User's Guide (version 5.8)

VideoCleaner can natively open a wide range of image and video files, including some that normally require a proprietary player. For all other situations, VideoCleaner includes an optional free screen capture utility (CamStudio) that can dub videos as they playback within their proprietary player.

VideoCleaner works best on videos that:
- Are extremely dark (e.g. shot at night) or overly bright where the target details are located
- Require a moderate increase in details or focus to see the target event
- Have specks or artifacts that are randomly located on each video frame
- Need to be resized, cropped, trimmed, slowed down, or changed to a more common format
- Have artifacts from a prior VHS-digital conversion
- Depict very faint motion or subtle (e.g. due to distance) color changes
- Have compressed (washed out) or incorrect colors, or have incorrect lighting levels
- Are suspected of having undergone post-production scene manipulations

VideoCleaner does little to help with videos that:
- Are visually perfectly clear, but include noisy audio
- Show image smearing where video details blend into adjacent video details
- Require a television crime show's fantasy level of clarity improvement

ABOUT:
VideoCleaner is the world's most relied upon forensic video enhancement software because it:
- ✓ Meets the highest evidentiary scientific standards validated by courts and experts worldwide.
- ✓ Automatically maintains an audit trail of all filters and settings, and generates a metadata log.
- ✓ Preserves evidence by applying industry accepted filters without altering the original recording.
- ✓ Opens its source code for peer review scrutiny and is supported by hundreds of programmers.
- ✓ Provides free unlimited updates and support, and is licensed for any legal purpose.
- ✓ Is cost-free, ad-free, allows unlimited usage, and never collects any personal information.

With VideoCleaner, you can recover license plates and facial details, illuminate poorly lit scenes, increase detail clarity, correct the viewing perspective, reverse lens distortion, repair VHS recordings, improve color contrast, isolate channels, and so much more. VideoCleaner is cost and advertising free, and created under the belief that clear evidence should be available to all those who need it.

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Frequently check **http://VideoCleaner.com** for the latest version update.

Launch "VideoCleaner" using the desktop icon. You will have the option to Reload the default slider settings. The "No" option is useful when working with multiple similar videos.

Once VideoCleaner loads, press the computer's **F5** key (or Ctrl-O) to load a new image or video file. Don't use **OPEN** (in the **FILE** menu) as it loads a script, not an image or video file
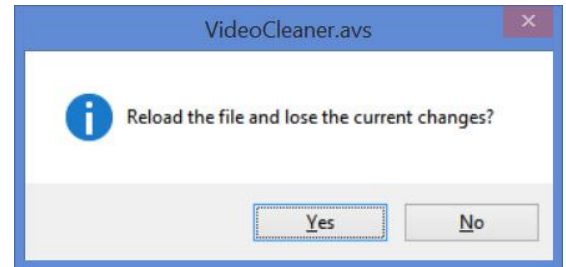
Adjust the program sliders to apply filters and features. The check boxes at the top of VideoCleaner toggle on/off additional filter/feature sections. Once optimal clarity has been achieved, press the computer's **F7** key to save the video file (or use **CTRL** and **S** keys to save the current frame).

Computer keyboard shortcut keys

F1.........Shortcut help screen (to view this list of shortcut keys).

F2.........To access the VideoCleaner settings screen to configure user preferences.

F5.........or **ctrl-O** key to select an image-video to open in VideoCleaner, or reload the current scene.

F6.........Exports the enhanced VideoCleaner video to VirtualDub (VideoCleaner can then be closed).

F7.........Save the resulting video file onto the computer. Works in both VideoCleaner and VirtualDub.

ctrl-B ...Bookmark the currently viewed frame. *(hold down the "ctrl" key and touch the letter "B")*
alt-B.....Jump to the Bookmarked frame.

ctrl-S....Save the currently viewed frame in the format and destination folder of your choosing.
alt-S .....Save all frames as a sequence of images in the format & destination folder of your choosing.

ctrl-Z....Undo the user's last setting change, then press the F5 key to reload the video with the prior settings (this is useful after getting an error message in VideoCleaner).

NOTES:
- If the user activates conflicting VideoCleaner settings, or their computer's configuration prevents a specific feature from working, an informational on-screen message will be displayed.
- The program shortcut, "**VideoCleaner fix**", resets VideoCleaner back to its installation defaults.
- The program shortcut, "**Reload last session**" does just that, with all prior settings intact.
- For technical support or feature requests, visit **http://www.linkedin.com/groups?gid=2461639**

KNOWN ISSUES:
VideoCleaner's playback controls cause a stuttering view if your computer cannot keep up with the filter processing demands. Use the right/left arrow keys or navigation bar to move to a specific frame.

Sometimes, pressing the "F5" (or ctrl-O) key will cause multiple file "open" windows to appear. This occurs when Windows thinks that it hasn't yet offered the VideoCleaner file open selection window. If this occurs, use the "Cancel" button (or the "ESC" key) to close the extraneous file selection windows.

If you are unable to see the sliders, even though the right-hand side panel is open, right-click on the C:\VideoCleaner folder and select "Properties", then select "Edit" on the "Security" tab. Choose your login, check the "Allow Full Control" option, and select OK to allow VideoCleaner to access its folder.

USAGE HINTS

Looking for a fast image/video enhancement or authentication solution? Here are a few examples, along with their corresponding VideoCleaner solution (denoted as feature group - specific feature).

PROBLEM	SOLUTION
See active settings or their inverse affect	MAIN - Use / List / Override / Subtract Features
Blend the original to the enhanced	MAIN - Enhancement Transparency
Place original next to enhanced result	MAIN - Compare Original to Enhanced
Video details appear or need fuzzy	MAIN - TOOLS - Unsharpen, Sharpen Strength
Video details/colors are compressed or expanded	MAIN - TOOLS - Video/Color Contrast Strength
Video colors are too subtle or intense	MAIN - TOOLS - Color Saturation Strength
Color correction or scene was colorless	MAIN - TOOLS - Shift Overall Hue
Remove glare or flashing lights	MAIN - TOOLS - Suppress HotSpot Strength
Scene is too dark or too bright (automatic)	MAIN - TOOLS - Backlight / Histogram
Scene is too dark or too bright (manual)	MAIN - TOOLS - Equalizer & MAIN - CURVE
Video has random specks or blurring	MAIN - TOOLS - Deblur/Denoise
Handheld camera motion is erratic	MAIN - TOOLS - Stabilize Iterations
Video or image is slightly out of focus	MAIN - TOOLS - Focus
Scene looks like a mosaic of tiny squares	MAIN - TOOLS - Deblocking
License plate, text or logo is hard to read	MAIN - FORENSIC - Canny, Sobel & Edge
Hard to detect moving objects/people	MAIN - FORENSIC - Isolate Motion / iFrames
Movement or color changes are too faint	MAIN - FORENSIC - RGBamplifier Strength
Can't read stationary signage or license plate	MAIN - FORENSIC - Frame Averaging
Video's authenticity is suspect	MAIN - ANALYSIS - Extract & Test & MinMax
Identify file's characteristics	MAIN - ANALYSIS - File Information
Audio is too quiet or shouldn't exist	PROPERTIES - CORE - Volume
Video plays at the incorrect speed	PROPERTIES - CORE - FPS speed
Only need a range of video frames	PROPERTIES - CORE - Starting & Keep frame
Video plays in reverse order	PROPERTIES - CORE - Reverse Video
Video contains repeated frames	PROPERTIES - DUPLICATE frame removal
Fast moving objects look jagged	PROPERTIES - FIELDS - Sep/Swap
Video jerks up/down or left/right (after Sep/Swap)	PROPERTIES - FIELDS - Nudge & Shift
Interlaced fields are out of horizontal alignment	PROPERTIES - FIELDS - Horizontal alignment
Only a small portion of the video matters	PROPERTIES - CROP
Adjust video resolution or aspect	PROPERTIES - RESIZE
Video needs to be flipped or rotated	PROPERTIES - ANGLE
Certain color channels contain greater detail	PROPERTIES - CHANNELS
Remove frames inconsistent with reference frame	SPECIALTY - DESEQUENCE
Digitized video shows VHS or ghosting defects	SPECIALTY - VHS
Perspective is distorted, or is pincushion or barrel	SPECIALTY - VIEW
Overall image/video color is incorrect	SPECIALTY - COLORIZE
Add a header to contain annotations	FINALIZING - MARGIN - Header
Add the audio waveform for visual impact	FINALIZING - MARGIN - Waveform
Need to highlight or pixilate a specific area	FINALIZING - ACCENT
Need to add on-screen text annotation	FINALIZING - TEXT
Need to add frame number annotation	FINALIZING - NUMBER
Need to add a progressive time stamp annotation	FINALIZING - TIMEstamp

<h1 style="text-align:center">VERSION HISTORY (beginning with version 5.0)</h1>

5.8 MATRIX view now maintains relative scale of the original untouched image in upper left quadrant. Improved the TOOLS "Sharpening" softening effect with negative values. Added -2 position to ACCENT "Mask" slider for inverse mask behavior. Combined ANGLE "Apply" & "Borders" sliders.

5.7 Color limiter added to Forensic-RGBamplifier. DeGhosting added to VHS in Specialty section. Negative Tools-Sharpening values now soften the scene.

5.6 New variables (inserted using the F2 key) to include file and system information into TEXT annotations. VideoCleaner now loads for users who never followed the installation instructions.

5.5 Reorganized TOOLS "Deblur Denoise" slider, and added dirt denoise option. New CURVE "Data bit depth" slider posterizes. Combined FORENSIC "Sobel" and "Canny" sliders. Swapped order of FORENSIC "Isolate" and "RGBamplifier" sliders. Removed redundant MARGIN active slider. Fixed error when all feature groups are made inactive.

5.4 New TOOLS "Hue" slider improves detail perceptibly through color shifting. New Append position in CORE appends unaltered original prior to the enhanced results. Removed a slider redundancy by allowing a Duplicate Frame Removal strength of zero to also serve as the filter's on/off switch.

5.3 Significantly improved VideoCleaner's automatic proprietary video extractor. Combined RESIZE "Preserve aspect" and "Snap to common" sliders. New COMPARE slider Matrix option zooms in on rectangular area defined in ACCENT. New "-1" "mask" position of ACCENT's Pixelation slider confines enhancements to user defined oval or rectangle accent area (unless using COMPARE's Matrix). The VELA file is now named and retrieved from the same folder as the file being tested.

5.2 F7 key also saves videos from within VideoCleaner. New top slider OVERRIDE option overrides protective user limits. Increased TIMESTAMP annotation size range. FRAME number annotation auto-resizes based upon aspect ratio. TRANSPARENCY slider moved to top (rightmost position "7" replaces the now removed Bypass option). COMPARE's "Original" text overlay is less opaque. Removed "mid-frame" option (was redundant to the frame range options within the CORE group).

5.1 Combined TOOLS slider pairs (Backlight & Histogram) and (Denoise & Deblur), plus FORENSIC slider pair (Motion & iFrames). Added 8th Forensic edging mode that most discards colored pixels. New "Reload last session" program shortcut (also useful if installation step #1 was ignored).

5.0 FINALIZING section defaults to active. SuperResolution can be applied to any resizing. ACCENT feature group defaults to a rectangular or oval highlight. DEBLOCKING and EQUALIZER feature groups have been simplified, defaulted to their optimal mode, and relocated into TOOLS group. The DESEQUENCER feature group was relocated into the SPECIALTY section. Added "Nearest neighbor" to the RESIZE group, and Looping to the CORE group. Sub-second accuracy added to time stamp annotation. Untouched video and its cropped version can now be placed beside the fully enhanced version. Sliders streamlined to improve speed. Improved wording & error handling.
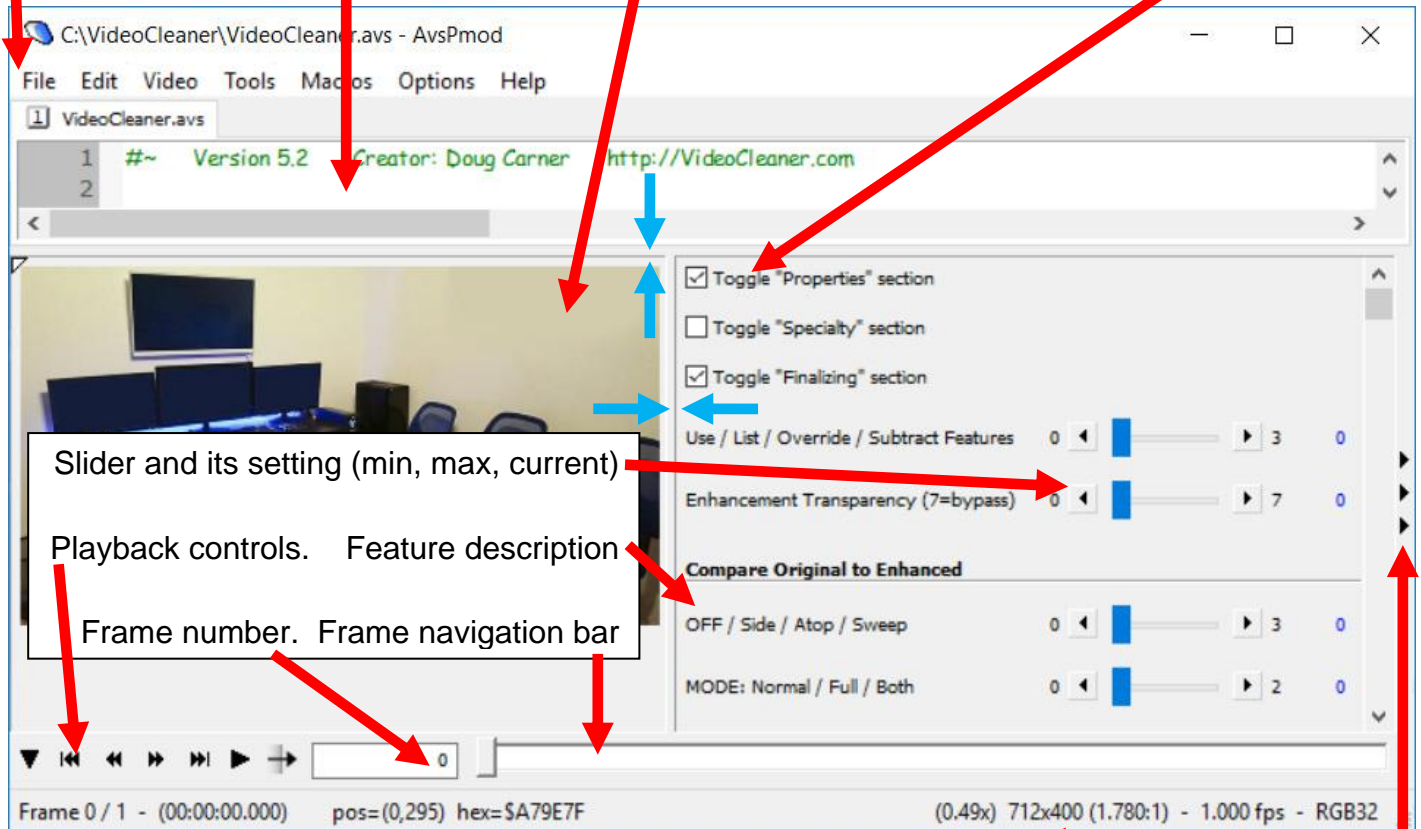
THE VIDEOCLEANER INTERFACE:

Do not use the menu at the very top of this program. It relates to the AvsPmod interface and not the VideoCleaner features. Instead, use the controls located on the right-hand side.

Script code: No need to examine this area unless you want to modify or understand the VideoCleaner source code.

Preview window: Shows the video in its current state. Apply filters to make changes. Auto-resizes to fit the entire video.

Section toggles: Check a toggle box to activate and display the features of that section. The program automatically reloads.

C:\VideoCleaner\VideoCleaner.avs - AvsPmod

File   Edit   Video   Tools   Macros   Options   Help

1 VideoCleaner.avs

1   #~   Version 5.2   Creator: Doug Carner   http://VideoCleaner.com
2

☑ Toggle "Properties" section

☐ Toggle "Specialty" section

☑ Toggle "Finalizing" section

Slider and its setting (min, max, current)

Use / List / Override / Subtract Features   0 ◄ ▮━━ ► 3   0

Enhancement Transparency (7=bypass)   0 ◄ ▮━━ ► 7   0

Playback controls.   Feature description

Compare Original to Enhanced

Frame number.   Frame navigation bar

OFF / Side / Atop / Sweep   0 ◄ ▮━━ ► 3   0

MODE: Normal / Full / Both   0 ◄ ▮━━ ► 2   0

▼ ◄◄ ◄◄ ►► ►►| ► ⟶   0

Frame 0 / 1 - (00:00:00.000)   pos=(0,295) hex=$A79E7F   (0.49x) 712x400 (1.780:1) - 1.000 fps - RGB32

Ratio of displayed size to true size

Current frame #

Color space

Playing time of current frame

Playback frames per second

Total number of video frames

Video resolution and aspect

If the VideoCleaner sliders are not visible, click on these 3 mini arrows to restore their visibility. You can adjust the size of the control windows by moving the boundaries guides (see the blue arrows in the image above).

NOTE: Avoid using Playback controls because most computers lack the power to play an enhancing video in real time. Instead, use the computer's arrow keys or navigation bar to select a specific frame.

SAVING YOUR WORK

VideoCleaner provides several methods to save one's work. The user can hold down their computer's **CTRL** key and touch the letter "**S**" to save the current enhanced video frame as a single image, press the **ALT** and "**S**" keys together to save all video frames as a series of images, or press the "**F7**" key to save their enhanced results as a new video. All VideoCleaner settings are automatically retained, and reloaded for reuse unless the user chooses to "Reload the file and lose the current changes" (which resets all settings and sliders back to their defaults) the next time VideoCleaner is started. The latest VideoCleaner settings are automatically logged in a file ending in "**VideoCleaner_settings.txt**" which is located in the video's file folder (and also in C:\VideoCleaner). This log file is a powerful resource to ensure that VideoCleaner results can be replicated on demand, and easily presented to the court.
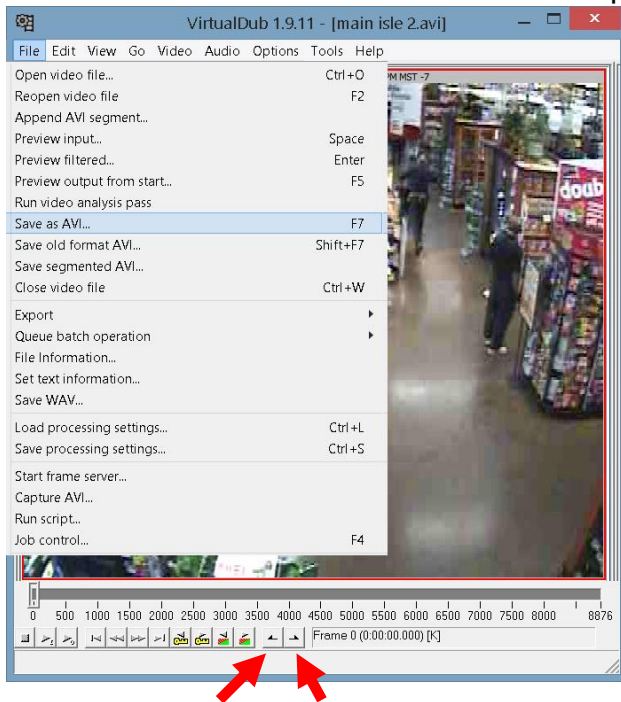
Another saving method is to press the "F6" key to export the enhanced video into a program called VirtualDub, which has a wider range of save options. This method allows the user to close and restart VideoCleaner to work on a different image or video file, as both programs work independently of each other.

Once inside of VirtualDub, press the "F7" key (or select "Save as AVI" under the "Video" menu) to save a copy of the enhanced video in the uncompressed format (a huge file format that retains 100% of the video details). If a smaller compressed file size is desired, press CTRL-P (hold down the "ctrl" key and touch the letter "P") or select "Compression" under the "Video" menu to choose a compression Codec, and then press "F7" to save the video. VirtualDub will ask for the file's name and where the user wants to save their finished video.

To save only a portion of the video, the user only needs to select the first and last frames by moving to the beginning and ending frame of the desired range and then selecting the relevant icon (see the red arrows above). Similarly, pressing the computer's Delete key will remove only the designated frame range. If frames are accidentally deleted, pressing CTRL-Z *(holding down the "ctrl" key and touching the letter "Z")* will undo the last change.

There are additional VirtualDub features and filters available through the internet. Unless the user activates such additional filters inside of VirtualDub (located under the "Video" menu), the side-by-side before-after views of the video will be exact duplicates of the VideoCleaner results. As with VideoCleaner, the keyboard's right and left arrow keys are used to move forward and backward through the video.

NOTE: The Lagarath video Codec will save 100% of the video detail in about 20% of the file size of using uncompressed. However, the resulting video will only be playable on computer's with that Codec installed. Lagarath is recommended for use when saving intermediary video versions on your computer to save hard drive space.

CAMSTUDIO

If a view cannot be opened in VideoCleaner, CamStudio can record that video while it the proprietary software displays it onto the computer screen, including sound, and then save the resulting video so that it can be opened by VideoCleaner. A low-resource ad-free version of CamStudio is ready to install (Choose "Install - Camstudio screen capture", located in the VideoCleaner program shortcuts folder). Once installed, follow these usage instructions:
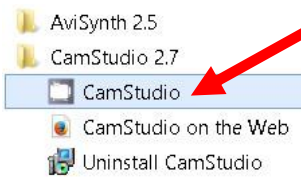
Launch the CamStudio program and select "**Video Options**" under the "**Options**" menu to choose a compression Codec. In general XVID (http://xvid.com) provides optimal visual quality in a very compact file size (the VideoCleaner shortcut folder also includes the XVID installation). Using "**Max Framerate**" can help ensure that no video frames are skipped or lost, but may result in a larger final file size.
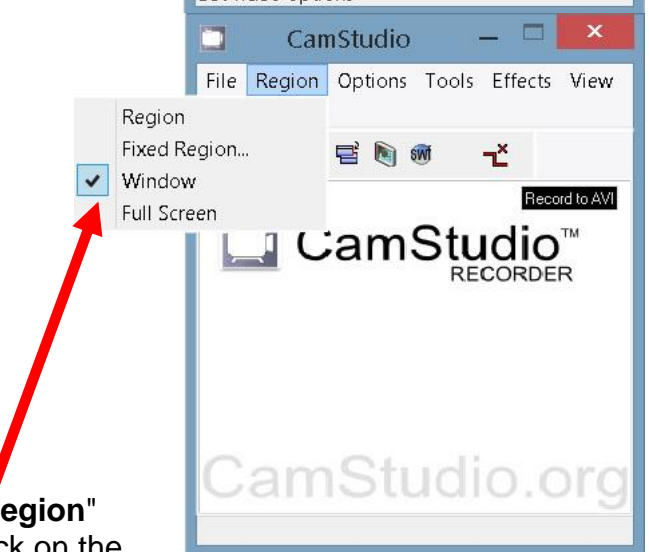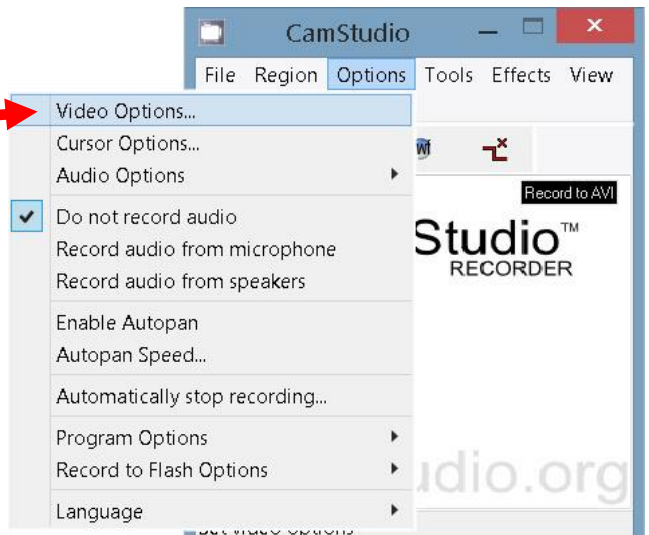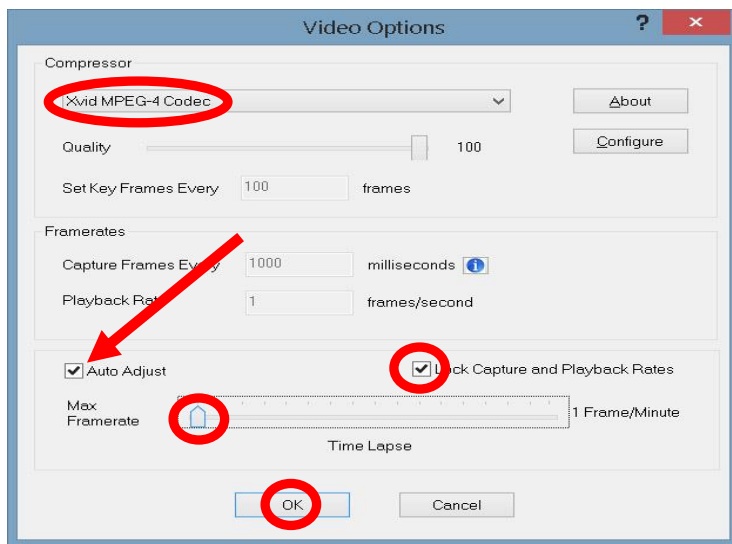
To record a video, select "**Window**" located under the "**Region**" menu, then select the Red record button. Now mouse click on the proprietary video player's viewing window to select it, and then start playing the proprietary video. A progress bar will indicate how large the dubbed copy is becoming. When the desired portion of the proprietary video has finished playing, select the stop button in CamStudio to complete the recording.

Once the user presses the CamStudio Stop button, they will be asked for a file name and saving location for the newly created recording. The recommended name is "Screen.avi" since that matches the default input name for VideoCleaner. Be aware that screen captured recordings, while typically much larger than the originating video file, will not contain any additional video details.

Once the newly dubbed video has been saved, it can be opened directly in VideoCleaner without the need to use the proprietary viewing software. VideoCleaner can then be used to remove duplicate frames and restore details to create a more accurate and compact dubbed video version.

WARNING: Depending on your computer, the dubbed version may include blended frames (hybrids of two sequential moments in time) that compromise file accuracy and VideoCleaner enhancements.

MEDIAINFO

The first time a video is loaded, VideoCleaner may create several support files in the same folder as that video. One of those files may have a name extension that ends in ".ffindex". If this file exists, it is a temporary index file created by FFDSHOW (the tool that opens most VideoCleaner's videos) to index frames, and speed up future load times for that same video. Another file has a name extension ending in ".Mediainfo.txt" and contains video metadata and facts useful for your reports and analysis.

The Mediainfo file may include GPS coordinates, camera settings, capture date/time, the creating software name/version, and other identifying information. This file can be opened with any text editor. Below is a simple Mediainfo.txt file for example purposes. Abbreviated metadata can be viewed within VideoCleaner by moving the "File information" slider (located in the "Analysis" filter group) completely to the right.

If your video is on a read only media (e.g. a video DVD), you can access the file "Mediainfo.txt" which is located in the "C:\VideoCleaner" folder. That file contains the most recent video metadata, but this file will be overwritten each time a new video is opened using VideoCleaner.

Depending on the video's file format, the displayed metadata may not be secure and could have been modified prior to your review. Furthermore, some metadata will be in a seemingly cryptic format. Here are some useful links to convert that data:

Convert UTC time
Convert GPS coordinates

NOTE: You can use VideoCleaner to load any TXT file, including the Mediainfo file, and the computer's right arrow key will scroll through the metadata file. If you attempt to use the left arrow, you may get a seek error because VideoCleaner is trying to view this text file as a video file. If this occurs, press the computer keyboard's "F5" key to reload the metadata file to continue reading it.

```
CH08-2013-01-06-06-19-24__enhanced_images_03110-03440.m...    —  □   ×
File  Edit  Format  View  Help

General
Complete name                        : D:\BURN FILES TO DISC\CH0
Format                               : MPEG-4
Format profile                       : Base Media / Version 2
Codec ID                             : mp42
File size                            : 26.7 MiB
Duration                             : 5mn 31s
Overall bit rate mode                : Constant
Overall bit rate                     : 678 Kbps
Encoded date                         : UTC 2014-07-18 21:38:48
Tagged date                          : UTC 2014-07-18 21:39:17

Video
ID                                   : 1
Format                               : MPEG-4 Visual
Format profile                       : Advanced Simple@L4
Format settings, BVOP                : No
Format settings, QPel                : No
Format settings, GMC                 : No warppoints
Format settings, Matrix              : Default (H.263)
Codec ID                             : 20
Duration                             : 5mn 31s
Bit rate mode                        : Constant
Bit rate                             : 678 Kbps
Width                                : 1 408 pixels
Height                               : 960 pixels
Display aspect ratio                 : 3:2
Frame rate mode                      : Constant
Frame rate                           : 1.000 fps
Color space                          : YUV
Chroma subsampling                   : 4:2:0
Bit depth                            : 8 bits
Scan type                            : Progressive
Compression mode                     : Lossy
Bits/(Pixel*Frame)                   : 0.501
Stream size                          : 26.7 MiB (100%)
Language                             : English
Encoded date                         : UTC 2014-07-18 21:38:48
Tagged date                          : UTC 2014-07-18 21:39:17
```

We recommended that you do not update the MediaInfo software as the newer versions include adware and other potentially undesirable characteristics.

Within each VideoCleaner section, are groups of features. Each feature is controlled by sliders. To the left of the slider is its description plus the default (inactive) value shown in brackets. To the right of the slider's name is the actual slider control. The number on the left edge of the slider control is the lowest allowed value. The highest allowed value is listed to the right side of the slider. The farthest right number (in blue) is the current value of that slider. Mouse clicking on the blue current value will reset the slider to its setting from when the current video was last loaded or reloaded.

MAIN SECTION

This is a group of sliders and **NOT** the program's "TOOLS" drop down menu.

This section is always visible, regardless of the other feature section check boxes. Most video clarification work will occur within this section. These first few sliders act as master controls.

Use / List / Override / Subtract Features (0)
Set this slider to "0" for normal functionality. Set to "1" and on-screen text will list active features. Use position "2" to override built-in protective restrictions. Position "3" subtracts the enhanced version from the original to display what has changed.

> The "subtract" setting displays how your filter settings have affected your video and is useful in confirming that critical details were not accidentally removed.

Enhancement transparency (0=none)
Any value above zero allows the original video blend into the final result. Position seven effectively bypasses all VideoCleaner features. Changes made in the Properties section are not affected by this slider's position.

Compare Original to Enhanced
"OFF / Side / Atop / Sweep (0=off)"
Set this slider to "0" for normal viewing. Set to "1" to place the original and enhanced views side-by-side, or to "2" to have them stacked vertically. If set to "3", the original & enhanced views will interchange by sweeping over time.

". Normal / Full / Both / Matrix"
Set this slider to "0" for enhanced and unenhanced. Set to "1" for unenhanced to be uncropped or "2" to include both cropped and uncropped unenhanced. Set to "3" for a matrix that also includes the zoomed-in ACCENT rectangular area if Mask mode is active.
TOOLS

Apply TOOLS settings (0=no)
A value of zero (0) disables all features in this filter group. A value of one (1) allows them.

Unsharpen Strength (0=off)
Subtracts a local contrast Gaussian blur to retain the high-frequency details. If set to high, object edging can appear overly exaggerated.

> Although the filter's name is misleading, unsharpening not only sharpens the video, but can provide pseudo-focus correction.

Sharpening Strength (0=off)
Any value above zero (0) increases sharpness and a negative value increases softness.

Video Contrast Strength (0=off)
A value of zero (0) turns this feature off. Any other value applies an ever increasing or decreasing amounts of luminosity contrast.

Color Contrast Strength (0=off)
A value of zero (0) turns this feature off. Any other value applies an ever increasing or decreasing amounts of color contrast.

Color Saturation Strength (0=off)
A value of zero (0) turns this feature off. Any other value applies ever increasing or decreasing color saturation of the scene.

Suppress HotSpot Strength (0=off)
Positive values apply an ever increasing amount of hotspot suppression (reduction of bright or flashing lights while preserving details and lighting levels). Negative values substitute pure black to aid in histogram skewing.

Shift Overall Hue (0=off)
Any value other than zero "0" shifts the overall color hue, amplified by the above Color Saturation slider. Useful to correct any color errors or to improve the detail perception of previously dark or black/white videos.

Equalizer Strength (0=off)
A positive value applies an increasingly intense illumination correction without the risk of blowout, with negative values using a video negative. Strong anti-banding (interpolation of luminosity transitions between adjacent pixels) and the full luminosity range are always used.

Backlight / Off / Histogram (0)
A value of zero (0) turns this feature off. A negative value applies automatic back-lighting correction while a positive value applies an automatic color histogram equalization.

Deblur / Off / Denoise (0=Off)
A value of zero (0) turns this feature off. A negative value applies lens deblur. A positive value applies denoising based upon the noise sizes: 1= Large, 2=Small, 3=Dirt.

> Review these filter changes as they can over-compensate or distort subtle details.

Stabilize Strength (0=off)
A value of zero (0) turns this feature off. Any other value applies ever increasing stabilization

Focus Correction (0=off)
Any value above zero (0) optically refocuses every pixel of every frame. The available range is up to twenty tenths of one pixel radius, using a finite impulse response (FIR) Wiener filtering.

Deblock Model (0=off)
Set above "0" to find a model to repair or soften the square tiling artifacts typically found in over-compressed videos. If they exist, iFrames and Color data is automatically referenced.

Deblock Strength (0=lowest)
Higher values strengthen the attack on any blocking artifacts. Increase until just prior to causing any detectable losses in scene details.

CURVE (lighting balance)

Apply CURVE settings (0=no)
A value of zero (0) disables all features in this filter group. A value of one (1) allows them.

Lowest Lumins in (0)
Sets the darkest lighting level to be retained as being unique with zero (0) representing pure black and 255 representing pure white. If set to high, darker details may become clipped.

Gamma Multiplier (1)
A value of one (1) leaves the video untouched. Higher values skew the brightness distribution upward, while lower values do the opposite, without luminosity blowout or clipping.

Highest Lumins in (255)
Sets the brightest lighting level to be retained as being unique with zero (0) representing pure black and 255 representing pure white. If set too low, brighter details may become clipped.

Data bit depth (default=8)
Luminosity ranges from 0 to 255 using 8 data bits. Lowering the value of this slider posterizes using few data bits, allocated over 32-bit RGB.

> NOTE: If using the Denoise filter responds with "**Feature not available**", the solution is to locate the Windows™ VideoCleaner shortcut folder and then RIGHT click on the option named "**VideoCleaner fix**" to select "**Run as administrator**". This will copy two required files into the Windows file directory. Once complete, this fix solution will never need to be repeated on the same computer.

> NOTE: The Backlight, Denoise and Focus features are math intensive and may require long time periods to process and reprocess, especially when used in combination. Instead, try using one or two of these filters, save the resulting file, and then close VideoCleaner. Reopen that saved video file in a new VideoCleaner session to continue where you left off to apply additional filters.

FORENSIC (iFrame can be slow)

Apply FORENSIC settings (0=no)
A value of zero (0) disables all features in this filter group. A value of one (1) allows them.

Edge: Sobel / Off / Canny (0=off)
A negative value applies Sobel Edge filtering (dual axis quadratic mean of masked and dominantly weighted pixels): a value of (-1) uses just the Luma channel, (-2) uses just the Chroma channels, and (-3) uses all channels. Increasing positive values apply Canny edge filtering in an ever higher hysteresis range for the relevant gradient threshold magnitudes.

__Sobel/Canny value (0=default)
If using Sobel mode, each increase in the slider's value above zero (0) reduces the edge mask saturation limit by an additional 10%. If using Canny mode, higher values reduce the applied Gaussian blur ("9" disables blurring).

Edge Filtering Mode (0=off)
Any value above zero (0) emphasizes edges using these algorithms:
  1=Inverse spatial differentials
  2=Spatial differentials
  3=Differentials
  4='Y' channel of spatial differentials
  5='Y' channel intensities
  6='U' channel intensities
  7='V' channel intensities
  8=Suppress colored pixels

Isolate: Motion / iFrame (0=off)
A value of one (1) suppresses all pixels which remain unchanged in the preceding and following 25 frames to supress static objects. A value of two (2) removes any detectable non-iFrames. This process is slow, so save the resulting file, and re-open that new file in VideoCleaner to apply additional filters.

RGBamplifier Strength (0=off)
This value sets the strength to emphasize each pixel's deviation from its average RGB among the preceding and following 25 video frames.

__RGBamplifier Color Limit (0=none)
Restricts the affected color range as follows:
(only some colors were definable): 1=black, 2=maroon, 3=brown, 4=red, 5=darkgreen, 6=darkoliveGreen, 7=sienna, 8=chocolate, 9=forestgreen, 10=olivedrab,

11=darkgoldenrod, 12=goldenrod, 13=limegreen, 14=chartreuse, 15=yellowgreen, 16=gold, 17=midnightblue, 21=darkslateGray, 22=dimgray, 24=tomato, 25=seagreen, 27=darkkhaki, 28=sandybrown, 29=springgreen, 33=darkblue, 34=indigo, 35=dark magenta, 36=deeppink, 40=palevioletred, 41=lightseagreen, 42=cadetblue, 43=dark gray, 44=tan, 45=medium springgreen, 46=mediumaquamarine, 47=lightgreen, 48=khaki, 49=mediumblue, 51=blue violet, 52=fuchsia, 54=slateblue, 55=medium purple, 56=orchid, 57=dodgerblue, 58=cornflowerblue, 60=plum, 61=darkturquoise, 62=turquoise, 63=lightblue, 64=white

Frame Averaging Radius (0=off)
Any value above zero (0) blends that number of preceding and following frames together into a lower noise version, applied to all frames.

ANALYSIS and Information

Apply ANALYSIS settings (0=no)
A value of zero (0) disables all features in this filter group. A value of one (1) allows them.

Extract (Off / Noise / DCT / Motion)
A value of zero (0) leaves the video alone. A value of one (1) subtracts a Gaussian blur (leaves an amplified noise profile), two (2) isolates the DCT (Discrete Cosine Transform) AC component (Curves or Equalizer improves results view-ability), and three (3) generates motion vectors (this can be a slow process).

Test (Off / PseudoColors / VELA)
A value of zero (0) leaves the video alone. A value of one (1) assigns a random color palette to highlight subtle color differentials to detect clipping or masked content (add the Channels-Grayscale slider to test temperature). A value of two (2) performs VELA (to detect cropping or content addition, removal or relocation. Read page #19 of this guide for more instructions).

MinMax Range (0=off)
Any value above zero (0) displays the luminosity clipping distance from pure black and white, shown as blue and red respectively. Clipping is inconsistent with an authentic video.

File information (0=off)
A value of zero (0) leaves the video alone. One (1) displays the luminance waveform, two (2) displays a color allocation Vectorscope, and three (3) displays the file's summary Metadata. (see "Mediainfo.txt' in the video's file folder for a more comprehensive list of file Metadata).

PROPERTIES SECTION

CORE Settings

Apply CORE settings (0=no)
A value of zero (0) disables all features in this filter group. A value of one (1) allows them.

Volume (0=ignore 1=mute)
A value of zero (0) leaves the audio alone, one (1) mutes the audio, and higher values amplify audio. Be aware that VideoCleaner does not play audio. The user will need to press F6 to export and hear the audio using VirtualDub.

FPS Speed seconds (0=same)
 FPS Millisec (add to above)
A value of zero (0) for both sliders leaves the playback speed as-is. Otherwise, the value of both sliders are added together to set a new playback frame rate. For example, 29 seconds and 973 milliseconds results in a 29.973 frames-per-second video playback frame rate.

> NOTE: Some computer configurations have issues playing videos with non-standard frame rates, especially videos playing under one frame-per-second.

Starting Frame thousands (0)
 Starting Frame (add to above)
The first slider set the number of frames (in thousands) and the other slider value is added. For example, if the thousands is set to 2 and the second slider is set to 100, then the first 2100 frames of the input video will be ignored.

Keep Frames thousands (0=all)
 Keep Frames (add to above)
The first slider set the number of frames (in thousands) and the other slider value is added. For example, if the thousands is set to 2 and the second slider is set to 100, then only 2100 frames of the input video will be retained.

Off / Reverse / Loop / Append (0=off)
Setting "1" reverses the direction of playback, so the last frame becomes the first. Setting "2" loops the video ten times. Setting "3" appends so the original video is prior to the enhanced.

DUPlicate frame removal

Duplicate Removal Strength (0=off)
This setting is the percentage of difference (threshold) between successive frames for each frame to be considered unique. This feature is activated by any value above zero. A value of 0.1 will work for most videos.

> NOTE: Duplicate frame removal is a critical first step, and is always the first filter applied to any video, regardless of any other active VideoCleaner filters.

Auto-adjust Framerate (0=no)
A value of zero (0) retains the current frame rate so that, if duplicate frames were removed, the resulting video will play in less time and may appear to be sped up. A value of one (1) adjusts the playback frame rate so that the resulting video retains its original duration, albeit with fewer video frames to display.

> NOTE: Duplicate frame removal can be very time consuming and is re-invoked with each subsequent VideoCleaner settings change. It is recommended that you perform duplicate frame removal by itself, save the resulting video and close VideoCleaner. Re-launch VideoCleaner to reopen that saved video to apply any remaining filters that may be required.

FIELDS

FIELDS: Off / Overlay / Apply (0=off)
A value of zero (0) disables all features in this filter group. A value of one (1) Displays an overlay to assist the user with the "Horizontal alignment" slider {vertical lines will become thinner as the alignment improves}. A value of two (2) applies normal Fields functionality.

Fields: off / Separate / Swap (0)
Each frame of an interlaced video is composed of two interlaced fields, thus representing two independent moments in time in one image. A value of zero (0) leaves the video alone. A value of one (1) separates ("deinterlaces") the fields, thus creating a half height video with twice as many frames. A value of two (2) works the same way, but swaps the field pair order.

Hint: Use the keyboard's right-left arrow keys to advance through the video and, if the movement seems to oddly jerk forward-backward, try setting this slider to two "2".

Nudge Fields (Off / Up / Down)
A value of zero (0) leaves the video untouched. A value of one (1) nudges the even numbered fields, of the now deinterlaced frames (requires the prior slider), upward a half-pixel. A value of two (2) will nudge them half a pixel downward.

Use this slider if the video slightly alternates up/down as you use the computer right-left arrow keys to advance through the video.

Nudge Fields (Off / Left / Right)
A value of zero (0) leaves the video untouched. A value of one (1) will shift the even numbered fields, of the now de-interlaced frames, leftward one-half pixel. A value of two (2) will shift the even numbered fields rightward half a pixel.

NOTE: Sub-pixel nudging, when required, improves final enhancement results, but its interpolation can impact Photogrammetry and Videogrammetry measurement accuracies.

Horizontal alignment (0=off)
A value of zero (0) leaves the video untouched. A positive value shifts the fields from the center, with even fields moving rightward. A negative value shifts in the other direction. Higher values will invoke a greater shift.

Retain Which Fields (All / Even / Odd)
A value of zero (0) leaves the video untouched. When a set of fields is blurrier than the other, one (1) retains only the even numbered fields, while two (2) retains the odd numbered fields.

Restore Original Size (0=no)
A value of zero (0) leaves the video untouched. A value of one (1) will use bicubic resizing to restore the deinterlaced video's height back to its original size prior to the field filter changes.

ANGLE

Off / Apply / plus borders (0=off)
A value of zero (0) disables all features in this filter group. A value of one (1) allows the user to modify the viewing angle, and a value of two (2) also adds borders so the rotated video remains fully visible without rescaling.

Turn: Off / Right / Left (0)
A value of zero (0) leaves the video alone. A value of one (1) turns the video 90-degrees clockwise and a value of two (2) turns the video 90-degrees counter-clockwise.

Flip This Video (0=no)
A value of zero (0) leaves the video alone. A value of one (1) flips the video horizontally. This can be required when a video Codec incorrectly determines the video's left edge.

Rotate Video Angle (0)
Any value above zero (0) rotates the video clockwise by that value's number of degrees. The video is cropped to retain the video's dimensions. A value of "180" degrees can be used with the "Flip" filter to create a vertical flip.

CROP

Apply CROP settings (0=no)
A value of zero (0) disables all features in this filter group. A value of one (1) allows the user to zoom in by cropping the viewable scene, rounded to the nearest multiple of four pixels for maximum playback compatibility.

Crop by Percentage (0)
A value of zero (0) means that cropping is by the following values number of pixels. A value of (1) changes each value to behave as a percentage of the video's original dimensions.

From Left (0)
A value of zero (0) leaves the video alone. Any other value trims away the designated portion of the left edge of the video.

The next three sliders behave the same as the above slider, but from their respective edges:
From Right (0)
From Top (0)
From Bottom (0)

HINT: Cropping has an immediate exponential improvement on VideoCleaner's filter processing time. A popular trick is to activate cropping to show just the critical scene, test and apply all of the required VideoCleaner filters, and then deactivate cropping as the last step before saving the video results. This will significantly improve your overall workflow efficiency.

NOTE: The included SuperResolution mode is fully functional, but applies a demo mode watermarked as thin diagonal lines. You are under no obligation to use SuperResolution or purchase a license from Infognition. This enhancement feature is offered solely because it produces extremely clear results.

Visit **HERE** to read more or to purchase a license. Click **HERE** after purchasing a license to remove the demo watermark.

RESIZE

Off / Neighbor / Cubic / SR (0=off)
A value of zero (0) disables this filter group, while any other value resizes (in multiples of four pixels for optimal playback compatibility). A value of one (1) magnifies using nearest neighbor {best for forensic measurements), A value of two (2) applies bicubic interpolation resizing, and a value of three (3) applies SuperResolution {usually best for upsizing},

Aspect: Off / Preserve / Common (0)
A value of zero (0) leaves the video alone. A value of one (1) automatically adjusts the video's height, based upon the selected width, that best preserves the video's aspect ratio. A value of two (2) lets VideoCleaner select the closest common video size relative to the user's selected New width and New height.

New Width (0=same)
A value of zero (0) leaves the video alone. Any other value resizes to the closest valid value.

New Height (0=same)
A value of zero (0) leaves the video alone. Any other value resizes to the closest valid value.

CHANNELS selector

Apply CHANNELS settings (0=no)
A value of zero (0) disables all features in this filter group. A value of one (1) allows them.

Due to the way videos are saved, defects may prominently exist in one color channel, which can be disabled using the next three sliders:
Turn Red OFF (0=no)
Turn Green OFF (0=no)
Turn Blue OFF (0=no)

Off / Gray / Negative/ Both (0)
A value of zero (0) leaves the video alone. A value of one (1) converts the scene to monochrome, two (2) inverts all active color channels, and three (3) applies both filters.

SPECIALTY FEATURES SECTION

DESEQUENCE

Apply DESEQUENCE settings (0=no)
A value of zero (0) disables all features in this
filter group. A value of one (1) allows the user
to remove broken or inconsistent frames,
including those from a sequenced video.
NOT INTENDED FOR PANNING VIDEOS.

Frame to use as the reference
Set this to the first frame that shows the scene
that you wish to retain. The range is 0 to 99.

Retention strength (15=default)
If set too low, desired frames may be missed. If
set too high, bad frames may be retained. "15"
is a good starting point for surveillance videos.

VHS Toolbox

Apply VHS settings (0=no)
A value of zero (0) disables in this filter group
while one (1) applies the active features. These
filters are effective with digitized VHS tapes,
without any benefit to other types of videos.

Repair Chroma Lines (0=no)
A value of zero (0) leaves the video alone. A
value of (1) applies automatic Chroma repair
and applies line strength.

Lines Strength (0=off)
Any value above zero (0) sets the strength of
line repair. Requires "Repair Chrima"

Jitter Size (0=off)
Any value above zero (0) sets the strength of
scene jitter correction.

Threshold (0=off)
Any value above zero (0) sets the sensitivity
threshold required to incur scene correction.

Synch Signal Width (0=off)
A value of zero (0) leaves the video alone. Any
value above zero (0) proportionally shifts the
video synch horizontally.

VIEW Perspective changer

Apply VIEW settings (0=no)
A value of one (1) changes the video's viewing
perspective, maintaining bicubic frame sizing.

Lens Curve (0=off)
A positive value corrects fish-eye distortion. A
negative value corrects barrel lens distortion.

Top Left (X) 0=default
A non-zero value selects a different top left
corner along the horizontal (X) axis by the
value's percentage of total pixels.

Top Left (Y) 0=default
Same functionality as above, but referencing
the top left corner's vertical (Y) coordinate.

These next six sliders work in a similar manner
on their respective corner's coordinates.
Top Right (X) 100
Top Right (Y) 0
Bottom Right (X) 100
Bottom Right (Y) 100
Bottom Left (X) 0
Bottom Left (Y) 100

COLORize section

Apply Colorize settings (0=no)
A value of one (1) will apply color corrections
as defined by the other sliders in this group.

Filter Strength (10)
Sets the colorizing strength.

Low Tones Strength (10)
Determines the strength of also applying
colorization upon the low energy pixel values.

For the next sliders, a positive value applies
that color while a negative value reduces it.
Add/Subtract Red (0)
Add/Subtract Green (0)
Add/Subtract Blue (0)

FINALIZING FEATURES

MARGIN
The margin(s) becomes active when either the "Annotations Header" or "Waveform Footer" sliders are set above zero (0).

Annotations Header Size (0=none)
A value of two (2) creates a video header, equal to 25% of the file height, and then forces all annotations (Text, numbered frames, and Timestamp) proportionally into that header. Use a setting of one (1) to half this height.

Waveform Footer - Intensity (0=off)
Adds a video footer displaying the video's current audio volume waveform. This slider controls amplitude. Stereo audio is visually averaged into a mono representation.

ACCENT an area

Apply ACCENT settings (0=no)
Highlights the user defined region and/or the residual region. A value of one (1) will apply all active features within this filter group. A red border will appear until highlighting or pixilation has a non-zero value. This can help placement and serves as its own type of accenting style.

Use an Oval (0=rectangle)
A value of (1) changes the affected region's shape from a rectangle into an oval.

Highlight Inner (0=neutral)
A positive value lightens inside the selected region while negative values darken it.

Mask / Off / Pixilation (0=off)
Slider only affects the inner highlighted region. Values above (0) apply increasing pixilation. A (-1) value masks enhancements to this region and, when used with COMPARE's Matrix mode and the inner region is a rectangle, that region enlarges to become its own Matrix quadrant. A (-2) value inverts the mask affected area.

Highlight Outer (0=neutral)
The default value is zero (0). A positive value lightens outside the highlighted outer area while a negative value darkens that area.

Percent from_Top (0)
Percent from_Bottom (0)
Percent from_Left (0)
Percent from_Right (0)
Any value above (0) defines the percentage, away from the relevant video border, that is to be ignored by the features of this filter group.

TEXT Annotate

Apply TEXT settings (0=no)
A value of one (1) annotates the video with the exact text saved in VideoCleaner's options, which is defined by pressing the "F2" key, else the default annotation wording of "**Target**".

Insert keywords into F2 text to include special information. Keywords are not case sensitive, but must be formatted as (#keyword). e.g.:
   File (#File) opened on (#Day) at (#Time)
displays the word "File", then the current file's name, the words "opened on", then the day of the week, then "at", and then the current time.

The available keywords are	
Folder	Folder holding the image/video file
File	Name of the image/video file
Size	Size of the file measured in bytes
Width	Width of the scene in pixels
Height	Height of the scene in pixels
Aspect	Width to height ratio of scene
Day	Current day of the week
Date	Current date as month/day/year
Time	Current time in 24-hour format
Duration	Total playing time of the file
Framerate	Play speed in frames per second
Frames	Total number of file frames
User	User as defined by F2 key text
Line	Forces each line break
Logo	Inserts a logo image, if one exists. Must be named "LOGO.PNG" in the C:\VideoCleaner\Support folder, places at the left edge of the text, and is not affected by the size, angle or color TEXT format sliders

Relative Size (0=smallest)
The larger the value, the larger the relative size of the text annotation. Depending on the size of the target video, the default value of zero (0) may make the text too small to be seen.

Percent From Top (50)
Percentage from the video's top edge to show the annotation. Default of fifty (50) is midway.

Percent From Left (0)
Percentage from the video's left edge to show the annotation. Default of zero (0) is left edge.

Text Color (0=white)
Each value uses a different annotation font color and transparency to ensure the text is visible over nearly any video colors. The default value of zero (0) shows white text.

Angle (0=horizontal)
A positive value rotates annotation clockwise, while a negative rotates it counter-clockwise.

NUMBER Frame Numbers

Apply NUMBER settings (0=no)
A value of one (1) places an incrementally increasing frame number along the left edge. The number size is relative to the video's size.

Percent From Top_(0)
This value defines the percentage from the top edge to place the frame numbers. The default is zero (0), the top left corner of the video.

Starting Number (0)
The value is the starting frame number to be used (useful if the current video is a brief continuous portion from a much longer video).

Add a **TIME**stamp

Timestamps are preceded by a tilde to denote that this time is approximate.
Apply TIMEstamp settings (0=no)
A value of zero (0) disables this filter group. A value of one (1) displays an incrementally increasing timestamp on each video frame.

Percent from_Top (0)
The value defines the percentage from the top edge to place the timestamp. The default is zero (0) the top edge of the video.

Percent_from_Left (50)
This slider sets the timestamp's percentage distance from the left edge. The default is fifty (50), which approximates midway. As the value approaches 99, you will effectively hide the fractional seconds portion of the timestamp.

Relative_Size (4=medium)
The larger the value, the larger the relative size of the text timestamp, relative to the size of the target video. The default value is four (4).

Starting Hours (0)
  Starting Minutes (0)
    Starting Seconds (0)
These slider values determine what timestamp is to be displayed upon the first video frame (in 24-hour format). The timestamp increments upon subsequent frames at the video's frame rate (adjustable in the PROPERTIES filter group within the CORE section).

Apply Frame Offset (0=none)
VideoCleaner's timestamp counts in milliseconds and sometimes a video clip does not begin exactly on the second. Any value above zero will increment the starting timestamp by that many frames worth of timing. For example, at a setting of nine, the first frame of a video set to play at ten frames-per-second will have a timestamp of 00:00:00.900 and the next frame timestamp will be 00:00:01.000 and so on.

FINAL ColorSpace

Convert to YUV (0=no)
VideoCleaner works in RGB colorspace. If this slider is set to one (1), the final colorspace is changed to YUV, which significantly reduces the saved file size. It is common practice that, if the originating video began in YUV colorspace, the resulting enhanced video is saved in YUV.

FORENSIC AUTHENTICATION AND TAMPER TESTING (explained)
Performing and understanding Noise, Motion, DCT, PseudoColors, VELA and Min/Max analysis

Surveillance video is saved with destructive (lossy) compression, which results in compression error artifacts, and is perceived as high-energy moving noise. The continual absence or inconsistency of "noise", "motion vectors", and "DCT" (Discrete Cosine Transform) high-energy at any portion of a video is a strong indicator of post-production editing or subjective blurring at that portion of the scene.

PseudoColor, converts subtle pixel intensity differentials into extreme color shifts, making it easier to detect content cloning and intensity clipping, which will appear as identical colors. VELA (Video Error Level Analysis) depicts content cropping or alterations tampered content as inconsistent brightness and/or color, when compared to other scene details of similar contrast. Contrast or luminosity skewing (e.g. excessive darkness/brightness) is depicted as blue/red respectively by the Min/Max test.

WHAT YOU MUST DO FOR VELA IN VIDEOCLEANER
VELA testing requires that a re-compressed version of the test video already exist. First, be sure that the XVID codec is installed (there is an "Install - XVID Codec" shortcut in the VideoCleaner shortcut folder). This installation only needs to be done once, but there is no harm in repeating this step if you are unsure. The XVID Codec installation is fast with only a momentary on-screen message.

Open your video using VideoCleaner and, without applying any sliders, press F6 to transfer the video to VirtualDub, but don't close VideoCleaner. In VirtualDub, press CTRL-P and select the XVID Codec, and now to the right you will see a "Configure" button (select that and in the third box down labeled "Target quantizer" enter the number "8", select OK to save your settings), and click OK to commit the XVID Codec. Now press F7 to save the video. Save the video in with the same folder and name as the file being tested, but add ".VELA.AVI" to the file name. VideoCleaner will guide you to do this if you forget. Close VirtualDub once the file saving process is complete.

In VideoCleaner, move the "Apply ANALYSIS settings" slider to the right to activate this feature group and then move the "Test" slider to its rightmost position to activate VELA testing. Be aware that any saved *VideoCleaner.avi* file will be automatically deleted the next time the VideoCleaner program is re-started. As such, be sure to save or review your VELA results before closing VideoCleaner.

NOTES: Lossy compression or a skilled manipulator can affect testing results. Test results should be treated as compelling evidence and not as a definitive conclusion. Prior training and understanding of test results is expected. VideoCleaner analysis tests are based upon prior peer reviewed and public domain research: NOISE (Niabot, Djembayz, and Waithamai), MOTION (Laurent de Soras and pavelsx2), DCT (N. Ahmed, T. Natarajan, and K.R. Rao), Pseudo Colors (Dschwen, and Aimcotest), VELA (kaʁstn, George Chernilevsky, Dr. Neal Krawetz, and Doug Carner), and MinMax (Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, 1989 pp.240).

HEX EDITOR - VIRTUALDUB
VirtualDub includes a basic hex editor (located under the Tools menu) that display's hidden metadata.
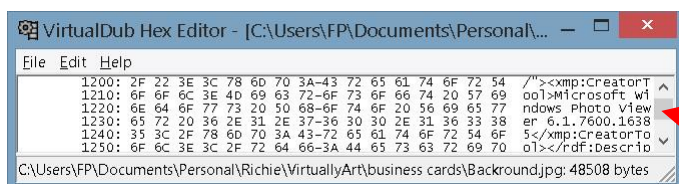
This example denotes that the loaded image file was last saved using Microsoft's Windows Photo Viewer.

TUTORIAL (Enhancing sample files**)**

The "VideoCleaner" folder on the user's computer includes a sub-folder named "Samples" which has several practice files. Each file is listed below along with the recommended enhancement steps to apply. Remember that, video enhancement is somewhat subjective. The quality of your vision and computer monitor will affect your perceived results. You are encouraged to experiment with different VideoCleaner features and settings. As with all skills, practice improves performance.

For these tutorials, it is recommended that the user install the Xvid Codec and Lagareth Codec, both of which are listed as links in the VideoCleaner program shortcut menu on their computer.

First, use the desktop icon to launch the VideoCleaner program. When VideoCleaner loads, the user then presses their computer's "F5" key (or CTRL-O) to load the desired file to work with.

Dark.jpg

Open the image file named "Dark" (or "Dark.jpg" depending on the computer's configuration). It is so dark that it is almost impossible to see anything, so first activate the **TOOLS** filter group by moving the slider named "**Apply TOOLS settings**" rightward.

This is a very dark scene, so move the "**Backlight / Off / Histogram**" slider rightward to position 1 (histogram) to expand the lighting and color levels. Since the text appears faint, move the **Video contrast Strength** slider rightward to about "14" to emphasize the luminosity differentials between adjacent pixels (dots of resolution). Now you can add additional improvements by moving the **UnSharpen** or **Deblur** sliders all the way rightward to improve image clarity.

NOTE: The Deblur filter can take minutes or even hours to process a video (which is why you should always test it without applying any other filters when working with high-resolution videos. Since "Dark.jpg" is just an image (a one frame video), the Deblur results will apply nearly instantaneously.

Turn ON the **FORENSIC** filter group (by moving **Apply Forensic settings** slider to the right) and set **Sobel** to position "2". This filter will automatically locate and emphasize edges. Since position 2 is for Chroma, and the image is nearly black/white, the resulting image takes on a greenish hue. To remove the color, you need only turn ON the **CHANNELS** filter group and move the **Off/ Gray / Negative / Both** slider Rightward to position "1". Although, the green version may appear clearer due to the way that our eyes work.

Now let's save the finished image by holding the computer keyboard's CTRL key down while then pressing the letter "S". Alternatively, the user can press their computer keyboard's "F6" key to send this image into VirtualDub, where it can be saved in a wider range of image (FILE --> EXPORT --> IMAGE SEQUENCE) or video file formats.

XVID.avi

The "XVID.avi" video demonstrates an extremely dark video from a stationary camera. For this video, you will need to have previously installed the XVID Codec. If this was never done, there is an installation shortcut in the VideoCleaner program shortcut folder to take care of that now.

Load the "**XVID.avi**" video, which is located in the "Samples" folder of "VideoCleaner" on your computer's C drive. As you play or scroll (right arrow key of your computer keyboard) through this video you will likely see nothing except darkness. We can fix this by turning ON the **TOOLS** filter group (by moving the slider named "**Apply TOOLS settings**" rightward), and then move the "**Backlight / Off / Histogram**" rightward to position 1 (histogram). Now scrolling through the video we can see a license plate, but each frame is not very readable due to the extreme pixilation noise.

Since this noise is random, we can average the video frames to improve the signal-to-noise ratio. To do this, turn ON the **FORENSIC** filter group (by moving the slider named "**Apply FORENSIC settings**" rightward), and then move the "**Frame Averaging Radius**" slider to its rightmost position, "50". Immediately the random noise is suppressed. Since this setting averages the prior and successive 50 frames, viewing frame number 50 (midway into the video) will maximize the effect.

Applying additional VideoCleaner settings will further improve the end results. For example, just turning setting the **Deblock Model** to "1" (located in the TOOLS filter group) will apply a subtle effect that leads to a slightly clearer image.

You can also move the "**Video Contrast Strength**" slider, located in the TOOLS filter group, to a position of "10" to further gain additional subtle improvements, and move "**Color Contrast Strength**" to a position of "5" to give the image a more visually pleasing appearance. That is the power of having access to such an extensive enhancement toolbox within in VideoCleaner.

Now let's save the finished result by holding down the CTRL key and then pressing the letter "S", which lets you save the current image in the location and format of your choosing. Alternatively, press the F6 key to send the video to VirtualDub. Within VirtualDub, press the "F7" key to save your enhanced video. If you hold the CTRL and press the P key (or "Compression" option under "Video" menu) before pressing F7 Save, you can select a compression codec that will reduce the file size.

There is a slider named **Deactivate all enhancements** located above the Tools filter group. Move that slider to the right to see what the image looked like prior to the applied enhancements. Alternatively, you can use the **transparency** slider (the second to last VideoCleaner slider) to blend the before and after versions. You can also use the **OFF / Side / Atop / Sweep** slider located near the top to compare the before and after results.

Noise.avi

Open the "Noise" video file. We can see that there is a lot of distracting noise in the Red and Green color channels. Before we turn off color channels, we will need to ensure that the luminosity levels will remain balanced. Turn ON the **TOOLS** section (by moving the slider named "**Apply TOOLS settings**" rightward) and "**Backlight / Off / Histogram**" rightward to position 1 (histogram).

Move down several filter groups to locate and turn ON the **Channels** filter group (Apply CHANNELS settings) and within that group turn OFF (move the slider rightward) both the **Red** and **Green** channels, leaving a blue channel image. In this same filter group, move the **Off/ Gray / Negative / Both** slider Rightward to position "1". The image should appear much clearer but you can clearly see that it is upside down.

In the Properties section is the **ANGLE** filter group. Turn this group on (Move the **Apply ANGLE settings** slider rightward) and then change the **Rotate video angle** to a setting of "180". The image is right side up, but we can see that it includes a noise pattern from having been a scanned image. Change the rotation value to "181" and notice how the resulting interpolation reduces that pattern effect.

We can further improve the the signal-to-noise ratio by adjusting the image's resolution using the **RESIZE** filter group. Turn ON that group (also in the Properties section) and activate **Preserve General Aspect Ratio** and adjust the **New Width** to "800". Like the angle change, here too we are using interpolation to suppress the distracting noise from the image details.

At the top of all the sliders, mouse click a check mark to activate the Toggle "Specialty" Section and be patient while the new feature group loads. Turn ON the **COLORize** feature group and set **Filter strength** to "12", **Low tones strength** to "9", **Add/Subtract red** to "4", **Add/Subtract green** to "-2", **Add/Subtract blue** to "4". These settings help restore a more natural color to the resulting image.

We can use the **ACCENT** filter group to define an area for highlighting (set the **Use an oval** to "1", **Highlight inner** to "9", **Highlight outer** remains at "0", **percent from_top** to "60", **percent from_bottom** to "24", **percent from_left** to "33, and **percent from_right** to "37"). Use the **TEXT** filter group to place the word "Target" on the image (set the **Relative size** to "6", **Percent from top** to "55", **Percent from left** to "27", **Text color** to "4", and **Angle** to "-18"). The actual text word (defaults to "Target") and is changed using your computer keyboard's F2 key.

Optionally, go to the **LENS Fish Eye Barrel Correction** section and use the top slider to turn this filter group ON. Now play with the settings to see their effect. You can also try the **VIEW** section to change the perspective (set the **Top left (x)** to "2" and **Top right (y)** to "4", with all other settings remaining at their default).

You may wish to experiment with additional effects to see if the final results can be further improved.

DCT.jpg

In nearly all circumstances, videos and images are compressed in a lossy manner, meaning that details are discarded and error artifacts are introduced, while the perceived visual accuracy is generally preserved. Each successive resave introduces additional compression errors. As such, post-production manipulations will show different error artifacts from the remaining untouched scene.

Open the "DCT" image file (located in the C:\VideoCleaner\Samples folder) to see one of our forensic lab stations. The picture appears normal, but it has been manipulated. Turn ON the **ANALYSIS** filter section (by moving the slider named "**Apply ANALYSIS settings**" rightward) and then move the "**Extract (off/Noise/DCT/Motion)**" slider to position number 2 to use the DCT (Discrete Cosine Transform) filter feature. DCT reduces the variable differential from the scene's energy level, and this is how most image and video files are compressed. In VideoCleaner, the DCT filter only displays the variable component, which is where most compression errors reside. As such, once the DCT filter is applied, the resulting scene may appear strange and quite dark.

Turn ON the **TOOLS** section (by moving the slider named "**Apply TOOLS settings**" rightward) and then move the "**Equalizer Strength**" slider to its rightmost position to enhance the brightness differentials. Notice that the area above the three chairs is devoid of noise, as are the three desktop monitors. These are the altered portions of the scene. If you would like a more pleasant view, set the "**Enhancement Transparency**" (the second to last slider in VideoCleaner) to about "4" to blend the before and after results. In practice, DCT is highly effective at detecting in-painting, which is the most common type of video manipulation.

DCT.jpg (the suspicious scene you are given)

The original unaltered image

VideoCleaner's DCT and VELA are powerful tests for common types of visual manipulations. However, extreme post-production compression and sophisticated tamper methods can prevent manipulation detection. As such, a lack of tamper detection is not proof of file authenticity.

The VideoCleaner DCT test results depicting the manipulations (wall picture and desktop monitors).

REFERENCES

Legend

A. Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, 1989 (isbn:0133325784)

B. Marcus Weise & Diana Weynand, How Video Works, 2nd edition, Focal Press, 2007 (isbn:0240809335)

C. Vlado Damjanovski, CCTV Networking and Digital Technology, 2nd edition, Elsevier Butterworth-Heinemann, 2005 (isbn:0750678003)

D. Bernard Grob & Charles E. Herndon, Basic Television and Video Systems, 6th edition, McGraw-Hill, 1999 (isbn:0071163093)

E. Nosratinia, Enhancement of JPEG-Compressed images by re-application of JPEG, Journal of VLSI Signal Processing, vol. 27, 2007 (issn:0922-5773)

F. J. Canny, A Computational Approach to Edge Detection, in IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 8, no. 6, 1986 (issn: 0162-8828)

G. S.Murali, Govindraj B. Chittapur, Prabhakara H.S, & Basavaraj S. Anami, IJCSA vol. 2, no.6, 2012 "Comparison And Analysis of Photo Image Forgery Detection Techniques"

H. Advances in Visual Computing: 7th International Symposium ISVC 2011 Las Vegas, NV "A Non-intrusive Method for Copy-Move Forgery Detection"

I. Hitesh C Patel and Mohit M Patel, IJCA (0975-8887) Volume 111, No. 15, 2015 "An Improvement of Forgery Video Detection Technique using Error Level Analysis"

J. W. Wang, J. Dong, and T. Tan, Digital Watermarking: 9th International Workshop, IWDW 2010 Seoul, Korea Section 3: "Tampered Region Localization of Digital Color Images"

Feature	References (in order of their appearance within VideoCleaner)			
Subtract	**A**. pp. 240	**B**. pp. 57	**C**. pp. 47	**D**. pp. 241
Unsharpen/Sharpen	**A**. pp. 249			
Video Contrast	**A**. pp. 49, 51, 120, 235...			**D**. pp. 51
Color Contrast/Saturate	**A**. pp. 235, 262			**D**. pp. 51
Suppress Hotspot	**A**. pp. 240		**C**. pp. 202	**D**. pp. 82
Equalizer/Histogram	**A**. pp 241-244, 344, 396	**B**. pp. 268		
Backlight Compensation	**A**. pp. 234-241			**D**. pp. 86
Stabilize	**A**. pp. 81	**B**. pp. 268		
Denoise	**A**. pp. 273			
Deblur Lens	**A**. pp. 322		**C**. pp. 58	
Focus Correction	**A**. pp. 276-284			
Deblock				**E**. pp. 69-79
Curve	**A**. pp. 240		**C**. pp. 202	**D**. pp. 82
Canny Edge Filtering				**F**. all
Sobel Edge Filtering	**A**. pp. 347-357			
Edge Filtering	**A**. pp. 71 & 234-241	**B**. pp. 57	**C**. pp. 47	**D**. pp. 241
Isolate Motion	**A**. pp. 522	**B**. pp. 167		
Isolate iFrames	**A**. pp. 485	**B**. pp.166		
RGBamplifier	**A**. pp. 234-241		**C**. pp. 197	
Frame Averaging	**A**. pp. 234-241		**C**. pp. 197	
Analysis	(see the bottom of page #20 of this guide)			

SCIENCE, MATH and CODE (continued reading)

Additional and optional components ([AviSynth](#), [CamStudio](#), [Codecs](#), [Lagarith](#), [VirtualDub](#), [xvid](#))

Color and luminosity ([AutoGain](#), [Histogram Adjust](#), [Histogram Equalize](#), [RgbAmplifier](#))

Edge detection and analysis ([Canny](#), [Sobel](#), [VELA](#), [DCT](#))

Opening a file ([DGDecode](#), [Direct Show Source](#), [ffms2](#), [MPEG2Dec3](#), [Rawsource](#))

Perspective filters ([DeBarrel](#), [Rotate](#))

Sharpening filters ([LSFmod](#), [Unsharp](#), [Sharpen](#))

Spatial noise filters ([Chroma Shift](#), [Remove Grain](#), [SmoothD2](#), [Vague Denoiser](#))

Specialty tools ([3dFourier](#), [Debanding](#), [Dejitter](#), [Deshaker](#), [Subtitler](#), [VideoCleaner](#))

Support tools ([ExpLabo](#), [GScript](#), [MaskTools](#), [Mvtools](#), [Mvtools2](#), [Nnedi2](#), [RT_Stats](#))

Temporal noise filters ([3d](#), [Degrain](#), [Denoise](#), [RemoveDirt](#), [Smoother](#), [Wavlet](#))

Demo license filters ([SuperResolution](#)) {purchase a license [here](#) and activate it [here](#)}*

*The development team of VideoCleaner is not compensated in any manner for the inclusion of filters that have a demo license. These filters do not have any advertising or tracking, are fully functional in their demo mode, and are included solely because they deliver superior peer-reviewed results.

VIDEOCLEANER FILTERS ARE ALWAYS APPLIED IN THIS ORDER
(*regardless of the order in which the user activates the program's sliders*)

DUPLICATE, CORE, FIELDS, ANGLE, CROP, RESIZE, CHANNELS (except negative), TOOLS + FORENSIC + ANALYSIS, CURVE, negative, DESEQuencer, VHS, VIEW, COLORIZE, MARGIN, ACCENT, TEXT, NUMBER, TIMEstamp, FINAL, *subtract*, COMPARE

> NOTE: There is no such thing as a perfect order to apply filters that will always work best for all videos. The order of the VideoCleaner filters are based upon the optimized results spanning thousands of real world forensic videos.

SUPER-USER (special features)

COMPARE's Matrix automatically substitutes the enhanced full view with a reference image (e.g. a vehicle or person) that ends in ".matrix.jpg". For example, if you were working on "TEST.AVI" then the reference image must be located in the same folder, and named "TEST.AVI.matrix.jpg".

PRIVACY

VideoCleaner is intentionally designed to operate cleanly and anonymously on the most secure networks without causing any exposure to security threats. VideoCleaner does NOT communicate over the Network or Internet, does NOT collect any usage information, and does NOT include any ad-ware, beggarware, etc.. of any type. VideoCleaner installs into one folder, does not invoke any background or scheduled Windows™ tasks, and closing the VideoCleaner interface immediately terminates all of its processing threads. The user is in full control at every stage of installation and usage, and all source code is included for full operational transparency.

LEGAL

VideoCleaner can be redistributed and/or modified under the terms of each component's relevant GNU General Public License, available in the VideoCleaner Support folder. VideoCleaner is provided "as is" without any warranties or guarantees, and its installation or usage constitutes a unilateral unlimited release of any and all related risks, damages and liability, actual or implied.

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Doug Carner donates his time as VideoCleaner's lead programmer and support, and Forensic Protection donates funding to keep the software and website advertising free. Neither party is financially compensated, nor accept donations or pay, for any aspect of VideoCleaner, but gladly accept accolades. Special thanks and appreciation are given to the invaluable development contributions by Marc Robinson and Allen Combs. VideoCleaner would not be possible without the peer review, user feedback and programming efforts of others. If you appreciate the features, consider donating to the respective programmers (see the SCIENCE, MATH and CODE section above). Users are encouraged to read the source code, create their own custom VideoCleaner versions, participate in the free support forum, and communicate with the developers.

GLOSSARY (definition of terms)

- **Codec** - An abbreviation of the words Compression Decompression, and it defines (in computer code) how a given video is to be saved and later reconstituted. Nearly all Codecs are lossy; meaning that details are irreversibly discarded to reduce file size. These losses can appear as muted brightness, an out-of-focus appearance, strange artifacts, and tiling (when the video looks like a mosaic of tiny rectangles). VideoCleaner provides the option to save files uncompressed, which preserves the available file details, thus creating very large file sizes. The noted defects can be suppressed using VideoCleaner's Tools and Deblocking sliders.

- **Color space** - There are different standards to record visual luminosity and color values. The color wheel is based upon RGB (Red, Green, Blue) where each value is that color's contribution to a given pixel. If all the RGB values are zero, the pixel appears black. If all the RGB values are at their maximum, then the pixel appears white. Television, and thus nearly all security cameras, use a planar color space, where pixel brightness is one value, and the color values are often shared with their neighboring pixels. YV12 is the most common planar color space used with surveillance video. The 2nd to last VideoCleaner slider transforms the enhanced video into YV12 color space.

- **Contrast** - Linearly expand or contract the value difference between adjacent pixel. If the critical details blend together, then VideoCleaner's video contrast (luminosity) and color contrast adjustments can expand the subtle differences to make the visual details easier to recognize. Adjust contrast with caution because, as contrast is increased, details located in the darkest or brightest areas of the video can become clipped as they try to exceed the allowed values. Videos that lack both very bright and very dark areas will benefit the most from contrast adjustments.

- **Histogram equalization** - Non-destructively increases the global contrast of the entire video by more evenly distributing the intensity differences between adjacent and overall pixel values. Videos that are extremely bright (e.g. details are washed out) or extremely dark (e.g. a nighttime video with insufficient lighting) will benefit the most from this process.

- **iFrames** - Frames that contain the entire scene and thus are the truest to what the camera saw. All other types of video frames are composites made by adding or subtracting pixels from the closest iFrames. Depending on the video Codec, non-iFrames can introduce additional visual defects. VideoCleaner's Forensic tools include an option to isolate just the iFrames.

- **Interlaced** - When video broadcasting was invented (over 70 years ago), images from two consecutive but independent moments in time (called fields) where simultaneously displayed as one frame by interlacing these fields in a vertical weaving pattern. While newer systems use progressive systems that avoid this (e.g. 1080i for interlaced and 1080p for progressive), most security systems still record interlaced video. When those systems use their proprietary playing software, that software will often deinterlace (undo the interlacing) by blending both moments in time, which creates distortion and a false set of facts. VideoCleaner's Field filters (located in the Properties section) can non-destructively isolate, and correctly align, those interlaced fields.

- **Pixel** - A video or image is actually displayed as a grid of dots called pixels. Each pixel is denoted by values that, depending on its format, may include details about luminosity (brightness), color and transparency. VideoCleaner uses 32-bit RGBa color space to retain maximum pixel details, and the status bar seen below the video displays the relevant values for the current image pixel located under the computer's mouse pointer position.