Deshaker Guide

Quick note for the impatient: If you already know about VirtualDub and don't want to read all this stuff, click on the link in the "Downloading Programs" section to download Deshaker, and then skip to the "Basic Guide" section to see what settings to use.

Now, on to the guide …

You already know that your camera should be mounted on a tripod. *Blair Witch Project* and *Bourne Supremacy* actually made their audiences sick, not because of content, but because of camera motion. However, sometimes you don't have time to set up, lock down, and compose. You also may have to use amateur footage. For these reasons, you have probably wished you could motion-stabilize your video in post production.

You can purchase several software tools that stabilize video (*Steadyhand* from Dynapel, and *Steadymove* from a company called 2d3 are the two best-known commercial products). However, the one I have found works the best is a freeware utility called *Deshaker*. While Deshaker includes an excellent guide, the settings and setup can be a little intimidating. Since the program is so good, and since so many people in the Vegas forums have expressed an interest in using it, I developed this guide. I have written this with the Vegas user in mind, but people using other editing programs can use the guide as well, as long as you don't mind my occasional reference to a specific Vegas feature.

Downloading the Programs

Deshaker is a "filter" that works with a freeware editing utility called VirtualDub. "Filters" are the same as fX plug-ins in Vegas.

Download Deshaker here:

http://home.bip.net/gunnart/video/Deshaker.zip

The author's own guide for the program is found here:

http://biphome.spray.se/gunnart/video/

In order to use this program, you need to download and "install" VirtualDub. Here's the link to that program:

http://www.VirtualDub.org/download

To save AVI files from VirtualDub, I recommend you use some sort of codec. Unfortunately, the excellent DV AVI codec in Vegas cannot be accessed by any other program. However, you have three good options:

1. Download and install the free Panasonic codec from this site:

http://www.free-codecs.com/download/Panasonic_DV_Codec.htm

2. Purchase and install the MainConcept DV codec from here:

   http://www.mainconcept.com/downloads.shtml

3. Download and install the free Huffyuv codec from this site:

   http://neuron2.net/www.math.berkeley.edu/benrg/huffyuv.html

This last codec is not a DV codec, but is a lossless codec that also preserves a broader colorspace than DV. Vegas can read AVI files encoded by Huffyuv.

If you choose not to install a codec, you can save the file as an uncompressed AVI file. Be warned however, that uncompressed video takes 90 GB per hour, compared to 13 GB per hour for DV video.

Installation

VirtualDub does not include an installation program. You just open the zip file and copy all the files to some folder on your disk. I chose to copy them to the c:\program files\video folder. Make sure you tell your unzip program to include folders in the unzip operation. Why? Some of the files need to be in their own folder, and this information is included in the zip file. In Winzip, you tell it to "Use Folder Names." If you get an error message telling you that "readme.txt" already exists, then you definitely forget to tell your unzip program to create the folders contained in the zip.

Once you have copied the VirtualDub files, open the Deshaker.zip file and copy the "deshaker.vdf" file to the "plugins" folder created by the VirtualDub install.

You are now all set to start "deshaking!" Oh yeah, baby, this is gonna be fun.

Theory of Operation

You want theory? Well, in theory, you can motion stabilize video in Vegas. Open the pan/crop dialog for a video event. Step through that event one frame at a time. For each frame, look at the position of the video compared to the previous frame and use the pan crop window's left/right, up/down, and rotate controls to make the video "line up" with the previous frame.

This is exactly what Deshaker does.

Of course if you tried to motion stabilize video using the pan/crop tool in Vegas, it would take you hours to fix just a few seconds of video, and the results would still not be that good because it is very difficult to "line up" two frames of video.

Deshaker works its magic by using motion estimation algorithms (similar to what are used for MPEG2 encoding) to determine what has moved since the previous frame. This

gets tricky, because movement can be caused by the camera moving in the operator's hands; by the camera operator actually moving (in a car, on a dolly, or just walking); or by the subject of the video moving. The trick of stabilizing video — both for the software, and for you the person setting the Deshaker controls — is to figure out what movement is caused by unwanted shaking of the camera, and what movement is caused by the camera moving or the subject matter moving.

Running VirtualDub

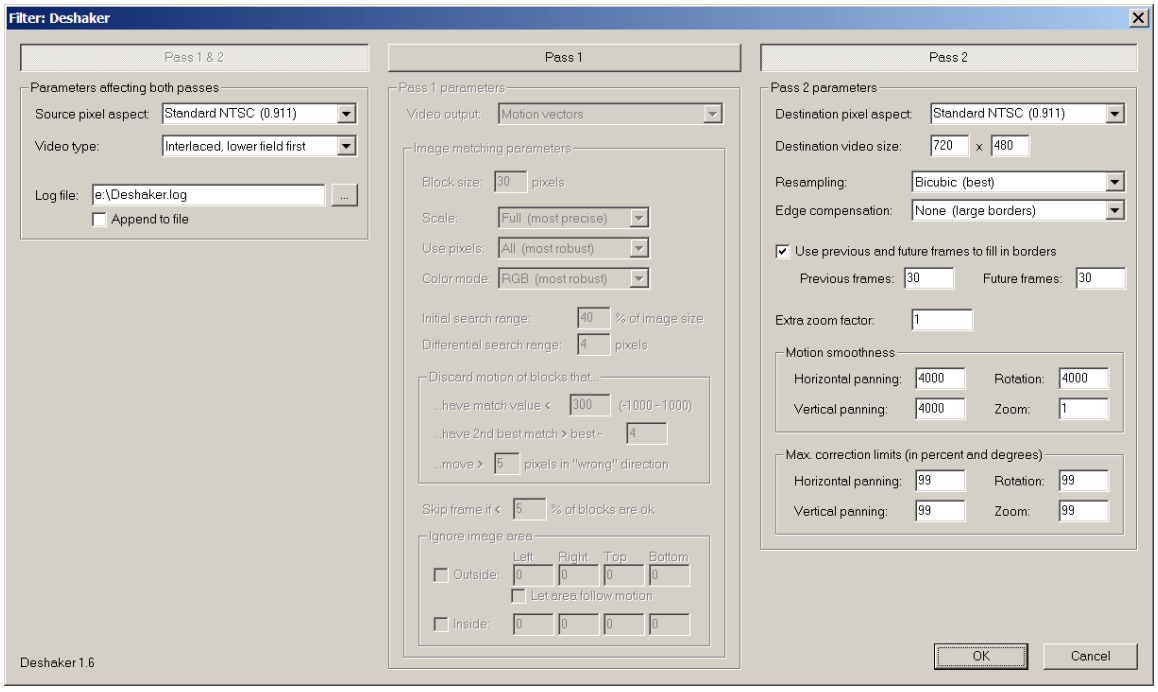
This section of the guide is for those *not* familiar with VirtualDub. If you already know about this program, skip this section.

VirtualDub is a very simple video editor, but its main reason for being popular is that it provides a simple way to let people use an amazing array of "filters" that alter video, frame-by-frame. While some VirtualDub filters are duplicated in Vegas, many are not.

To run VirtualDub, double-click on the virtualdub.exe file in the folder you created during installation. If you are going to use this program frequently, right-click on virtualdub.exe, select "Create Shortcut," and then drag that shortcut to your desktop.

Next, click on File -> Open Video File to open the AVI file you wish to stabilize. You can stabilize large AVI files that contain many scenes, but I generally prefer to work on AVI files that have just one scene.

The final step before actually doing the stabilization is to load the Deshaker filter. This is the same as clicking on the fX button for a Vegas event and then loading the fX. To load a VirtualDub filter, click on Video -> Filters. In the Filters dialog, click on the Add button. Look for the Deshaker plug-in, click on it, and then click on OK. You should now see Deshaker dialog.



Basic Guide

Now that you have your video clip loaded into VirtualDub, and you are looking at the Deshaker dialog, what do you do?

If you are *really* impatient, just read this one, short paragraph:

Change all the settings to match the above dialog, click on Pass 1 and go back to the main VirtualDub screen. Rewind and play to output. Return to the Deshaker dialog, click on Pass 2, go back to the main VirtualDub screen, and save the video.

If you want a little more information, read the following. If you need more help than this, go to the Advanced Setting section.

1. Click on the big “Pass 1&2” button at the top of the left column in the dialog box. Set the Source Pixel Aspect to “Standard NTSC (0.911)” or “Standard PAL (1.094).” If you are using some other type of video, then make the appropriate choice.
2. Change “Video Type” to “Interlaced, lower field first” if your video is DV. If your video is some other type, then make the appropriate choice.
3. Change the drive letter for the “Log File.” I don’t like storing things in the root directory of my C: drive. The “Log File” will be used to store the X, Y, rotational, and zoom information for each frame of video in your clip.

4. Click on the big “Pass 1” button. You can leave all the values at their defaults, but for better quality (but slower processing), change “Scale” to “Full (most precise)” and “Use pixels” to “All (most robust).” There is a significant speed penalty for

doing this, and the results are often “good enough” with the defaults (which are Scale: Half, and Use Pixels: Every 4th).
5. Click on the big “Pass 2” button.
6. Change the “Destination pixel aspect” to match what you set in step 1. Set the destination video size to 720x480 for NTSC DV video or 720x576 for PAL DV video.
7. Set “Edge Compensation” to “None (large borders).”
8. Put a check mark in “Use previous and future frames to fill in borders.” Don’t change the default of 30 for the previous and future frames.
9. Set Motion Smoothness values of 3000 (NTSC). Set Zoom to zero (to turn it off). You can use larger values in order to make the motion smoother (I’ve used settings up to 18,000), but the results may look somewhat artificial, and you may begin to see unwanted artifacts that make the video look like it was placed on top of a flag rippling in the wind on top of a flag pole.
10. Set all Max Correction Limits to 99.
11. Finally — and this is important — click on the big “Pass 1” button (the one on top of the center column).

You can now click on OK to exit this dialog and then click on OK again to exit the Filters dialog.

The Deshaker plug-in now needs to play through the entire video in order to figure out what motion occurs from one frame to the next. During this first pass, it stores this information in the LOG file. To make this happen, press the rewind button in VirtualDub

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to put VirtualDub at the first frame in your clip. Then, without doing anything else, press the play to output button

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Make sure you press the play to output button, the one with the little “o” next to it, not the play input button (the one with the little “i" next to it).

The left side of the VirtualDub screen will show your video, and the right side will show the motion tracking algorithms at work. If your video is interlaced (which it probably is), you will see two screens at the right, one for the odd fields and the other for the even fields.

Pass 1 takes a long time. Be patient.

When Pass 1 has finished, don’t touch any of the play controls in VirtualDub, and immediately open the Filters dialog again, click on the Deshaker plug-in, and then click on the “Configure” button. Since you have already configured Pass 2, all you need to do

is click on the “Pass 2” button, and then click on OK, and then on OK again in the Filters dialog.

Before you save the results, you need to choose the codec you want to use to save the resulting, stabilized video. Click on Video -> Compression, and choose the output codec you want. If you decided not to install a video codec, you can skip this step and the video will be save as uncompressed video, which will consume 90 GB per hour of video.

(If you have used VirtualDub for some other project, make sure “Full Processing Mode” is selected in the Video menu.)

Once you have chosen a codec, you don’t need to do this again until you quit and then re-start VirtualDub (see below about saving settings between sessions).

Now, click on the rewind button again, and this time, save the results, using the “Save As AVI” option in the File menu. When you start the save operation, Deshaker will begin the second pass. This goes much faster than Pass 1.

When the save has finished, you will have a nicely stabilized video file that you can bring into Vegas. I usually put it on a track above or below the original video and then use the track solo or mute buttons to A/B compare to an external monitor. I line it up exactly with the original video, and I use then use the audio from the original video. Another excellent approach would be to add the video as a take. To do this, find the video event that is the original that you used as input to Deshaker and then use the *right* mouse button to drag the file from the Vegas explorer to the video event. You will get a pop-up asking giving you several options, and you can choose to “Add as Takes.” You can then press “T” on your keyboard while playing the clip to alternate between takes.

If you want to “play around” with various settings in Pass 2, you can run Pass 2 over and over again, without running Pass 1 again. This can be very useful if you want to experiment with different “Motion Smoothness” settings.

Special Considerations

One thing you will find, if you followed the directions above, is that your stabilized video has thirty frames of blank video appended to the beginning, and the end is thirty frames short. This is explained in the Deshaker guide referenced at the above site. This is the result of Deshaker accessing past and future frames. You can easily fix this problem by appending at least thirty frames of video before starting Pass 2 (where you save the AVI file). To append video, click on File -> Append AVI Segment, and pick a short clip of just a few seconds. You need a clip that is at least as long as the Future Frames setting (which in this guide is 30 frames). If it is longer, it won’t make the final clip any longer. It doesn’t matter what is in the clip because the actual video isn’t used. This is simply a way to get around one of the few rough edges in the plug-in.

You may get a “livelock” warning from VirtualDub at the end of Pass 1. Ignore it and proceed. It appears to be a harmless bug in either Deshaker or in the latest version of VirtualDub.

Saving Settings

Once you get settings that work, you sure don’t want to enter them each time you use the plug-in. Fortunately, you can save everything about your current setup.

In VirtualDub, click on File -> Save Processing Settings and enter a file name. The next time you use VirtualDub, simply click on File -> Load Processing Settings, choose the same file name, and the Deshaker plug-in will be loaded, with every one of the settings restored to the values you saved. The video compression settings will also be restored, so you don’t have to specify your codec again.

Thus, for the next project, you just:

1. Load your video
2. Load the processor settings
3. Click on Pass 1, rewind, and then play the video to the output screen
4. Click on Pass 2 and save the video file

Advanced Settings

The settings in the basic guide works pretty well for the usual situation where you are standing still, with the zoom set to telephoto, and you are not panning. If you don’t think you are getting enough correction, you can increase the motion smoothness parameters in Pass 2. I have used settings as high as 18,000 for horizontal, vertical, and for rotation. Since video is almost never supposed to rotate, the author recommends setting the rotation smoothness setting quite high, perhaps as high as 20,000.

If you set these too high, and you have Edge Compensation set to none, you will begin to see some pretty wild things happening to the edges. You will occasionally see these artifacts even with smaller settings, but usually they will not be seen on most television monitors: They usually get lost in the overscan, so I don’t bother to remove them. If they are a problem, you can use “extra zoom” setting in Deshaker, or the pan/crop tool in Vegas, to zoom in on the video slightly and thereby eliminate the edges.

For more complicated situations, you might need to adjust some of the other settings. Here are a few things you might want to do:

If the video still looks too shaky, even after you have increased the motion smoothness parameters in Pass 2, then the motion vectors were probably not set correctly during Pass 1.

To improve the motion tracking, you need to help the software focus on the part of the video that is moving because of the camera motion, and ignore the part of the video that is supposed *to be moving.*

Deshaker provides a great tool to do just that. At the bottom of the Pass 1 column, you will find the "Ignore Image Area" controls. You can use this to define either which area of the frame you wish to ignore, or which area you wish to include when saving the motion information for each frame. Usually, the center of the video contains the actor or something else that is *supposed* to be moving. The edges of the video are usually the background. Therefore, the most common way to improve the motion tracking is to tell Deshaker to only track the pixels around the outside of the frame, and ignore everything in the center. To do this, put a check mark in the "Inside" box in the Ignore Image Area section, and enter the number of pixels you want for the border at the top, bottom, left, and right side. For instance, if I want to only look at the top quarter and bottom quarter of the video (which is a very common situation), for 720x480 NTSC DV video, I would enter 120 in both the top and bottom Inside Image Area settings. When you now run Pass 1, you will see video only at the top and bottom of the output preview screen.

If you use the ignore settings, make sure that video that remains after the masking process has a lot more pixels than the "Block Size" specified at the top of the Pass 1 column. I don't know how to define "a lot" but with a 30 pixel block size, I would want to make sure that a 30 pixel block in the center of the first frame of video never (or at least seldom) disappeared. Thus, the shakier the video, the less you are going to be able to mask. The author says that he often uses smaller block sizes to improve motion tracking (down to block sizes of 16), but only if "Use Pixels" in Pass 1 is set to "All (most robuts)."

Camera is Moving

If the camera is in motion (you are walking or driving), it is much more difficult for Deshaker (or any motion stabilization software) to figure out which motion to eliminate, and which motion should be retained.

One setting that is designed to deal with this is the Pass 1 setting called "Discard Motion of Blocks That Move >x Pixels in the Wrong Direction" (one of the longest names ever devised for a setting). If the camera is moving, and you are not getting good results, then try increasing this setting from the default 5 to something more like 15, perhaps even as high as 30. During Pass 1, you can see the effect of this in the output pane of VirtualDub. You will see all sorts of arrows, showing how Deshaker thinks pixels are moving in each section of video. If you see *red* arrows, this indicates that Deshaker is going to ignore the motion in this part of the picture when computing its "deshaking." Ideally, you should see red arrows only around that part of each frame that are actually moving, and should see white arrows around the portions of the image that are moving only because of the unsteadiness of the camera.

Using the "Ignore Image Area" setting can also help.

If you still are not getting the results you want, you can try changing the "Discard motion of blocks that have match value <" setting. The default is 300. Try increasing it by to 500 or 600. If that doesn't do anything, or makes things worse, try decreasing it to 150.

As the guide that comes with Deshaker describes, the “Discard motion of blocks” settings are normally designed to let you make changes to avoid problems when a large part of the frame has indistinct objects, like blue sky, calm water, etc. In these situations, there are few distinct "objects" that can be tracked, and therefore you want to throw out the spurious, random motion matches that the tracking algorithms might generate just from random noise. In extreme cases, you might actually ADD shakiness, rather than reduce it. However, the setting can sometimes also be used to fine-tune the results from a camera that is moving.

Back to the “Wrong Direction” setting for a moment. For normal stabilization (as defined in the Basic Guide above), the author actually recommends setting this at 1 instead of the default 5.

Stabilization Limitations

When the camera moves, it blurs the image because the “shutter speed” of a video camera is normally quite slow. If you step through shaky video on the Vegas timeline, one frame at a time, you will see the video go out of focus at the point where the camera shakes. Usually this blur doesn’t bother the viewer, because your eye doesn’t see moving objects sharply. However, when you look at a stationary object, you expect it to be in focus. The problem is that once the image is stabilized, and the objects in the video that *were* moving are now stationary, those objects are now out of focus. The out-of-focus frames are the ones where the camera was moving. There is absolutely nothing you can do about this. You’ll have to decide which is more annoying: The shaky video, or video that pops in and out of focus. I generally prefer the steady video.

If you know you are going to be shooting video hand-held, and you suspect you might want to use Deshaker later on, there *IS* a way to avoid this problem: Use the “shutter speed” control on your camera to increase your shutter speed. Although this does impart a slightly different “feel” to the video, it will completely eliminate the focus problem. This is especially important when you are filming from a moving vehicle or other situation where even your professional, rock-solid, hand-held camera techniques will not be able to stop some fairly violent camera motion.

Other Uses

If you don't own and can't afford Steadicam equipment, you can use Deshaker to generate a “poor man’s” version of Steadicam. The results can often be quite good. For instance, if you plan ahead, and do a little work, you can use this technology to "approximate" a dolly shot. You can walk with the camera, using the camera's own steadying mechanism, plus a cheap steadying device, use the Deshaker software, and end up with something that is VERY stable. Also, if your hand-held camera technique is good, and you can maintain a steady aim, then this software can often make the result 99% as good as video taken on a tripod. This is especially true if you have optical image stabilization enabled on your camera. That feature usually gets rid of the shake, but the video will still “wander” slightly. Deshaker can often remove the residual drifting and wandering.

One possible use, suggested by one user, is to set the horizontal, vertical, and rotational motion smoothness settings to -1. As described in the Deshaker documentation, this causes Deshaker to never move the camera from its original position, even if it means moving the video violently and destroying the edges. I have used -1 settings, and didn't find them useful. However, what I forgot is that the LOG file created by this process is in essence a set of instructions for how to keyframe a video to exactly match the motion of this clip. Thus, if you could use the "Ignore Image Area" and also the -1 settings to force Deshaker to track the motion of one portion of the video, then you could load a *different* video into Deshaker, and perform a pass 2 *using the LOG file from the first video clip* (and with the motion smoothness settings on -1) in order to make that clip match the motion of the object in the first clip. You would then render this to an AVI file, line it up in Vegas, and then composite it with the first frame, thus giving you a composite track that would match the motion in the child track. Again, this is theory, but it is intriguing theory nonetheless. Again, the central part of the idea is to use the stored motion vectors from one clip to *introduce* identical motion in a second clip, so that the two would track.

Perhaps another guide, for another time …

Conclusion

Deshaker is a great tool to salvage shaky camera footage. It can be used to make amateur hand-held video look like professional hand-held video, or make professional hand-held video look like it was taken on a tripod. You can also use it to approximate the results from a Steadicam (notice I used the word "approximate," not duplicate). With care and forethought, you can even use it to produce moving camera results that begin to look like they were taking on a track dolly. It is a *very* useful tool to have in your bag of tricks.