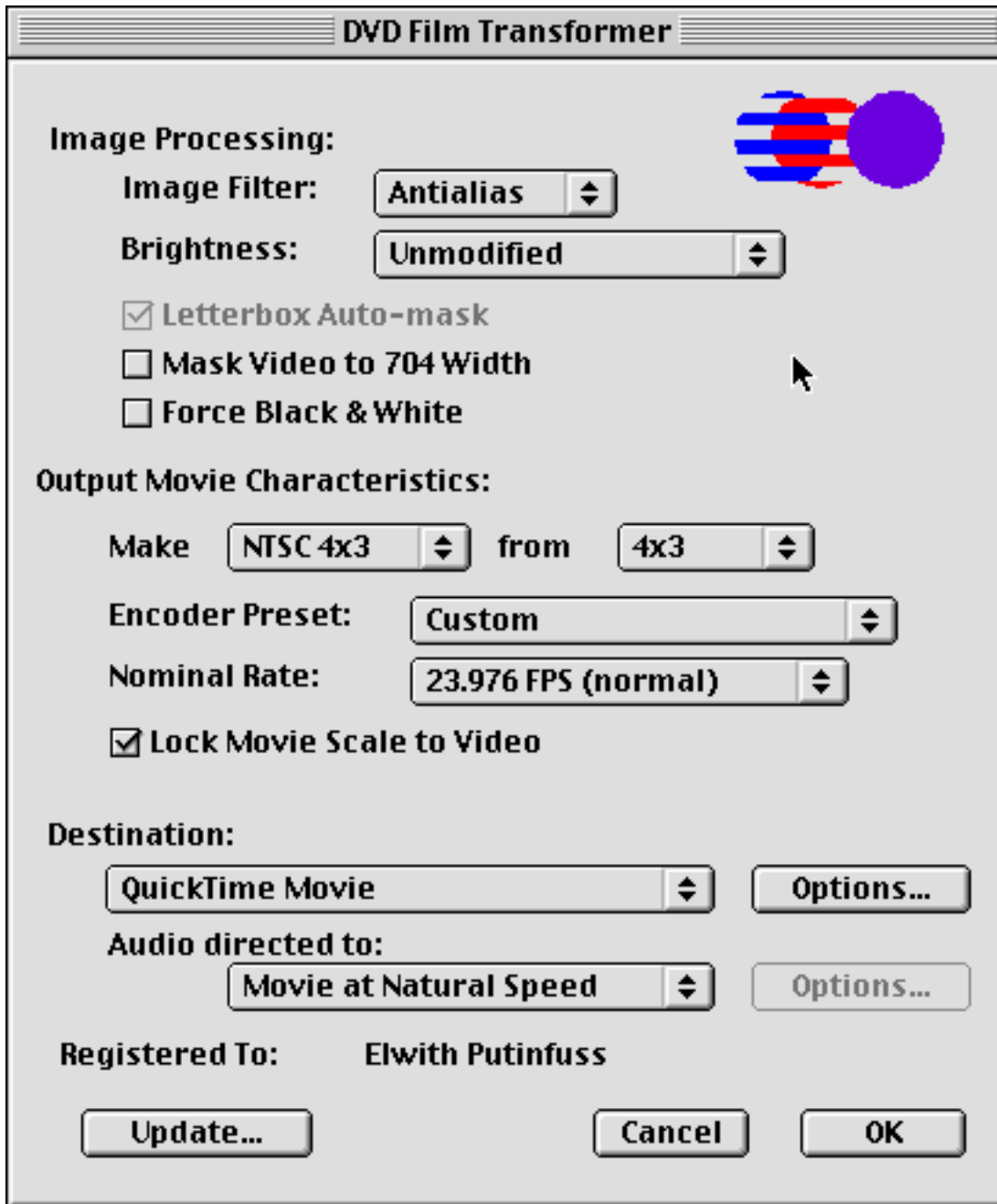
1. Capture your analog video from the source using the highest quality settings at 720x480 or 720x486 for NTSC, 720x576 for PAL image size. Capture the audio at

6. If your MPEG encoder does not insert the telecine flags (Repeat First Field, Top Field First), use the included MPEG Telecine application to add those flags and make the output suitable for DVD presentation.

10. Author, build and burn your DVD.

Options

TV System and Shape



The TV System and shape of the picture are the most important settings for DVD Film Transformer. It can accept video in either 720x480 or 720x576 forms and convert it to PAL or NTSC, standard or anamorphic formats. Which of these you choose will determine the options available in the frame rate area (PAL uses only one frame rate).

NTSC Output

When you select NTSC output (either 4:3 or 16:9) the video frame size will be 720x480. Since NTSC may be encoded at several different frame rates to achieve optimal results, several options are enabled when you select it.

PAL Output

When you select PAL output (either 4:3 or 16:9), the video frame size will be 720x576. The

Select the options appropriate to your video and the encoder you will use

video will be scaled into that size after the progressive frames are recovered and post processing filters are applied.

7. Export the audio either from the reference movie created in step 2 or the DVD Film Transformer movie created in step 3 as an AIFF or WAV file.

8. Use A.Pack to convert the audio file to AC-3 format.

9. Add the video and audio assets to your DVD SP project.

The frame rate is locked at 25 FPS, which is universal for PAL. Since the same frames will be displayed at a slightly faster rate than the normal 23.97 FPS, the runtime of the final movie will be about 4% shorter than the original.

To facilitate the conversion, the duration of the audio is reduced to match. The pitch will be shifted slightly by this audio scaling.

The audio options will change somewhat when you select a PAL format, since the audio must be scaled to maintain audio synchronization.

Brightness Control

Some video sources produce video luma or brightness levels that exceed the limits of the video specifications. This can cause artifacts with some encoders. You can leave the levels alone, clamp them to the legal range or scale them into the legal range. For minor or rare excursions outside the normal range, clamping will change the video the least. For video with substantial parts outside the range, scaling will preserve some detail from areas that would be clamped.

Encoder Presets

You can setup the basic parameters for some common encoders by selecting an encoder preset. This will set the frame timing and audio output type according to the recommendations later in this document.

You must still set the particular codec for both audio and video. In particular, you must set the audio section to 48 kHz, 16-bit, stereo or mono to use it with A.Pack.

Post Processing

There are several optional features that you can enable during preparation for DVD encoding. Inverse telecine is always performed.

Auto-Mask

The Auto-Mask option (only available during the processing of NTSC video by inverse telecine) examines each video frame to determine how much video is active and how much is composed of black letterbox bars. It tracks this information over a number of past and future frames and uses the most conservative values to set the area that is written with clean, digital black to the output. This avoids errors that might occur if frames were evaluated in isolation where dark gray (but real) video might be overwritten.

If you are working with letterboxed source, turn this

option on. If you are working with full screen video, turn it off. If the video is mixed, leave it on.

If your video is full screen, do NOT use this feature.

Filter Popup

Under the filter popup item you can choose to leave the video alone (None) or apply either a median or anti-aliasing filter.

Median Filter

The Median Filter is a noise reduction filter that replaces each pixel in the source with the median value of the 9 pixels in the 3x3 square that contains the source element.

Since the median is not the average, this tends to preserve edges better than blurring filters. However, it also tends to aggravate flicker problems with small horizontal lines, like the slats of window blinds.

Anti-Alias Filter

Aliasing is a natural byproduct of the conversion of analog signals to digital form. It is best known as the stair-step effect seen on computer monitors with diagonal lines.

Anti-aliasing is a method of blending the sharp corners of digital signals so that the eye sees a more continuous line.

DVD Film Transformer uses a fast and effective algorithm to perform this anti-aliasing function on your digital video. This reduces a number of undesirable artifacts that occur during recording and digitizing of video, including pixel crawl around the edges of objects and flicker in small horizontal lines.

This filter also smooths some amount of noise from the image, but less than the median filter. It works best with high quality sources.

Nominal Frame Rate

DVD Film Transformer can output the progressive video at several frame rates to facilitate encoding. In each case, the same number of frames are written to the movie.

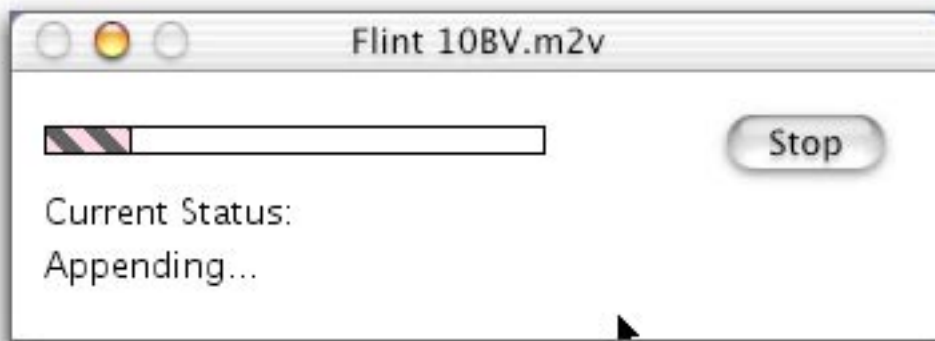
23.976 (Natural Rate)

The natural rate of telecined NTSC material is 23.97 FPS. At this rate the run time of the movie is unchanged and the audio does not need to be scaled. Use this rate when possible.

There are cases when this is not appropriate such as when it is not supported or poorly supported with a specific encoder.

24 FPS Exactly

Setting the 24 FPS Exactly option causes DVD Film Transformer to change the timing slightly so that



MPEG Telecine Converting an MPEG File For In-Player Telecine

instead of the natural 23.976 rate of inverse telecine video from a 29.97 FPS source, the output has exactly 24 frames per second. The actual frames are the same.

At this rate, you should either choose to export the audio as an AIFF file (if you are preparing a DVD) or scale it to fit if you want to use a frame rate of 24 fps with another encoder such as Sorenson.

This option is offered primarily because it may make encoding from a QuickTime movie much more efficient with encoders like TMPGEnc when used with the Lock Movie Scale to Video option. (The QuickTime plug-in for TMPGEnc tends to confuse the movie scale with the frame rate, which makes it very slow to encode QuickTime movies using either the 600 or 2997 scales).

Lock Movie Scale to Video

The default scale for QuickTime movies is 600 units per second. This value dates from the first version of QuickTime before there was any serious thought of using QuickTime for broadcast quality video. This

value was chosen as a value that is evenly divisible by many common frame rates including 12, 24, 25, and 30 FPS.

Unfortunately, it is not possible to use the real NTSC based frame rates of 29.97 and 23.976 FPS with this value without operating on partial frames. This causes time slip and synchronization problems when a number of segments are cut and pasted together and encoded by a fixed frame rate process like MPEG.

When you set the Lock Movie Scale to Video option, DVD Film Transformer will force the output movie scale to be the timescale of the output video track (2997, 25 or 24). This will allow that movie to be edited and encoded cleanly without having to deal with partial frames.

Used in conjunction with the 24 FPS Exactly option, this may improve performance of the TMPGEncoder on the PC when the output movie is encoded.

Force Black and White

This option removes all color from the output video, creating black and white images. It will reduce or remove color fringing that can occur when black and white video is played. It also insures that the video will be encoded with maximum efficiency/quality.

Auxiliary Programs

MPEG Telecine

MPEG Telecine is an MPEG post-processor that will add the necessary player level telecine flags that allow 24 or 23.976 FPS encoded MPEG files to be used as DVD assets in DVD Studio Pro.

Some MPEG encoders can insert these flags themselves, in which case post-processing is not required. Most encoders, however, omit this feature so you will need to post-process the encoded MPEG file to make it meet the DVD requirements.

Force Anamorphic

Force Anamorphic is another MPEG post-processor that changes the specified aspect ratio of the MPEG file produced by an encoder to 16x9 or anamorphic mode.

Use this post-processor when your MPEG encoder does not support anamorphic video (and the source video is in anamorphic form) or if you forget to set that option when encoding.

Frame Rerater

There are times when you just need to change the frame rate of video without altering it in any other way. Frame Rerater will do this for you.

quick. Any movie can be retimed in a fraction of a second.

To use Frame Rerater, drop the movie that you want to change on the application or launch the application and open the movie in the usual way.

The movie at its original rate will be displayed in the window. Below the standard movie viewer, you will see a few items. On the lower left, is a pop-up button that is initially set to 'Original'. This is the main control that determines the frame rate of the output movie.

You can set the control to 23.976 fps, 24 fps, 25 fps, 29.97 fps or 30 fps. Whatever rate you select will become active immediately in the viewer window.

You can also select a 'Custom' rate other than those shown. In this case, you enter the interval for each frame in the text box to the right of the pop-up, then enter the timescale that will be used. The interval divided by the timescale defines the frame rate of the movie. That value is shown in the information area between the pop-up and the interval text box as soon as you press the Update button to the right of the time scale box. When you press that button, the movie in the viewer will be updated as well.

When you have set the new framerate, the file name text field at the lower right of the window will become active with a default file name. A 'Save As' button immediately to the right of the text box will also become active.



Settings area of the Frame Rerater Window

Frame Rerater creates a reference movie from the original at any frame rate you specify. This movie is very small by comparison with the original because it uses the video samples from the original. Because it just alters the timing, there is no decoding and encoding so there is no generation loss.

Since it only works with the video timing, it is very

This approach is used instead of the traditional Save As window because to be portable between machines, the original and the reference movie must be on the same disk and preferably in the same folder.

Save As will not permit you to overwrite the original movie because the new movie would be useless without the original.

Frame Rerater is primarily used for changing the video frame rate, by changing the movie's internal timescale and that of its media and setting all video sample time to the value specified. In addition, it uses basic QuickTime functionality to scale the other tracks including audio and text so that they will be in at least approximate synchronization.

Using QuickTime MPEG Encoder for Film

Overview

The QuickTime MPEG Encoder, supplied with DVD Studio Pro is normally used to handle either PAL or NTSC video at the nominal system rates of 25 and 29.97 FPS.

To coerce it into handling 24 FPS film video for NTSC output, you need to feed it frames that it thinks are 29.97 FPS, then it will do what you need.

The QT MPEG Encoder does not support the functionality necessary to export directly from the DVD Film Transformer Filter, so you will have to use an intermediate or transfer codec.

Once the intermediate movie has been created, open it with the QuickTime Player. If you play the movie now, it will run about 25% fast because it is really a 23.976 FPS movie, but QuickTime has been told that it is 29.97 FPS.

Export the movie to MPEG 2 using no audio and a bit rate about 1.2x the actual bitrate you need. So if you calculate that a bitrate of 5.0 would allow you to use the space on the disc effectively, then increase that value to 6.0 when encoding this faked 29.97 FPS footage.

Process the resulting file with MPEG Telecine to restore the original timing and use the result as an asset in DVD Studio Pro.

NTSC Output Step by Step

Prepare to export using DVD Film Transformer.

Select the filename for the output movie, then press 'Options'. Choose '29.97 FPS Output (runs fast)' from the 'Nominal Frame Rate' area.

Select other appropriate options (Filtering, Masking, etc.) as you see fit.

In the output popup, select Export as QuickTime Movie, and press the options button next to that selection.

In the video section, select an appropriate intermediate codec (MJPEG A, B or PhotoJPEG). For best results (but huge disk files) choose component video. Leave the frame rate blank (Best) and leave the size as 'Current'.

Since the frame rate in the movie will be fictional, you cannot include the audio in the movie (it would not match anyway or would sound a bit like the Chipmunks), so select No Audio Output.

Click OK to accept the QuickTime Movie settings.

To extract audio at the correct rate, select AIFF or WAV audio export from the Audio Output popup. Set the rate to 48 KHz and stereo using its options button.

Export the files.

Open the resulting movie file in QuickTime Player.

Export the file as MPEG 2 using the standard NTSC settings (and no audio). Because the frame rate of the MPEG file will be reduced later, you should increase the data rate that you set by about 20%, or use the size on disc to set the rate that you want to use. A nominal rate of 6.0 will allow you to encode 2 hours of video at about the highest quality for a 4.7 GB DVD-R.

When the MPEG export completes, drop the resulting file on the supplied MPEG Telecine application.

Select a filename and location for the final DVD Studio Pro MPEG Asset.

Press save.

When the conversion completes, add the asset to a new or existing DVD Project.

Convert the AIFF or WAV file you created in an earlier step to AC-3 using the A.Pack application that accompanies DVD Studio Pro.

Add that asset to your project.

PAL Output Step by Step

Output for PAL is easy. Just select PAL as the system type with either 4:3 or 16:9.

In the output popup, select Export as QuickTime

Movie, and press the options button next to that selection.

In the video section, select an appropriate intermediate codec (MJPEG A, B or PhotoJPEG). For best results (but huge disk files) choose component video. Leave the frame rate blank (Best) and leave the size as 'Current'.

In the sound section, select compression none, 48KHz, 16-bit and either mono or stereo as appropriate.

In the Audio Output popup, select 'With Movie Scaled'. This will cause the length of the clip to be adjusted so that it remains in sync if the movie is run at the PAL rate of 25 FPS.

When the movie has been converted, open the converted version. You should be able to preview it and verify both appearance and audio synchronization.

From this point on, your actions are the same as with any PAL encode.

Then export the converted movie using the QuickTime Player and the Apple MPEG Encoder. Select PAL, select 16x9 if the video is in anamorphic form, enable Audio save (to have the MPEG Encoder write the AIFF file you will need for A.Pack.)

Encode. Run A.Pack on the output audio.

Add the assets to your project.

Using BitVice for Film

Overview

BitVice is a reasonably priced MPEG encoder for the Macintosh that can produce high quality output. Unlike the QuickTime MPEG Export component, BitVice is implemented as an application.

That application directly supports QuickTime movies for its source material and it will place the finished .m2v file in the same location as that source.

When you launch BitVice, it will display a small window with very limited options. You will need to click the disclosure triangle labeled 'Advanced Settings' to expose the option necessary for film processing.

NTSC Output Step by Step

Prepare to export using DVD Film Transformer.

Select the filename for the output movie, then press 'Option'. Choose '24 FPS Exactly' from the 'Nominal Frame Rate' area.

Select other appropriate options (Filtering, Masking, etc.) as you see fit.

In the output popup, select Export as QuickTime Movie, and press the options button next to that selection.

In the video section, select an appropriate intermediate codec (MJPEG A, B or PhotoJPEG). If your source is DV, then DV remains a good choice. For best results (but huge disk files) choose Component Video. Leave the frame rate blank (Best) and leave the size as 'Current'.

Since the frame rate in the movie will not be the real, final time, you cannot include the audio in the movie, so select either AIFF or WAV in the Audio Output popup and specify 48KHz, 16-bit and mono or stereo as appropriate. This file will be emitted at the normal scale so that it will synch with the final MPEG file that you use as a DVD asset.

Once you have created the 24 fps video file, drag the movie file onto the BitVice application. The application will open in its simplified form. Click the

Advanced disclosure triangle to expose the important settings.

Clear the 'Interlaced Source' check box (you have created progressive video).

Select NTSC (4:3 or 16:9) and 24 fps options.

Select the average bit rate you want to use. A value of 5.0 will allow two hours on a 4.7 GB DVD-R.

Set the minimum rate and the maximum rate to use for encoding. Values of 3.0 and 8.0 seem to work well with an average of 5.0 Mbps.

In the lower right corner, make sure that the matrix setting is 'FCC (NTSC default)'.

Depending on your experience, you may want to enable the DV color and brightness adjustments. If you don't have experience with this encoder, try a small sample before committing to a long encode.

When you have all the settings to your liking, press the encode button.

When the encode completes, there will be an .m2v file located in the same folder as the source movie.

Drop the MPEG file on the supplied MPEG Telecine application.

Select a filename and location for the final DVD Studio Pro MPEG Asset.

PAL Output Step by Step

Prepare to export using DVD Film Transformer.

Select the filename for the output movie, then press 'Option'. Choose PAL with either 4:3 or 16:9.

Select other appropriate options (Filtering, Masking, etc.) as you see fit.

In the output popup, select Export as QuickTime Movie, and press the options button next to that selection.

In the video section, select an appropriate intermediate codec (MJPEG A, B or PhotoJPEG). If your source is DV, then PAL DV remains a good choice. For best results (but huge disk files) choose Component Video.

Leave the frame rate blank (Best) and leave the size as 'Current'.

When you have a separate audio file, use A.Pack to encode it for inclusion on your DVD.

Since the frame rate in the movie will be the real, final time, you can either include the audio in the movie or export it as a separate file. If you need to perform further editing before encoding, it is best to keep the audio with the converted movie. Otherwise, save a later step by exporting it as either AIFF or WAV in the Audio Output popup and specify 48KHz, 16-bit and mono or stereo as appropriate.

In either case, the audio length will be adjusted to match the somewhat shorter length of the movie when played at 25 fps (the pitch of the audio will also increase slightly as a result).

Once you have created the 25 fps PAL video file, drag the movie file onto the BitVice application. The application will open in its simplified form. Click the Advanced disclosure triangle to expose the important settings.

Clear the 'Interlaced Source' check box (you have created progressive video).

Select PAL and 25 fps options.

Select the average bit rate you want to use. A value of 4.8 will allow two hours on a 4.7 GB DVD-R.

Set the minimum rate and the maximum rate to use for encoding. Values of 3.0 and 8.0 seem to work well with an average of 4.8 Mbps.

Depending on your experience, you may want to enable the DV color and brightness adjustments. If you don't have experience with this encoder, try a small sample before committing to a long encode.

When you have all the settings to your liking, press the encode button.

When the encode completes, there will be an .m2v file located in the same folder as the source movie.

You can use the MPEG asset directly in DVD Studio Pro, so add the asset to a new or existing DVD Project.

If you have not exported the audio from the 25 fps movie, then export it now as AIFF or WAV at 48KHz, 16-bit and mono or stereo as appropriate.

Using TMPGEnc for Film

Overview

TMPEGEnc is a Windows based MPEG encoder that is economical and produces high quality output. While it does not directly support QuickTime files, it does support frame server plugins. To use TMPGEnc with QuickTime files you will need the plugin called 'QTRReader.vfp'. Search for and download it and place the expanded file in the same folder as TMPGEnc.exe.

TMPEGEnc seems to support all the legal frame rates for video, but with QuickTime files, you should use 24 FPS video. Frame rates that are not small integers will take many times longer to encode because of what appears to be a bug in the QTRReader plugin.

Once you have encoded the video on the Windows computer, bring it back to the Macintosh and process the MPEG file with MPEG Telecine to adjust the rate and add the necessary flags for usage on DVD.

NTSC Output Step by Step

Prepare to export using DVD Film Transformer.

Select the filename for the output movie, then press 'Option'.

Select NTSC (either 4:3 or 16:9). Choose '24 FPS Exactly' from the 'Nominal Frame Rate' area.

Select other appropriate options (Filtering, Masking, etc.) as you see fit.

In the output popup, select Export as QuickTime Movie, and press the options button next to that selection.

In the video section, select an appropriate intermediate codec (MJPEG A, B or PhotoJPEG). For best results (but huge disk files) choose Component Video. Leave the frame rate blank (Best) and leave the size as 'Current'.

Since the frame rate in the movie will not be the real, final running time, you cannot include the audio in the movie, so select either AIFF or WAV in the Audio Output popup and specify 48KHz, 16-bit and mono or stereo as appropriate. This file will be emitted at the normal scale so that it will synch with the final MPEG

file that you use as a DVD asset.

Transfer the converted movie file to the Windows machine over your network or via a FireWire disk.

Set the stream type to Video Only and click the settings button.

On the Advanced tab, check the 'Do Not Frame Rate Conversion' option, Uncheck the 3:2 pulldown button.

On the Video tab, set TMPGEnc to encode at 720x480, NTSC, 24 FPS, non-interlaced mode.

When you set the target or average bit rate, you should set it to the rate you calculate by dividing the available space by the time. Do not adjust this to compensate for a change in playback rate, as you would with the QuickTime encoder.

Set other parameters like the aspect ratio, quality and others as you feel appropriate.

TMPEGEnc is relatively fast at its highest quality settings, so it makes sense to use that for any film transfer. If your Windows machine is slow, you may want to choose a lower setting and see if it is good enough.

On the GOP Structure tab, you can set some intimate details of the output, but the only one you will usually need to modify is the Output Bitstream for Edit (Closed GOP). In general, Closed GOP is safest and required for Multi-Angle clips and provides the best performance in interactive presentations.

Since feature films are not very interactive, despite the efforts of some DVD authors, an Open GOP encoding with its higher efficiency may be worth experimentation.

Encode the movie to MPEG 2, and move that file back to your Macintosh.

Drop the MPEG file on the supplied MPEG Telecine application.

Select a filename and location for the final DVD Studio Pro MPEG Asset.

Press save.

When the conversion completes, add the asset to a

new or existing DVD Project.

Convert the AIFF or WAV file you created in an earlier step to AC-3 using the A.Pack application that accompanies DVD Studio Pro.

Add that asset to your project.

PAL Output Step by Step

Prepare to export using DVD Film Transformer.

Select the filename for the output movie, then press 'Option'. Choose PAL System (either 4:3 or 16:9).

Select other appropriate options (Filtering, Masking, etc.) as you see fit.

In the output popup, select Export as QuickTime Movie, and press the options button next to that selection.

In the video section, select an appropriate intermediate codec (MJPEG A, B or PhotoJPEG). For best results (but huge disk files) choose Component Video. Leave the frame rate blank (Best) and leave the size as 'Current'.

Since the frame rate in the movie will be the real, final time, you could include the audio in the movie. However, it is better to export the audio immediately so that it does not have to be part of the movie than you move to the Windows machine. So, select either AIFF or WAV in the Audio Output popup and specify 48KHz, 16-bit and mono or stereo as appropriate. This file will be emitted at the adjusted scale so that it will synch with the final MPEG file that you use as a DVD asset.

Transfer the converted movie file to the Windows machine over your network or via a FireWire disk.

Set the stream type to Video Only and click the settings button.

On the Advanced tab, check the 'Do Not Frame Rate Conversion' option, Uncheck the 3:2 pulldown button.

On the Video tab, set TMPGEnc to encode at 720x576, PAL, 25 FPS, non-interlaced mode.

When you set the target or average bit rate, you should

set it to the rate you calculate by dividing the available space by the time.

Set other parameters like the aspect ratio, quality and others as you feel appropriate.

TMPEGEnc is relatively fast at its highest quality settings, so it makes sense to use that for any film transfer. If your Windows machine is slow, you may want to chose a lower setting and see if it is good enough.

On the GOP Structure tab, you can set some intimate details of the output, but the only one you will usually need to modify is the Output Bitstream for Edit (Closed GOP) . In general, Closed GOP is safest and required for Multi-Angle clips and provides the best performance in interactive presentations.

Since feature films are not very interactive an Open GOP encoding with its higher efficiency may be worth experimentation.

Encode the movie to MPEG 2, and move that file back to your Macintosh.

You can use the MPEG asset directly in DVD Studio Pro, so add the asset to a new or existing DVD Project.

Using ProCoder for Film

Overview

ProCoder is a Windows based MPEG encoder from Canopus that produces very high quality output. ProCoder directly supports QuickTime files.

ProCoder can process files at many frame rates, but for film sourced video, 23.976 is the most appropriate choice.

Once you have encoded the video on the Windows computer, bring it back to the Macintosh and process the MPEG file with MPEG Telecine to adjust the rate and add the necessary flags for usage on DVD.

NTSC Step by Step

Prepare to export using DVD Film Transformer.

Select the filename for the output movie, then press 'Option'.

Select NTSC (either 4:3 or 16:9). Choose '23.976 FPS (normal)' from the 'Nominal Frame Rate' area.

Select other appropriate options (Filtering, Masking, etc.) as you see fit.

In the output popup, select Export as QuickTime Movie, and press the options button next to that selection.

In the video section, select an appropriate intermediate codec (MJPEG A, B or PhotoJPEG). For best results (but huge disk files) choose Component Video. Leave the frame rate blank (Best) and leave the size as 'Current'.

The frame rate in the movie will be the real, final time, so you can include the audio with the movie for proofing purposes before you encode. You can then allow ProCoder to extract the audio to a WAV file as part of the encoding process (similar to what the QuickTime encoder does when you select Save Audio). To keep the audio with the video, select With Video Natural Speed in the Audio Output section.

To export the file immediately, select either AIFF or WAV in the Audio output section.

Transfer the converted movie file to the Windows machine over your network or via a FireWire disk.

The metaphor for encoding using ProCoder is to select one or more movies as source files then create one or more targets that describe formats that each source movie will be converted into. And finally, starting the process with in the convert window.

This metaphor is designed to facilitate making a particular video available in several formats for web presentation (like QuickTime or Real or Video for Windows). For our purposes, we only need a single target and usually a single source.

Click the Sources button on the left side and begin by selecting the source movie from the Sources pane.

This will add an entry in the sources column. ProCoder may or may not recognize the important characteristics of the source video, so check and reset as necessary:

The video produced from DVD Film Transformer will always be non-interlaced, so you should always select the interlacing mode 'Non-Interlaced'.

If your video is anamorphic (either naturally or because you made it that way in DVD Film Transformer) select Aspect Ratio 16x9, otherwise select 4x3.

Move to the Target pane by selecting the Targets button in the left-hand column.

Start by selecting the base name for the output file. This is normally the name of the original file, less the '.mov' suffix. This name will have .m2v added to it for the video and .wav added for the extracted audio.

Select a destination path for the finished files from the path section.

In the Basic Settings section, start with the format DVD(MPEG2).

Select Video Standard as NTSC.

Select Stream Type MPEG 2 Video + Wave File. Do this even if you do not want the audio, otherwise you will have to choose an MPEG 2 Program stream which cannot be used as a DVD asset.

Scroll down to the Video Basic settings area.

Set Interlacing for the target file to Non-Interlaced (this is a separate setting from the source setting of the same name but should be set the same way).

Set the Aspect Ratio to the same value you chose in the source setting.

Choose the quality (time) you want to use for this video. The best quality takes the most time. On a fast Windows machine Mastering Quality can take six times as long as the source video in two pass mode.

In the CBR/VBR section select 2-Pass VBR (for best quality) or one of the other alternatives for faster processing.

Select that average bit rate for the output from the Video Bit Rate (kbps) section. A rate of 5000 will allow about one hour and 55 minutes of video to be encoded with 2 channel audio and a bit of room for menus and sundries.

Select the maximum bit rate to be generated from the Max Bit Rate (kbps) area. This will set the highest bitrate that the encoder will use for the most complex scenes. A range of 8000-8300 seems to work well, but with marginal players and burned media, you may want to set the value to below 8000.

In the Audio Basic section, select Mono or Stereo for the Wave file output.

Click the Advanced button on the left side of the Target pane. An additional Video Advanced settings group will appear in the settings list. This will allow you to set a few more parameters.

Scroll to that section and decide if you want to use Closed GOP or Open GOP encoding. Closed GOP is safer, required for multiangle use and is often a bit more responsive when used interactively (in menus or transitions). Open GOP is a bit more efficient in encoding so the results may look slightly better.

Check the Closed GOP box if you choose closed GOP encoding.

For the Number of Frames in a GOP setting, the value of 12 is good for film sources.

The Distance Between I/P frames can be left at the default 'automatic setting'.

The DC precision setting (available only with the first service pack for ProCoder) determines the number of discrete levels that can be represented in the Discrete Cosine Transform which is fundamental to MPEG encoding. Higher values use more bandwidth but can result in sharper images. The value of 8 is sufficient for most purposes.

You will notice that many of the settings in the advanced area and some in the basic area are grayed out and cannot be changed. To make changes in these areas you must select the User Defined option in the Format type at the top of the settings area.

We need to change one setting to properly encode our film sourced video.

Select User Defined for the Format.

Change the Frame Rate in the Video Basic section to 23.976 FPS from the default value of 29.97 FPS.

This should be the only setting changed. Altering any other setting can easily result in a stream that will not work for DVD authoring.

You are now ready to begin encoding. Select the Convert Pane by clicking the Convert button on the left side of the window.

Click the Convert button under the preview area to encode the movie to MPEG 2.

When the encoding completes, move the .m2v and .wav files back to your Macintosh.

Drop the MPEG file on the supplied MPEG Telecine application.

Select a filename and location for the final DVD Studio Pro MPEG Asset.

Press save.

When the conversion completes, add the asset to a new or existing DVD Project.

Convert the AIFF file (from DVD Film Transformer) or WAV file (from ProCoder) you created in an earlier step to AC-3 using the A.Pack application that accompanies DVD Studio Pro.

Add that asset to your project.

PAL Output Step by Step

Prepare to export using DVD Film Transformer.

Select the filename for the output movie, then press 'Option'. Choose PAL (either 4:3 or 16:9).

Select other appropriate options (Filtering, Masking, etc.) as you see fit.

In the output popup, select Export as QuickTime Movie, and press the options button next to that selection.

In the video section, select an appropriate intermediate codec (MJPEG A, B or PhotoJPEG). For best results (but huge disk files) choose Component Video. Leave the frame rate blank (Best) and leave the size as 'Current'.

The frame rate in the movie will be the real, final time, so you can include the audio with the movie for proofing purposes before you encode. You can then allow ProCoder to extract the audio to a WAV file as part of the encoding process (similar to what the QuickTime encoder does when you select Save Audio). To keep the audio with the video, select With Video Natural Speed in the Audio Output section.

To export the file immediately, select either AIFF or WAV in the Audio output section.

Transfer the converted movie file to the Windows machine over your network or via a FireWire disk.

The metaphor for encoding using ProCoder is to select one or more movies as source files then create one or more targets that describe formats that each source movie will be converted into. And finally, starting the process within the convert window.

This metaphor is designed to facilitate making a particular video available in several formats for web presentation (like QuickTime or Real or Video for Windows). For our purposes, we only need a single

target and usually a single source.

Click the Sources button on the left side and begin by selecting the source movie from the Sources pane.

This will add an entry in the sources column. ProCoder may or may not recognize the important characteristics of the source video, so check and reset as necessary:

The video produced from DVD Film Transformer will always be non-interlaced, so you should always select the interlacing mode 'Non-Interlaced'.

If your video is anamorphic (either naturally or because you made it that way in DVD Film Transformer) select Aspect Ratio 16x9, otherwise select 4x3.

Move to the Target pane by selecting the Targets button in the left-hand column.

Start by selecting the base name for the output file. This is normally the name of the original file, less the '.mov' suffix. This name will have .m2v added to it for the video and .wav added for the extracted audio.

Select a destination path for the finished files from the path section.

In the Basic Settings section, start with the format DVD(MPEG2).

Select Video Standard as PAL.

Select Stream Type MPEG 2 Video + Wave File. Do this even if you do not want the audio, otherwise you will have to choose an MPEG 2 Program stream which cannot be used as a DVD asset.

Scroll down to the Video Basic settings area.

Set Interlacing for the target file to Non-Interlaced (this is a separate setting from the source setting of the same name but should be set the same way).

Set the Aspect Ratio to the same value you chose in the source setting.

Choose the quality (time) you want to use for this video. The best quality takes the most time. On a fast Windows machine Mastering Quality can take six times as long as the source video in two pass mode.

In the CBR/VBR section select 2-Pass VBR (for best quality) or one of the other alternatives for faster processing.

Select that average bit rate for the output from the Video Bit Rate (kbps) section. A rate of 5000 will allow about one hour and 55 minutes of video to be encoded with 2 channel audio and a bit of room for menus and sundries.

Select the maximum bit rate to be generated from the Max Bit Rate (kbps) area. This will set the highest bitrate that the encoder will use for the most complex scenes. A value in the range of 8000-8300 seems to work well, but with marginal players and burned media, you may want to set the value to below 8000.

In the Audio Basic section, select Mono or Stereo for the Wave file output.

Click the Advanced button on the left side of the Target pane. An additional Video Advanced settings group will appear in the settings list. This will allow you to set a few more parameters.

Scroll to that section and decide if you want to use Closed GOP or Open GOP encoding. Closed GOP is safer, required for multiangle use and is often a bit more responsive when used interactively (in menus or transitions). Open GOP is a bit more efficient in encoding so the results may look slightly better.

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You will notice that many of the settings in the advanced area and some in the basic area are grayed out and cannot be changed. To make changes in these

areas you must select the User Defined option in the Format type at the top of the settings area.

For PAL video, we do not need to change any of the protected settings. Doing so can easily result in a stream that will not work for DVD authoring.

You are now ready to begin encoding. Select the Convert Pane by clicking the Convert button on the left side of the window.

Click the Convert button under the preview area to encode the movie to MPEG 2.

When the encoding completes, move the .m2v and .wav files back to your Macintosh.

The PAL video asset is ready for immediate use in a new or existing DVD Project.

Convert the AIFF file (from DVD Film Transformer) or WAV file (from ProCoder) you created in an earlier step to AC-3 using the A.Pack application that accompanies DVD Studio Pro.

Add that asset to your project.

DVD Film Transformer Technical Bits

Altivec

DVD Film Xfrmr is very Altivec intensive all access to video fields and frames is done using the G4's Altivec instruction set. G3's will never work. Don't ask.

Video Scaling

Scaling of video is done by linear interpolation. That is, each pixel color and luma value is calculated as if the values vary linearly between the known values. So each pixel's final value is determined by how close it is to the adjacent pixels and their values.

Audio Scaling

Scaling of audio is performed using the Macintosh Sound Manager. Samples of audio are labeled with sample rates that reflect the ratio between the original and final video frame rates. This allows those samples to be converted to the final rate as part of the normal export. This simple scaling method does not correct for pitch shift.

This is adequate for most applications, although there are better audio scalers available that can compensate for pitch shift.

Inverse Telecine

DVD Film Xfrmr performs inverse telecine using a long pipeline of fields. Each frame from the source movie is split into its upper and lower field. These fields are compared to their original mates to see if they exhibit substantial differences in a pattern that would indicate interlace artifacts. They are also compared to prior fields to determine if they are duplicates.

The stream of fields is synchronized using the intervals between the detected duplicates. This establishes the cadence where duplicate fields may be found even if local noise occurs that would conceal a duplicate frame or cases where several fields appear to be duplicates because they are part of a still scene.

The long pipelines of frames allow synchronization to occur reliably with relatively simple tests. The rela-

tionship between the field pipelines is derived from the similarity of the fields and their timing.

Median Filter

The median filter determines the value of each pixel in the output by examining a 3x3 group of pixels in the source corresponding to the output pixel and the eight pixels that surround it. Those pixels are ordered in value from highest to lowest and the 5th (or median) value is chosen for the output. The median filter works only on the luma component of the pixels, leaving the color alone.

Anti-Alias Filter

The anti-alias filter uses a 2x2 sample from the source to determine the output value. The values above, to the left, above and to the left are weighted lightly and added to the more heavily weighted value of the corresponding source pixel. The result is normalized to produce the output pixel. The anti-alias filter works only on the luma component of the pixels, leaving the color alone.

