

Neat Video

noise reduction plug-in for Pinnacle Studio

To make video cleaner.

User guide

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1. Introduction

1.1. Overview

Neat Video is a filter designed to reduce noise and grain in digital video.

Neat Video detects, analyzes, and reduces noise. The quality of noise reduction provided by Neat Video is higher than that of other methods because Neat Video incorporates the most advanced noise reduction algorithms in the industry and takes into account specific characteristics of particular video capturing devices – video camera, camcorder, computer TV-tuner, etc., – making the filtration customized and more accurate.

In addition, Neat Video can make video sequence look sharper without any degradation of quality. The combination of the sharpening and noise filter makes such an effect possible.

Neat Video plug-in for Pinnacle Studio is currently produced in three editions: Demo, Home and Pro. The Demo plug-in is a free edition of the software with limited functionality. The Home plug-in is intended for home users, it processes video data with up to DVD-size frames. The Pro plug-in provides professionals with all Neat Video features without limitations (no frame size limitations).

1.2. Features

Noise Reduction and Smart Sharpening

- **Advanced noise filter** to reduce noise and grain in digital video sequences
- **Temporal filtration** to reduce more noise and better preserve true details
- **Complete control** over the noise filter to achieve the desired level of noise reduction
- **Smart sharpening filter** to make video look sharper without amplification of noise

Device Noise Profiles

- **Custom noise profiles** to make noise reduction device-specific and more accurate
- **Automatic noise analyzer** to build noise profiles for your video-capturing device

Preview

- **Embedded preview** for any selected area of a frame from video sequence
- Preview of filtration results separately for each **channel** and **frequency component**
- **Variant Selector** for easier adjustment of the filters

Some features are only available in the Home or Pro plug-in. Detailed feature map (page 37) explains the differences between Neat Video Demo, Home and Pro plug-ins in details.

1.3. Requirements

Recommended system configuration is:

- Windows XP or newer
- Duo or Quad Core machine
- 1024 MB RAM or higher
- True color display, resolution 1024x768 or more

Minimum system requirements are:

- Windows 2000
- Pentium-III class machine
- 512 MB RAM
- True color display, resolution 800x600

System requirements for practical use of Neat Video depend on frame size and length of video sequences because processing larger frames and longer sequences takes proportionally more time than smaller ones. The processing speed is determined primarily by the processor number-crunching power and memory speed.

The Neat Video plug-in can process any RGB video sequence supported by the plug-in host.

Neat Video plug-in for Pinnacle Studio is compatible with the following plug-in hosts:

- Pinnacle Studio 12.0 and newer
- Pinnacle Studio 11.0 and newer
- Pinnacle Studio 10.2 and newer

The plug-in may be also compatible with other versions of Pinnacle Studio.

2. Key concepts

2.1. What it can do – functionality of Neat Video

Neat Video is a digital video filter. Its main function is to *reduce noise* in digital video sequences.

Neat Video can work with video sequences produced by any video recording devices – video cameras, camcorders, computer TV-tuners, film digitizers, etc. The software can be adjusted to a particular device by means of a *device noise profile*, which describes the noise characteristics of the device working in a certain mode.

A device noise profile is built by analyzing those areas of a video frame that contain no visible or important details. Usually, Neat Video can find such featureless areas completely automatically. In a difficult case, you can assist it and select a featureless area manually. Finding such areas is very easy for human eyes but may sometimes be a bit difficult for software.

By analyzing featureless areas in a frame, Neat Video's *noise analyzer* builds a profile which describes the noise in these areas. With this profile, Neat Video can efficiently reduce noise in the frame and in the whole video sequence.

The noise filter processes a video sequence in several *spatial frequency ranges*. This makes possible reducing noise in one frequency range even if details are present in other ranges. The filter can also selectively process any of the color channels of the video sequence.

Besides the intra-frame filtration, Neat Video also applies *temporal* (inter-frame) filtration to the video sequence. Neat Video uses several consequent frames to better reduce noise and preserve more true details in each frame. This improves the overall quality of noise reduction.

In addition to the noise filter, there is the *smart sharpening filter*, which only sharpens important details without increasing the level of noise. This filter also uses the noise profile to tell noise from details, so applying the noise and sharpening filters together saves time and produces better overall results.

2.2. When it works – types of noise

Neat Video is designed to reduce noise in video sequences produced by video cameras, camcorders, computer TV-tuners, film digitizers and can also be used to process video sequences from other sources. To be efficiently processed, a video sequence should satisfy the following requirements:

- **Noise must be uniformly distributed throughout each frame**, i.e., there should be no strong surges of noise intensity in some areas of one frame or significant changes of noise characteristics across the frame.

Neat Video works fine, for example, with video sequences produced in high sensitivity modes of a digital video camera (digital noise) or with sequences captured on highly sensitive film (film grain). However, traces of dust particles on a sensor or film do not satisfy the uniformity condition and, therefore, are not efficiently removed by Neat Video.

Another possible source of noise is video compression. The compression noise is approximately uniform when high compression quality is used. Low compression quality makes noise non-uniform. Therefore, we recommend using the highest quality levels whenever possible. Try to avoid visible compression artifacts in video sequences beginning from the early stages of your post-processing workflow.

- **Noise should be concentrated in high and medium spatial frequencies.** This condition is usually met by most video sequences produced by modern digital video capturing devices.

3. Installing the plug-in

When you install Neat Video using its standard installer, the installer should automatically install the plug-in into Pinnacle Studio. In case the plug-in has **not** become available in your plug-in host (the plug-in should appear as *Neat Video* in the list of available effects when you choose to Add Video Effect), you can manually install it using the guidelines below.

To manually install Neat Video plug-in into Pinnacle Studio

- ➔ Copy the *NeatVideoPN.fex* and *NeatVideoPN.xml* files from the Neat Video installation folder (typically, *C:\Program Files\Neat Video for Pinnacle Studio*) into the *\Plugins\RTFx\NeatVideo* subfolder inside the Pinnacle Studio folder.

Typically, the above two files should be copied to:

C:\Program Files\Pinnacle\Studio 1x\Plugins\RTFx\NeatVideo

Re-start Pinnacle Studio and find *Neat Video* in the list shown when you choose to Add Video Effect. After that, the *Neat Video* can be used in Pinnacle Studio projects.

4. Running Neat Video on a sample video clip

There is a test-kit prepared to help you start using Neat Video. You can download the test-kit from the Neat Video web page: <http://www.neatvideo.com/files/testkit.zip> (2 MB). Having downloaded, unzip it to a new folder on the hard disk.

The test-kit contains a sample video clip: the *SampleClip.mpg* file. This clip is a part of typical video sequence captured by a digital camcorder. Detailed information about the sample clip is available in the *SampleClipInfo.txt* file.

Please start Pinnacle Studio and go through the stages below to see how Neat Video can improve the clip.

4.1. Stage I. Add the sample clip to the project

1. Configure a new project in Pinnacle Studio

- ➔ Create a new project in Pinnacle Studio.

Then click the *Ok* button and Pinnacle Studio will open the new project with the *Timeline*, *Video Preview* and other windows.

2. Add the sample clip file to the project

- ➔ Use the *Show videos* panel in the *Edit* tab in Pinnacle Studio to find and select the *SampleClip.mpg* file from the test-kit.

3. Add the sample clip to video track

- ➔ Drag-n-drop the sample clip to the empty video track in *My Movie 1* window and then enable the *Timeline* view in that window.

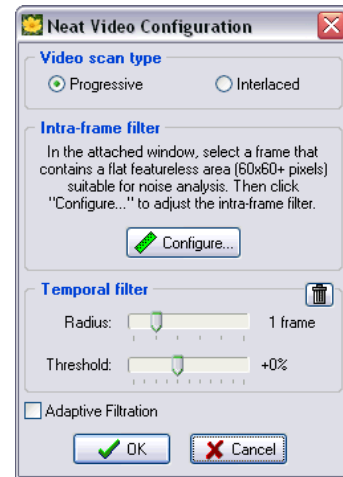
Select any frame in the clip and you will then see that there is strong noise in it (see the *Video Preview* window). The task of *Neat Video* is to reduce this noise.

4.2. Stage II. Add Neat Video

- ➔ 1. Go to the Toolbox menu and select the Add Video Effects command to open the empty list of currently used Video Effects and the list of available effects in the Add Video Effect list;
- 2. Select Neat Video in the Add Video Effect list and press the OK button.

Pinnacle Studio will add Neat Video and will show the Neat Video Noise Reduction settings panel with the only button in it: Edit Neat Video Noise Reduction settings.

Click that button to open the Neat Video Configuration window (see the picture on the right).



4.3. Stage III. Configure Neat Video


1. Open Neat Video plug-in window

- ➔ In the Neat Video Configuration window, click the Configure... button (in the Intra-frame filter box);

The Neat Video plug-in window will appear and will show the currently selected frame from the clip.

2. Open noise profile

To reduce noise in this frame and in the whole clip, Neat Video generally needs a noise profile describing the noise properties of the video sequence. We have prepared such a noise profile in advance. The profile is supplied with the test-kit in the *SampleProfile.dnp* file. Using the noise profile, Neat Video can efficiently reduce the noise in the video sequence.

- ➔ 1. Click  (blue disk) in the Device Noise Profile box on the right panel;
- 2. In the Open device noise profile dialog, navigate to the folder where the sample device noise profile has been unzipped and double click on the *SampleProfile.dnp* file.

The sample noise profile is now open and Neat Video is almost ready to filter the sample clip. Usually, you would adjust the filter settings at this stage. To make things easier for the first run of Neat Video, we have prepared a sample preset file that stores 'good' filter settings suitable for the sample clip.

3. Load filter preset

- ➔ 1. Switch to the Noise Filter Settings tab: 
- 2. Click  (pink disk) in the Filter Preset box on the right panel;
- 3. In the Open filter preset dialog, navigate to the folder where the sample filter preset has been unzipped and double click on the *SamplePreset.nfp* file.

Now the sample filter preset is open and the filter settings are adjusted to process the sample clip.

4. Apply the intra-frame filter settings

- ➔ Click  on the toolbar.

The Neat Video plug-in window will be closed and you will again see the Neat Video Configuration window.

- ➔ Keep the default values of the Temporal filter settings in the Neat Video Configuration window for now and press the OK button.

4.4. Stage IV. Apply noise reduction to the clip

- ▶ Use the *Make Movie* tab in Pinnacle Studio and the set of controls in that tab to render the whole clip. The clip will be filtered by Neat Video in this process.
- ▶ Then check the rendered clip using your video player to evaluate the results of noise reduction.

Please note that the noise in the filtered clip is significantly reduced while the true details are preserved. You can also find that the resulting noise-free clip can be compressed better (the file size is smaller) than the original noisy clip (this depends on Pinnacle Studio' output compression settings).

The sample noise profile and sample filter preset supplied with the test-kit are suitable only for the sample clip and similar clips produced by the same capturing device working in the same or similar mode. Neat Video can perform similar noise reduction on video clips captured or acquired by any other devices working in any mode. To be able to do that Neat Video needs device noise profiles that describe the noise characteristics of those devices. With Neat Video, you can easily build these profiles yourself. The software can completely automatically build a profile once you give it a suitable frame from a clip.

The next sections – Filtration process details, page 8, and Device noise profiles, page 19, – contain detailed descriptions of the filtration and profiling processes.

5. Filtration process details

This section explains how to apply the Neat Video noise reduction to a video sequence in Pinnacle Studio.

5.1. Stage I. Select a frame for noise analysis

Neat Video filter uses a frame (or two fields¹) from the video sequence to analyze noise and build a noise profile necessary to reduce noise in the sequence. This frame should include flat featureless areas that contain no visible details. To build a noise profile you have to manually find such a frame in the video sequence using the *Timeline view* in Pinnacle Studio. If there are many frames that contain flat featureless areas then select one with largest and most noisy flat featureless areas.

- ➔ Use the *Timeline view* controls to find and select a frame with large flat featureless areas; the selected frame will be used for noise analysis in the next stages.

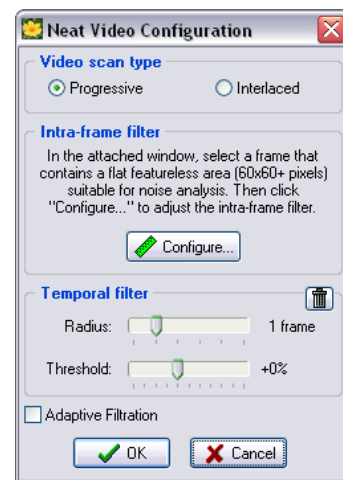
5.2. Stage II. Add Neat Video filter

To add the Neat Video noise reduction filter to the Pinnacle Studio project:

- ➔ 1. Go to the *Toolbox* menu and select the *Add Video Effects* command to open the list of currently used *Video Effects*;
- 2. Press the *Add New Effect* button in the bottom of the list;
- 3. Select *Neat Video* in the *Add Video Effect* list and press the *OK* button.

Pinnacle Studio will add Neat Video and will open the Neat Video Noise Reduction settings panel with the only button in it: *Edit Neat Video Noise Reduction settings*.

Click that button to open the Neat Video Configuration window (see the picture on the right).



5.3. Stage III. Open Neat Video plug-in window

- ➔ In the Neat Video Configuration window, click the *Configure...* button (in the *Intra-frame filter* box) to open the main Neat Video plug-in window;

The Neat Video plug-in window will appear and show the earlier chosen frame (for progressive video) or two fields, upper and lower, one on top of another (for interlaced video). This frame or fields will be used to build a noise profile necessary to filter the whole sequence.

To scroll and pan the frame

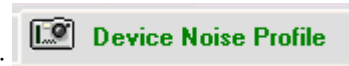
- drag the frame using the middle mouse button;
- press the spacebar and drag the frame with the left mouse button.

To change zoom level

- use the mouse wheel when mouse is over the viewer;
- use the zoom control on the toolbar;
- use the *Ctrl-Plus*, *Ctrl-Minus*, *Ctrl-0*, *Ctrl-Alt-0* keyboard shortcuts;
- use *Alt-Shift* to temporarily change zoom to fit the frame to window.

¹ We will use the term “frame” to refer to both variants: frame (in progressive video) or two fields (in interlaced video).

5.4. Stage IV. Prepare a device noise profile



Use the Device Noise Profile tab in the Neat Video plug-in window:

To filter the noise in the video sequence, Neat Video needs to know the characteristics of noise produced by the input device (video camera, TV-tuner, etc.) that the video sequence comes from. The noise characteristics of a device working in a certain mode are stored in a *device noise profile*.


There are several ways to get a device noise profile for the video sequence:

- To build a new profile using the selected frame from the video sequence;
- To select a suitable profile from a ready-made set of profiles.

The first option is often the easiest one provided the selected frame contains uniform featureless areas that include noise with no visible or important details. Neat Video can automatically find such areas in the frame and analyze noise in there to build a noise profile. When the selected frame contains featureless areas that can be analyzed, this way of preparing a noise profile is the most accurate and therefore recommended.

The second option is available once you have built and saved profiles for your video capturing device.

To build a new profile using the selected frame from the video sequence

- ➔ Click  (the Auto Profile button) on the toolbar, or select the Profile | Auto Profile menu item, or press F2.

Neat Video will find and highlight the area selected for analysis (see the blue selection box in the frame viewer; the blue color indicates that the area has been chosen automatically). Neat Video will then automatically analyze the noise in the area.


In difficult cases, Neat Video may have trouble finding a uniform featureless area in the frame. You will notice that the selected area, for example, will contain some important details, not just noise. In such cases, Neat Video also warns you that the area is not suitable for analysis. It may say that the selected area is not uniform in one or more channels, or is too small, or contains clipping in one or more channels. In such a case, just move the selection (or draw a new one) to an area that does not contain any important details and click the same Auto Profile button again.

After the profile is built, check the Profile quality indicator in the bottom of the Neat Video plug-in window. A profile built using a uniform and featureless area will show a high value in this indicator. If the profile quality is high then you can be sure that the noise profile is accurate. In this case, proceed to Stage V. Adjust intra-frame filter settings, page 10.


If the quality is not high, try to select another uniform and featureless area and use Auto Profile once again. That may not help still, especially if the selected frame contains only a few small featureless areas. In this case, consider building a noise profile using another frame from the same video sequence: close the Neat Video plug-in window and the Neat Video Configuration window and select another frame using the Pinnacle Studio controls in the Timeline view.

You can also try to build a profile in manual mode, which may provide a higher quality of noise analysis. You can find more details on automatic and manual profiling in the Device noise profiles section, page 19.

To select a noise profile from a pre-built profile set

- ➔ Click  (the Open device noise profile... button, blue disk) in the Device Noise Profile box or select the Profile | Open... menu item. In the Open device noise profile dialog box, select the device noise profile to be opened.
- or
- ➔ Select a profile using the popup menu: click on the button on the right side of the profile name

shown in the top part of the **Device Noise Profile** box, and select a profile from the popup menu.¹

You may want to additionally fine-tune the profile you have just opened. You can fine-tune this profile to the current video sequence using  (the **Auto Fine-Tune** button) or the **Profile | Auto Fine-Tune** menu item. Fine-tuning usually makes the profile more accurate and better matching the current video sequence.

Please note that you do not need to fine-tune a profile if you have just built it using **Auto Profile**. **Auto Profile** automatically applies auto fine-tuning so you do not need to repeat it.

5.5. Stage V. Adjust intra-frame filter settings


Use the **Noise Filter Settings** tab in the Neat Video plug-in window:



The Neat Video noise reduction and sharpening filters have several settings that you can adjust. Default noise filter settings are based on the noise analysis provided by the noise profile; these settings usually produce good filtration results if the noise profile is accurate. You may want to additionally vary the filter settings to achieve the filtration results that look best to your eyes.

There are two sets of filter controls available in the **Standard mode** and **Advanced mode** (you can select the mode using the **Tools | Standard mode and Advanced Mode** menu items). The **Standard mode** provides a simple control set, recommended for beginners who just start using Neat Video. The **Advanced mode** provides the most complete control set with maximum manual control over noise profiling and filtration processes. The **Advanced mode** is recommended for power users. Adjusting filter settings is described below separately for the **Standard** and **Advanced mode**. We recommend to start with the part about the **Standard mode** and then proceed to the part about the **Advanced mode** if you are going to use the complete control set.

5.5.1. Use intra-frame preview when adjusting filter settings

To use preview, click  (the **Preview** button). This will select an area in the frame displayed in the Neat Video plug-in window and will automatically apply filtration to the selected area.

Alternatively, you can manually select any area (press the left mouse button, drag the mouse and then release the button) in the frame. When an area is selected, Neat Video will automatically apply² filtration to the selected frame area. You can also manually update the preview using the **Preview** button, or the **Filter | Preview** menu item, or the **F5** hotkey.

As soon as the preview is ready, you can left-click on the selected area to temporarily switch back to the original for comparison.

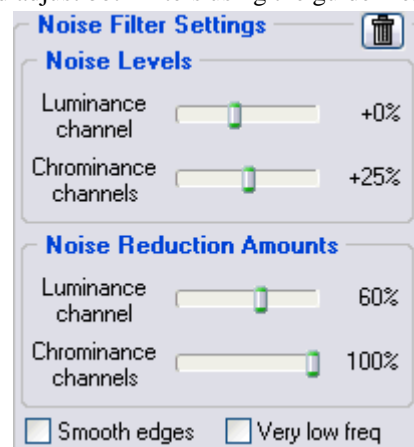
5.5.2. Adjust filter settings (Standard mode)

There are two main filters in Neat Video: noise reduction filter and sharpening filter. These two filters can be used together or separately. You can enable / disable and adjust both filters using the guidelines in the subsections below.

Adjusting noise filter settings in Standard mode

When you work with a color video sequence, two components of the video information can be distinguished: the luminance and chrominance component. This distinction is very useful from the standpoint of noise reduction because it allows processing luminance and chrominance information separately by the noise filter.

Some color video sequences are represented in color spaces that enable direct separation of the luminance and chrominance components (for example, the **YCrCb / YUV /**



¹ If there is no popup menu, please see **Folder options**, page 31.

² Only if **Auto recalculate preview** is checked; see **Filtration options**, page 30.

YPrPb color spaces). Other sequences (including RGB video sequences that Neat Video takes as input) have to be converted to another representation to enable separation of the luminance and chrominance components. Neat Video makes an internal color space conversion to achieve that (by default, Neat Video converts an RGB input frame to the YCrCb working color space). Once luminance and chrominance components of the video information are separated, Neat Video can treat them individually. Neat Video provides separate luminance and chrominance settings in the noise filter (see on the right).

Noise reduction applied to a video component is controlled by two settings: *noise level* and *noise reduction amount*. Such a pair of settings associated with a component (here, either the luminance or chrominance component) is fundamental for Neat Video noise reduction.

Let us return for a moment to the noise analysis and noise profile. When you did the noise analysis and built the noise profile, Neat Video measured levels of noise in each component of the analyzed frame. The measured noise level of a component can be low or high depending on the strength of the visible noise in this component. Neat Video analyses the noise and measures the noise level, which results in a number saved in the noise profile. You can see these numbers – the measured noise levels – using the Profile Viewer window (it is accessible via the Profile | Profile Viewer menu item or the Ctrl-I shortcut).

For example, the noise level of the luminance channel (Y channel) could be measured at 8.55 units. This number tells the noise filter which elements of the frame should be considered noise and which – important details: the elements that are weaker than 8.55 units are considered noise and reduced by the noise filter; the elements that are stronger than 8.55 units are considered details and are preserved.¹

If you do not change the default noise filter settings (Noise Levels: Luminance channel: +0%) then the noise reduction is determined only by the above noise level from the noise profile. However, if you do adjust the filter setting for the noise level of the luminance channel, then this adjustment is also taken into account. For example, if you set the Noise Levels: Luminance channel control to +15% then what is used by the noise filter as the actual noise level is:

$$8.55 * (100\% + 15\%) = 9.83 \text{ units}$$

With this adjustment, those frame elements (in the luminance channel) that are weaker than 9.83 units are considered noise and reduced, and elements that are stronger than 9.83 units are preserved.

As you have just learned, the *noise level* of a certain video component tells the noise filter *what* should be considered noise and what – important details in this component.

The *noise reduction amount* related to the same component tells the noise filter *how much* of the found noise should be reduced. For example, if the noise reduction amount is set to 50% then all frame elements that are weaker than the noise level (in the above example with noise level adjustment it is 9.83) are reduced (made weaker) in half. The noise reduction amount value of 100% tells the filter to remove the found noise completely.

Thus, with a *noise level - noise reduction amount* pair of settings you can adjust what should be considered noise in a video component and how much of this noise should be reduced. In the standard control set of Neat Video, you have access to two such pairs in the noise filter: one for the luminance channel of the video sequence and one for the chrominance channels.

Because the noise level estimations used by the filter are based on the noise profile, the default filter settings usually produce good filtration results if the noise profile is accurate². When the noise level controls are adjusted in some direction, the noise level estimations are raised or lowered accordingly. An adjusted noise level can be in the range from -100%, (no elements are considered noise, and therefore, no noise reduction is applied in the corresponding component) to +150% (noise reduction is applied to the frame elements that are weaker than $100\% + 150\% = 250\%$ of the noise profile's noise level).

Noise reduction amount controls determine how much reduction is applied to the frame elements identified as noise. Noise reduction amounts can be in the range from 0% (none of the detected noise is removed) to 100% (all the detected noise is removed). By default, the noise filter removes 60% of detected noise in the luminance channel and 100% of noise in the chrominance channels. Our experience shows that the default noise reduction amounts generally provide a good balance between noise removal and preserving natural (not over-processed) appearance of filtered video sequences.

¹ In this sense, the noise level (8.55 units in this example) may be considered a kind of threshold if you compare it with other filters you may use (e.g., Unsharp Mask).

² Use the Profile quality indicator in the bottom of the Neat Video window to estimate the accuracy of the profile. The Profile quality indicator shows how accurate and complete the noise analysis is.

Adjust noise reduction amounts¹

- ➔ Use the Noise Reduction Amounts: Luminance channel **and** Chrominance channels sliders.

You can vary the noise reduction amount for both luminance and chrominance component of the video sequence. The higher a certain noise reduction amount, the more of the detected noise is removed in the corresponding component. Be careful, setting the noise reduction amounts too high, especially in the luminance channel, may lead to loss of fine details and unnaturally looking (over-smooth, plastic-like) results. Too low amounts may be not enough to sufficiently reduce the objectionable part of the noise. You have to balance the noise reduction amounts (most importantly, the amount of noise reduction in the luminance channel) to get the result that looks best to your eyes.

As human vision is not very sensitive to variations of colors, strong filtration in the chrominance channels does not noticeably distort video sequence, but efficiently reduces color noise.

Adjust additional filter settings (optional)

- ➔ If the video sequence contains very coarse-grained noise (very low frequency² noise) then you may want to enable the very low frequency filter: check Very low freq in the Noise Filter Settings box.
- ➔ Check the Smooth edges checkbox to make edges and lines in the video sequence look smoother.

Use intra-frame preview

- ➔ Use the intra-frame preview when adjusting the noise filter settings.

After you have made changes to the noise filter parameters, do not forget to check the preview.³ Use the preview on different parts of the frame to get a better feeling for the results of noise reduction.

If the noise filtration looks too strong try to decrease the noise reduction amounts for appropriate channels. If the noise filtration is not sufficient then increase the amounts. Use the Component Viewer (see below) to determine the channels that require adjustment.

Adjust noise levels (when necessary)

Usually it is not necessary to change the noise levels if the noise profile is accurate. You only have to adjust the noise levels if you see that some noise elements are not reduced even if you set the noise reduction amounts to 100%. Such residual noise elements are usually caused by an inaccurate noise profile providing inaccurate noise level estimations to the noise filter. This may be compensated by adjusting (increasing) the noise levels in the filter settings.

- ➔ Use the Noise Levels: Luminance channel **and** Chrominance channels sliders.

The higher a certain noise level, the more elements in the corresponding video component are considered noise. Be careful, setting a noise level too high can lead to removal of important details. Setting a noise level too low can lead to incomplete filtration: residual noise and compression artifacts may remain in the video sequence.

As a rule, if the device noise profile has been built properly, it is not necessary to increase the noise levels by more than 50%.


If adjusting noise levels still does not help and some noise elements remain in the preview, probably the device noise profile is not good at all. Return to Stage IV, page 9, and additionally fine-tune the device noise profile or simply rebuild the profile from scratch.

¹ We recommend disabling the sharpening filter when adjusting the noise filter. To disable the sharpening filter, set the Sharpening amount: Luminance channel to 0%.


² See “what is frequency” question in page 35.

³ Using Auto recalculate preview is recommended (see Filtration options, page 30).


Use Component Viewer (optional)

The Component Viewer (use  to open it) is intended for detailed examination of video components. Find more details about using this tool in the Component Viewer subsection, page 27.

Use Variant Selector (optional)

The Variant Selector (use  to open it) is designed to compare several variants of filtration side-by-side to find the optimum filter settings easier and faster. More information about this tool is available in the Variant Selector subsection, page 27.

Use Viewer Adjustments (optional)

The Viewer Adjustments window (use  to open it) helps to adjust the Neat Video viewers. You can operatively adjust the brightness and contrast of the viewers to better see the effect of noise reduction in an interesting area of the frame (for example in a very dark part of the frame) easier and faster. More information about this tool is available in the Viewer Adjustments subsection, page 28.

Adjusting sharpening settings in Standard mode (optional¹)

The sharpening filter is designed to increase sharpness of the video sequence without increasing the noise strength.

The sharpening filter is disabled (sharpening amount is set to 0%) by default. Adjust the sharpening amount if you want to sharpen each frame in the video sequence. Like with any sharpening method, you have to balance the sharpening amount to avoid over-sharpening.

Use the preview when adjusting the sharpening settings.

Adjust sharpening amount

- ➔ Use the Sharpening Amount: Luminance channel slider.
Specify how much sharpening should be applied to the luminance channel of the video sequence.



Use intra-frame preview

- ➔ Use the intra-frame preview when adjusting the sharpening setting.
After you have made changes to the sharpening settings, do not forget to check the preview. Use the preview on different parts of the frame to get a better feeling for the results of sharpening.
As soon as you are happy with the preview results regarding both noise reduction and sharpening, proceed to save the filter settings into a preset (see page 16), or directly to Apply intra-frame filter settings, page 17.

5.5.3. Adjust filter settings (Advanced mode)

As compared with the Standard mode (see Stage V. Adjust intra-frame filter settings, page 10), the Advanced mode offers a more sophisticated set of filter controls. There are also two filters – noise reduction filter and sharpening filter – but these have more settings. Please follow the guidelines below to adjust both filters.

Adjusting noise filter settings in Advanced mode

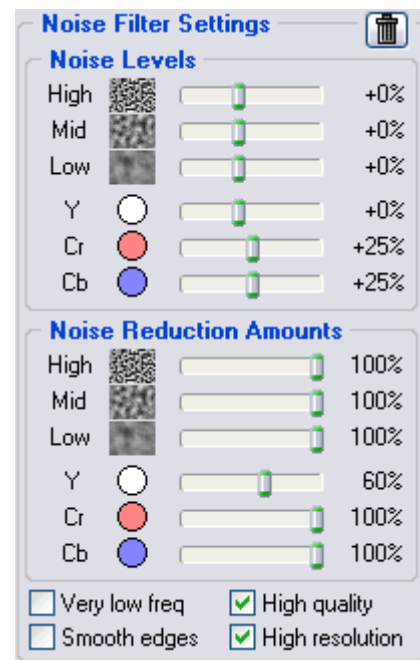
In the Advanced mode, the noise filter has separate settings for all frequency and channel components of the video sequence. There are pairs of *noise level - noise reduction amount* controls for each of these components. The meaning of each *noise level - noise reduction amount* pair is the same as explained in the Adjust filter settings (Standard mode) section, page 10: a noise level control determines which frame elements are considered noise in the corresponding video component; a noise reduction amount

¹ You can skip this subsection when reading for the first time.

control determines how much reduction is applied to the frame elements identified as noise in the same component.

Because the noise level controls are relative to the device noise profile, their defaults usually produce good results when the noise profile is accurate¹. The noise level defaults are 0%², which means the noise levels are completely determined by the noise profile. When the level controls are set differently, the noise level estimations are raised or lowered accordingly. A noise level can be in the range from -100%, which means no elements are considered noise, and therefore, no noise reduction is applied in the corresponding video component; to +150%, which means noise reduction is applied to the elements that are weaker than 250% of the noise profile's noise level.

Noise reduction amounts can be in the range from 0% (none of the detected noise is removed) to 100% (all the detected noise is removed). By default, the noise filter removes 100% of detected noise³.



Adjust noise reduction amounts (optional)⁴

- ➔ Use the Noise Reduction Amounts: High, Mid, and Low; Y, Cr, Cb (R, G, B) sliders.

You can vary the noise reduction amount for each frequency and channel component of the video sequence. The higher a certain noise reduction amount, the more of the detected noise is removed in the corresponding video component. Be careful, setting the noise reduction amounts too high can lead to unnaturally looking (over-smooth, plastic-like) results. Too low amounts may be not enough to sufficiently remove the objectionable part of the noise. You have to balance the noise reduction amounts (most importantly, the amount of noise reduction in the Y channel) to get the result that looks best to your eyes.

As human vision is not very sensitive to variations of colors, strong filtration in the Cr and Cb channels does not noticeably distort video sequence, but efficiently reduces color noise.

If the video sequence has only fine (high frequency) noise elements you may want to utilize only the high frequency filter and switch off the filters for other frequencies by setting their amounts to 0%.

Adjust additional filter settings (optional)

- ➔ If the video sequence contains strong low frequency noise then you may want to enable the very low frequency filter: check the *Very low freq* checkbox in the *Noise Filter Settings* box.
- ➔ Check the *Smooth edges* checkbox to make edges and lines look smoother.
- ➔ Check the *High quality* checkbox to enable higher-quality noise reduction filter. This will slightly slow down processing but will deliver the most accurate results in return. You may want to enable this option in the very end just before applying the filtration to the whole video sequence.
- ➔ Check the *High resolution* checkbox to enable the higher-resolution noise filter. This may be useful when processing video sequences with very fine details that should be better preserved by the filter.

Noise samples of different frequency/size are shown in the *Noise Filter Settings* box. These are examples of grainy structures typically regarded as noise.



¹ Use the Profile quality indicator in the bottom of the Neat Video window to estimate the accuracy of the profile. The Profile quality indicator shows how accurate and complete the noise analysis is. The indicator has to show a high value for the noise reduction to be accurate.

² Some of the noise level defaults may be different from 0%.

³ Some of the noise reduction amount defaults may be different from 100%.

⁴ We recommend disabling the sharpening filter when adjusting the noise filter. To disable the sharpening filter, uncheck all channels in the *Sharpening Settings* box.

Use intra-frame preview

- ➔ Use the intra-frame preview when adjusting the noise filter settings.

After you have made changes to the noise filter parameters, do not forget to check the preview.¹ Use the preview on different parts of the frame to get a better feeling for the results of noise reduction.

If the noise filtration looks too strong then decrease the noise reduction amounts for corresponding channels and/or frequency ranges. If the noise filtration is not sufficient then increase the amounts. Use the Component Viewer (see below) to determine components that require adjustment.

Adjust noise levels (when necessary)

Usually it is not necessary to change the noise levels if the noise profile is accurate. You only have to adjust the noise levels if you see that some noise elements are not reduced even if you set the noise reduction amounts to 100%. Such residual noise elements are usually caused by an inaccurate noise profile providing inaccurate noise level estimations to the noise filter. This may be compensated by adjusting (increasing) the noise levels in the filter settings.

- ➔ Use the Noise Levels: High, Mid, and Low; Y, Cr, Cb (R, G, B) sliders.

The noise filter has access to three frequency components and three channel components of the video sequence. Corresponding sliders adjust the estimated noise levels for each of these components.


The higher a certain noise level, the more elements in the corresponding component are considered noise. Be careful, setting a noise level setting too high can lead to removal of important details. Setting a noise level setting too low can lead to incomplete filtration: residual noise and compression artifacts can stay in the filtered video sequence.

As a rule, if the device noise profile has been built properly, it is not necessary to increase the noise levels by more than 50%. If the video sequence contains strong surges of noise in the high frequency range, it is recommended to increase the high frequency noise level up to +20 to 40%.


If the video sequence contains strong color noise, it is recommended to increase the Cr and Cb noise levels to +30%. In some cases, it may be useful to increase these noise levels up to +100%.

If adjusting noise levels still does not help and some noise elements remain in the filtered video sequence, probably the device noise profile is not good at all. Return to Stage IV, page 9, and additionally fine-tune the device noise profile or simply rebuild the profile from scratch.


Use Component Viewer (optional)

The Component Viewer (use  to open it) is intended for detailed examination of both frequency and channel components of the selected frame. Find more details about using this tool in the Component Viewer subsection, page 27.

Use Variant Selector (optional)

The Variant Selector (use  to open it) is designed to compare several variants of filtration side-by-side to find the optimum filter settings easier and faster. More information about this tool is available in the Variant Selector subsection, page 27.

Use Viewer Adjustments (optional)

The Viewer Adjustments window (use  to open it) helps to adjust the Neat Video viewers. You can operatively adjust the brightness and contrast of the viewers to better see the effect of noise reduction in an interesting area of the frame (for example in a very dark part of the frame) easier and faster. More information about this tool is available in the Viewer Adjustments subsection, page 28.

¹ Using the Auto recalculate preview option is recommended (see Filtration options, page 30).

Adjusting sharpening settings in Advanced mode (optional¹)

The sharpening filter is designed to increase sharpness of the video sequence without increasing the noise strength.

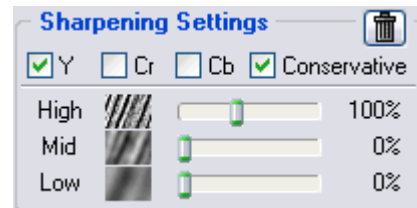
The default values of the sharpening settings should produce satisfactory results (when sharpening is enabled for any of the channel components) but you are encouraged to vary the settings to find values that produce the desired level of sharpness. Zero sharpening amounts will not sharpen the video sequence at all. The non-zero sharpening amounts will apply sharpening of the specified strength. Use sharpening controls for different frequency components to sharpen fine, medium or large details. As with any other sharpening method, you have to balance the amounts to avoid over-sharpening.

Use the intra-frame preview when adjusting the sharpening settings.

Select color channels where sharpening should be applied

- ➔ Use checkboxes in the Sharpening Settings box.

If the working color space is RGB, then all color channels should typically be sharpened. If it is the YCrCb color space (YCrCb or YCrCb Symmetric), then, usually, there is no need to sharpen the Cr and Cb channels.



Select sharpening mode

- ➔ Check the **Conservative** checkbox to enable more accurate sharpening, which produces much less halo effect around sharpened details.

Adjust sharpening amounts

- ➔ Use the High, Mid and Low sliders in the Sharpening Settings box.

Specify how much sharpening should be applied to each frequency component of the video sequence.

Use intra-frame preview


- ➔ Use the intra-frame preview when adjusting the sharpening settings.

After you have made changes to the sharpening settings, do not forget to check the preview. Use the preview on different parts of the frame to get a better feeling for the results of sharpening.

As soon as you are happy with the preview results regarding both noise reduction and sharpening, proceed to save the filter settings into a preset (below), or directly to Apply intra-frame filter settings, page 17.

5.5.4. Save intra-frame filter settings into a preset (optional)

To save the filter settings into a preset


- ➔ Click  (the Save filter settings as preset... button, pink disk) in the Filter Preset box or select the Profile | Save Filter Preset... menu item.

In the Save filter preset as dialog box, specify the name of the file to save the preset. The filter presets are stored in **.nfp* files.

Saved filter preset includes the noise filter and sharpening settings. By re-opening a preset, you can reproduce exactly the same intra-frame filter settings later on. Together, a device noise profile and a filter preset can be used to accurately reproduce the filtration results.

¹ You can skip this subsection when reading for the first time.

To load a previously saved filter preset


- ➔ Click  (the Load filter preset... button, pink disk) in the Filter Preset box or select the Filter | Load Filter Preset... menu item. In the Load filter preset dialog box, specify the name of the filter preset to be opened.
- or
- ➔ Select a preset using the popup menu: click on the button on the side of the preset name shown in the top part of the Filter Preset box, and select a preset from the popup menu.¹

There are several pre-written intra-frame filter presets in the **PRESETS** subfolder (in the folder where Neat Video is installed). Please explore these presets to see what combinations and values of the noise and sharpening filter's settings can be used to solve typical tasks (names of the presets explain these tasks).

5.5.5. Apply intra-frame filter settings

After you have prepared a noise profile and adjusted the intra-frame filter settings, you have to apply these changes.

To apply intra-frame filter settings

- ➔ Click  (the Apply button on the toolbar of the Noise Filter Settings tab) or select the Filter | Apply menu item.

The Neat Video plug-in window will be closed and the plug-in will automatically save the device noise profile and filter preset in the current Pinnacle Studio project.

5.6. Stage VI. Adjust temporal filter settings

Besides the intra-frame filtration (that you configured in the previous section) Neat Video also applies temporal (inter-frame) filtration to the video sequence. Temporal filtration allows Neat Video to improve the overall quality of noise reduction. Neat Video uses several consequent frames to better reduce noise and preserve more true details in each frame.

You can adjust the temporal filter settings using the controls available in the Temporal filter box in the Neat Video Configuration window.

To adjust temporal filter settings

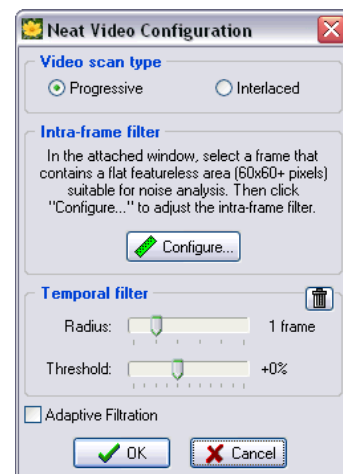
Adjust Temporal filter radius

The Temporal filter radius setting determines the number of consequent frames used for temporal filtration. Higher values of this setting lead to more aggressive (and slower) temporal filtration. Lower values lead to less aggressive (and faster) filtration based on a small number of consequent frames. Zero value disables temporal filtration completely. The default value is 1, which means three consequent frames (the current one, one before and one after the current one) are used for temporal filtration.

- ➔ Use the Radius control in the Temporal filter box in the Neat Video Configuration window.

Adjust Temporal filter threshold

The Temporal filter threshold setting determines how sensitive the



¹ If there is no popup menu, please see Folder options, page 31.

filter is to changes (for example, motion of objects) in consequent frames. Higher values of this setting lead to more aggressive filtration with less attention to temporal changes (lower motion sensitivity). Lower values lead to less aggressive filtration with more attention to temporal changes and better preservation of moving details (higher motion sensitivity).

- ➔ Use the **Threshold control in the Temporal filter box in the Neat Video Configuration window.**

5.7. Stage VII. Adjust adaptive filtration

Enable or disable adaptive filtration

The noise properties of the video sequence may vary in different parts of the sequence. Neat Video can automatically adjust its filters to the changing noise when this option is enabled. If the noise in the video sequence is the same in different parts of the sequence then this option can be left disabled.

- ➔ Enable the **Adaptive Filtration** option to let Neat Video automatically adjust its filters to the changing noise in the video sequence.

5.8. Stage VIII. Apply noise reduction

To apply Neat Video noise reduction

- ➔ Use the **Make Movie** tab in Pinnacle Studio and the set of controls in that tab to render the movie. The movie will be filtered by Neat Video in this process.

Neat Video is a processor-intensive filter, and in the current implementation, the processor's speed is the most critical. On Core 2 Duo 3.26 GHz, Neat Video v2.x processes a 352x288 video sequence at the speed of 16-25 fps depending on filter settings. Larger frame sizes are processed correspondingly slower. On a computer of typical configuration, the processing time is linear with respect to the length of the sequence.

6. Device noise profiles

A *device noise profile* (or *noise profile*, or simply *profile*) describes the properties of visible noise produced by a video capturing device (e.g., a video camera, camcorder, computer TV-tuner, film digitizer, etc.) working in a certain mode. Several noise profiles corresponding to different modes of a device constitute a *profile set* for this device. Neat Video can use a profile from a profile set to process a video sequence produced by a device working in the corresponding device mode.

You can easily build noise profiles for your video capturing device. Learn how to build and use device noise profiles in Neat Video in the subsections 6.1-6.3 below.

6.1. Building a profile for a device mode (standard profiling procedure)

This subsection explains how to build a single noise profile for a video sequence produced in a certain device mode.

When building a profile, you will mostly work with the **Device Noise Profile** tab in the Neat Video plug-in

window: 

Building a new noise profile generally consists of three stages:

- Stage I. Building a profile;
- Stage II. Documenting the profile;
- Stage III. Saving the profile.

6.1.1. Stage I. Building a profile

To build a noise profile for a video sequence you have to make 3 steps:

- Step 1. Selecting a frame suitable for noise analysis;
- Step 2. Selecting a working color space (Advanced mode only);
- Step 3. Analyzing the noise.

Step 1. Selecting a frame suitable for noise analysis

To build an accurate noise profile, Neat Video has to analyze a specific frame from the video sequence. This frame should include uniform featureless areas containing only noise without real details.

A uniform area (with minor variation in all color channels) may be overcast sky, clear sky (without clouds and birds), or any other part of a suitable frame, where there are no visually perceptible details (except the noise). Neat Video needs to analyze a uniform featureless area of around 128x128 pixels (the minimum size is 32x32 pixels).

Find a frame in the video sequence that contains flat featureless areas and use this frame to build a noise profile:

- 1. In the Timeline window, find and select a frame with large flat featureless areas; selected frame will be used for noise analysis in the next steps.
- 2. In Neat Video Configuration window, click the **Configure...** button in the **Intra-frame filter** box.

The Neat Video plug-in window will appear and will show the currently selected frame.

Step 2. Selecting a working color space (Advanced mode only)

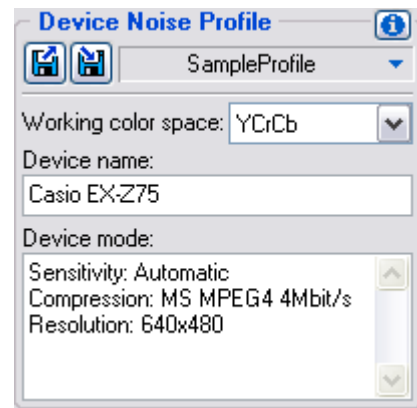
The working color space is an internal parameter of Neat Video noise reduction algorithm. The video sequence is temporarily converted to selected working color space for processing. The input and output are kept in the RGB color space and the conversion itself is very accurate so you do not have to worry about this internal color space conversion.

We recommend using the YCrCb color space to process all color video sequences in Neat Video.

Normally, the YCrCb (default) working color space is best for color video sequences, the YCrCb Symmetric color space – for grayscale (halftone) sequences represented in the RGB format. The RGB working color space may be useful for special purposes, for example, to filter only one color channel (R, G or B) of the video sequence.

- ➔ Use the Working color space list in the Device Noise Profile box to select required working color space.

The subsequent noise analysis will be done in selected color space. Neat Video will try to automatically redo the analysis if you change the working color space later on.




Step 3. Analyzing the noise (profiling)

Analyzing noise (profiling) is the main part of building a noise profile. Neat Video offers two ways of conducting the noise analysis: automatic and manual one. Using automatic profiling is easier and therefore recommended for beginners. In difficult cases (for example if there is no large uniform featureless area in the analyzed frame), automatic profiling may not work or produce less than perfect results. You can always override automatics and use manual profiling.

Case of automatic profiling

To analyze the noise properties of the video sequence, Neat Video uses uniform areas of the frame. Such areas should contain noise but no visible or important details. With automatic profiling, Neat Video tries to find one such area automatically and then uses this area to analyze noise.

- ➔ Click  (the Auto Profile button) on the toolbar, or select the Profile | Auto Profile menu item, or press F2.

Neat Video will show the frame area selected for analysis (see blue selection box in the viewer; the blue color is an indication of automatic selection) and will analyze it automatically.

In difficult cases, Neat Video may have trouble finding a uniform featureless area in the frame. You will notice that the selected area, for example, will contain some important details. In such a case, just move the selection (or draw a new one) to an area that does not contain any real details and click the same Auto Profile button again.

If you see that the area automatically selected for analysis is indeed uniform and featureless, then the resulting noise analysis is accurate. To be sure, check the Profile quality indicator in the bottom of the Neat Video plug-in window. A profile built using a uniform and featureless area will usually show a high value in this indicator.

If the profile quality is high (for example, higher than 75%) then you can be sure that the noise profile is accurate. In this case, proceed to Stage II. Documenting the noise profile, page 25.

If the quality is not high, try to select another uniform area and use Auto Profile once again. That may not help still, especially if the frame contains only a few featureless areas. In this case, consider using another frame to build a profile or try manual profiling.

Case of manual profiling (Advanced mode only)

As compared with automatic profiling, which produces a noise profile in one step, manual profiling is done in two sub-steps with two noise analyzers used (you have to use the Advanced mode to use these analyzers; see the Tools | Advanced Mode menu item). The Rough Analyzer makes the initial analysis; it produces a *rough noise profile*. The Fine-Tuning Analyzer improves the initial analysis and produces a *fine-tuned noise profile*.

Both Rough Analyzer and Fine-Tuning Analyzer use uniform areas in the frame to measure the noise properties of the video sequence. If the frame has uniform areas that contain noise without visible details, Neat Video can analyze the noise properties in these areas. In manual profiling, Neat Video

does not always automatically find these uniform areas (or areas that contain no details *important to you*), so you may have to manually specify areas that it should analyze. A uniform area (with minor variation in all color channels) may be overcast sky, clear sky (without clouds and birds), or any other part of the frame with no visually perceptible details (except the noise).

Sub-step A. Rough analysis

Rough analysis requires only one uniform featureless area in the frame. You have to manually find and analyze it:

1) Find a uniform featureless area

- ➔ Scroll, pan, zoom the frame in the `Device Noise Profile` tab to find a uniform area.

See examples of uniform areas (the subsection 9.1, page 37)

The area should be at least 32x32 pixels large. That is the minimum size; the recommended size is 128x128 pixels or more.

If you cannot find a uniform area in the current frame, consider using another frame from the same video sequence.

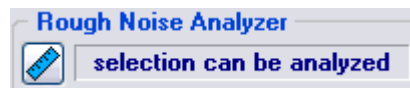
- ➔ Use `Viewer Adjustments` (optional)

The `Viewer Adjustments` window helps to adjust the viewers in the Neat Video windows. You can operatively adjust the brightness and contrast of the viewers to better see the noise in an interesting part of the frame (for example in a very dark part of the frame). More information about this tool is available in the `Viewer Adjustments` subsection, page 28.

2) Select found uniform area

- ➔ Use the mouse to select the uniform area that you have found: press the left button, drag the mouse and then release the button.

The selection should be at least 32x32 pixels large; the recommended size is 128x128 pixels or more. The selection edges will change their thickness according to the selection size. When you are selecting an area, the selection status in the `Rough Noise Analyzer` box is dynamically indicating whether the chosen area is large enough for analysis.




Warning

1) The selection status displays "**signal clipping!**" when the selected part of the frame is close to the dynamic range limit in some of the channels (R,G,B). A device noise profile built using the selected area could be inaccurate. Try to avoid this for best results.

2) The selection status and selection box display "**area not uniform in ... channel(s)**" when the selected part of the frame (some of its color channels) contains real details or the noise is not uniform in the selected area. A device noise profile built using the selected area could be inaccurate. Try to avoid this for best results.

3) Analyze selected area with `Rough Noise Analyzer`

- ➔ Click  (the `Rough Noise Analyzer` button) in the `Rough Noise Analyzer` box or select the `Profile | Build Rough Profile Using Selected Area` menu item.

Neat Video will measure the noise characteristics of the video capturing device by analyzing the selected area. You only have to make this analysis once to create a rough noise profile.

Sub-step B. Fine-tuning analysis

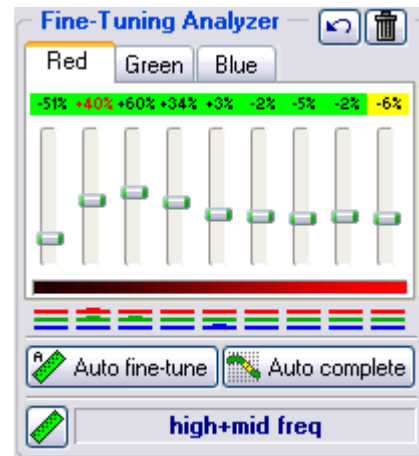
For more accurate noise reduction, it is necessary to measure the dependence between the noise level and the local brightness in different areas of the frame. This dependence should be taken into account if the noise appreciably depends on brightness (for example, if noise is strong in dark areas

and weak in light areas).

The Fine-Tuning Analyzer measures this dependence. The measurements results are displayed by the equalizer in the Fine-Tuning Analyzer box. The equalizer has nine sliders corresponding to the range of brightness from darkest to lightest for each color channel of the video capturing device.


The values of the equalizer sliders correspond to the estimated noise levels in different brightness ranges relative to the rough noise profile. Positive values of sliders reflect higher estimated noise levels and make Neat Video consider more elements to be noise; negative values reflect lower estimated noise levels and fewer elements are considered noise in the corresponding brightness ranges of the video sequence.

The Fine-Tuning Analyzer can be used in an automatic and manual way. Below, the automatic method is described first. Then the manual method is explained in details to provide a better understanding of the process and results.



Case of automatic fine-tuning

Automatic fine-tuning finds and analyses several flat featureless areas automatically. You do not have to do anything manually; auto fine-tuning can be done in just one click:

- ➔ Click  (the Auto Fine-Tuning Analyzer button) or select the Profile | Auto Fine-Tune menu item.

The whole frame will be automatically analyzed by Neat Video and some of the equalizer sliders will receive the ‘measured’ status (see page 24 for explanation of different status marking). The values of unmeasured sliders will be then automatically interpolated by the Auto Complete function and will receive the ‘manual’ status.

You may want to inspect the equalizer values after applying auto fine-tuning. In most cases, there is no need to do any additional slider adjustments. If you feel this is necessary (for example if some slider values have red shading – the ‘inaccurate’ status), please see the manual fine-tuning subsection below. Otherwise please proceed to Stage II. Documenting the noise profile, page 25.

Case of manual fine-tuning

Manual fine-tuning involves analyzing several flat featureless areas in the frame. You have to manually find and analyze them one after another:

1) Find and select a uniform featureless area

- ➔ Scroll, pan, zoom the frame in the viewer in the Device Noise Profile tab to find a uniform area. See examples of uniform areas, page 40.
- ➔ Use Viewer Adjustments to find a uniform area in very dark or very bright areas.
- ➔ Use the mouse to select a uniform area: press the left button, drag the mouse and then release the button.

The size of an area may be from 16x16 to 256x256 pixels. The selection edges will change their thickness according to the selection size. Also, when you are selecting an area, the selection status in the bottom of the Fine-Tuning Analyzer box is dynamically indicating which (spatial) frequency¹ components are contained in the selected area and would be analyzed: ‘high’, ‘high+mid’, ‘high+mid+low’, ‘high+mid+low+very low freqs’.



¹ See “what is frequency”, page 35.

Size of an area, pixels	Which frequency components would be analyzed	Rating
128x128 - 256x256	High, medium, low and very low	Best
64x64 - 128x128	High, medium and low	Good
32x32 – 64x64	High and medium	Ok
16x16 – 32x32	High	Poor


The selected area would be analyzed according to its frequency composition (of high, medium, low and very low frequency components). When a frequency component is not analyzed, all the data related to this component are estimated (extrapolated). That is always not precise; therefore, it is best to choose large areas so that all the frequency components could be analyzed.

Warning

- 1) The selection status displays "**signal clipping!**" when the selected part of the frame is close to the dynamic range limit in some of the channels (R,G,B). Fine-tuning a device noise profile using the selected area could be inaccurate. Please try to avoid this for best results.
- 2) The selection status and selection box display "**area not uniform in ... channel(s)**" when the selected part of the frame (some of its color channels) contains real details or the noise is not uniform in the selected area. Fine-tuning a device noise profile using the selected area could be inaccurate. Please try to avoid this for best results.

When you select an area, its position in the brightness range is shown with **red font color** of the value(s) of the corresponding slider(s)' in the noise profile equalizer. Also, it is displayed by the color indicators in the bottom of the equalizer (see page 24).

2) Analyze selected area with Manual Fine-Tuning Analyzer

- ➔ Click  (the Manual Fine-Tuning Analyzer button) or select the Profile | Fine-Tune Using Selected Area menu item.

The analysis results are shown in the noise profile equalizer. For uniform areas with noise only, the corresponding slider receives the 'measured' status – the green shading on the slider's value, like **-27%**. If an area with signal clipping has been used to analyze noise characteristics then the corresponding slider receives the 'inaccurate' status – the red shading, like **-86%**. When an area with unexpectedly strong level of noise is encountered, the orange shading is applied, like **+215%**.

Warning

The orange shading is applied when the analyzed noise in the corresponding brightness range is unexpectedly strong. There are several possible reasons for that:

- Fine-tuning is being done using a bad (e.g., containing visible details) area;
- Wrong device noise profile is used (the profile's device and device mode do not match those of the analyzed frame and video sequence OR the rough noise analysis has been done inaccurately);
- Noise in this frame is unusual and contains strong variations.

The orange shading is a warning sign. It does not necessarily signify wrong measurement. Please make your own judgment in this situation and if necessary rebuild the device noise profile or select a more uniform area for fine-tuning.

The red shading is a sure sign of wrong measurement. You have to reset the corresponding slider or undo the last analysis (see below).

3) *If necessary, reset status of a slider (optional)*

- ➔ Click on the color shading of a slider to reset its status and value.


If a slider has red (or any other color) shading, you can reset it and analyze another part of the frame to re-measure its value. There is no need to reset the entire equalizer because of one wrong value.

4) *If necessary, undo the last analysis (optional)*

- ➔ Click  (the Undo button) or select the Profile | Undo Last Fine-Tuning Analysis menu item.

Undoing the last fine-tuning analysis may be useful when a bad choice of a frame area has resulted in bad analysis results.

5) *If necessary, reset the whole equalizer (optional)*

- ➔ Click  (the Reset fine-tuning results button) or select the Profile | Reset Fine-Tuning Results menu.

6) *Repeat 1-5 with other uniform areas of different brightness*

To make a device noise profile more accurate you have to fine-tune it using several uniform areas of the frame (naturally, analyzing the same area many times makes little sense). Try to choose uniform areas to cover all brightness ranges in all channels of the equalizer (i.e., to get shadings on all sliders' values). Use color shadings as well as red markings (which are used to reflect the range of the current selection; like **-40%**) to guide the process of fine-tuning. Also use the color indicators in the bottom of the Fine-Tuning Analyzer box as guidance when doing that. If the majority of sliders' values have green shadings, proceed to point 7 below.

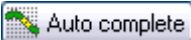
7) *Set remaining sliders at your option (optional)*

If not set by the Fine-Tuning Analyzer, the sliders of the equalizer have default values. You can leave them with default values or can adjust these sliders to bring them into better agreement with the measured ones. Adjusting the sliders can also be done automatically or manually:

- ➔ Manually adjust the remaining sliders as you consider necessary.

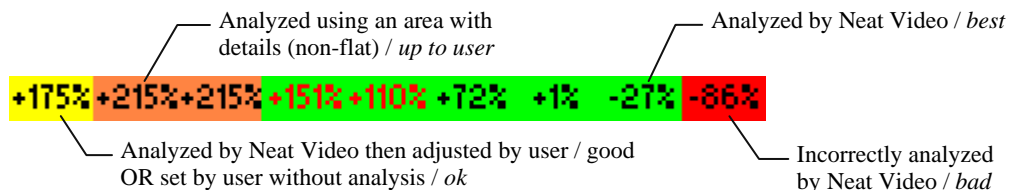
Manually adjusted sliders receive the 'manual' status (a yellow shading, like **+175%**).

or

- ➔ Use Auto Complete to automatically adjust the unmeasured sliders by interpolation based on the measured data. Click  (the Auto Complete button) or select the Profile | Auto Complete menu item to automatically complete the fine-tuning.

Using Auto Complete is highly advisable as the last step of the manual fine-tuning process.

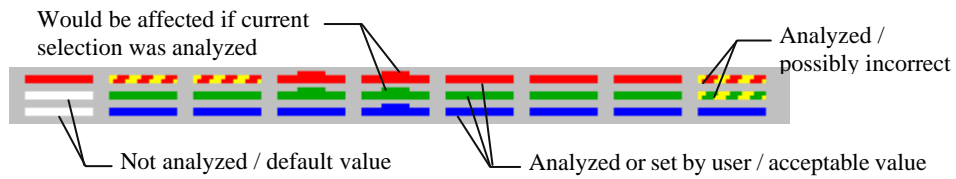
The figure below summarizes the status marking of sliders:



When using the noise profile equalizer, use the color indicator to simplify the fine-tuning process. Colored lines of the indicator show:

- which sliders of the equalizer correspond to the colors of the selected area/pixel (press the Shift key for pixel-wise indication);
- which sliders have values that are different from their default values;
- which sliders have (possibly) incorrect values.

The figure below explains each state of the indicator elements:



How to check if a device noise profile has been fine-tuned properly

The equalizer sliders should be mostly shaded in green and, occasionally, yellow. The color indicators should be filled with solid colored lines at all positions.

6.1.2. Stage II. Documenting the noise profile

At this point the noise analysis is done and all important noise characteristics are gathered in the profile. However, you may still want to manually document the profile by describing the video capturing device and its mode.

- ➔ Use the **Device name** and **Device mode** fields on the **Device Noise Profile** panel.

Specify the model of the video capturing device and describe the device mode used to capture the video sequence.

About the Device name and Device mode notes

It is highly recommended to specify these details to keep record of devices, device modes, and corresponding device noise profiles that you use.

The noise characteristics of any two devices can be extremely different. Even a single device in different modes can produce significantly different noise. Therefore, it is always better to use separate noise profiles for different devices and device modes to avoid inaccurate filtration and artifacts. Commenting on the device name and device mode parameters will help you re-use a noise profile later on when you will look for a suitable profile to process a video sequence.


There may be many device parameters but not all of them influence noise and those that do differ by the strength of their influence. It makes sense to document those parameters only that appreciably affect noise. In the tables below, those parameters are described that usually appreciably affect noise characteristics (from the most to the less important ones) for video capturing devices:

Video capturing device parameters in the order of decreasing importance		
Sensitivity of light-capturing device	Film type and sensitivity (for digitized analog video), effective sensor sensitivity (for digital video), etc.	More sensitive light-capturing devices / media usually produce stronger noise.
Compression of video sequence	Video compression method / mode used	Stronger compression typically produces more artifacts and destroys details; weaker compression preserves more details. It is preferable to use the lowest amount of compression possible for the best results.
Resolution/ frame size	1920x1080, 1366x768, 1280x720, 720x576, 512x384, 352x288, etc.	Video sequences in different resolutions usually have very different noise characteristics.

If two video sequences were produced by the same device in the same or similar conditions (most of the above device mode parameters are the same) then the noise of these two sequences should be

very similar. If you have built a device noise profile using one of these sequences, you can use this profile to filter both sequences with good results. If however, the conditions were different then the noise in two sequences could be significantly different. In this case, cross-use of the noise profile is not recommended. Instead, two different profiles should be built and used to filter these two sequences.

6.1.3. Stage III. Saving the noise profile

- ➔ Use  (the Save device noise profile as... button, blue disk) in the Device Noise Profile box or select the Profile | Save As... menu item.

In the Save device noise profile as dialog box, specify a meaningful file name and save the profile to the hard drive. Device noise profile are saved in **.dnp* files.

File naming considerations

If you are going to re-use the device noise profile, select a good file name explaining the device name and mode so that you could easily recognize this profile by its file name later on. Alternatively, you can use special folder structuring to keep many device noise profiles arranged according to their device modes.

Saved noise profile includes a complete noise analysis (including results of both rough and fine-tuning analyses). Therefore, by re-opening the noise profile with another video sequence, you can reproduce exactly the same conditions for noise reduction later on.

In addition, the noise profile can contain a noise sample that has been used to build the rough noise profile. You can control whether it is included into saved profile using the Save analyzed frame area in profile option, page 30.

6.2. Using noise profiles

When you have a set of profiles for your video capturing device, you can directly use these profiles to process video sequences in Neat Video. Usually the set contains only one profile that is most suitable to process a given video sequence. Therefore it is very important to select the right profile, which would provide good match between profile and video sequence. Profiles in a profile set usually have been built for different device modes and to make a perfect match between a profile and a video sequence, the device mode of this profile should be the same or very close to the device mode used to capture this sequence. In the current version of Neat Video, you have to manually select a device noise profile that matches the video sequence based on profile descriptions and file names.


Obviously it is preferable to build a new noise profile for each video sequence, because such a profile would perfectly match the noise of that sequence. Nevertheless, any noise profile can, with some degree of accuracy, be used to process other sequences captured by the same device working in the same or similar mode. This is less accurate than building a profile for each video sequence but saves time because building a new profile usually takes more time than re-using a ready-made one.

7. Additional tools

7.1. Component Viewer


The Component Viewer is intended for detailed examination of both channel and frequency components of a video sequence. Examining the components helps to find the optimum filter settings easier and faster.




- ➔ Working in the Device Noise Profile or Noise Filter Settings tab of the Neat Video plug-in window, open the Component Viewer window by clicking  (the Component Viewer button) on the toolbar or by selecting the Tools | Component Viewer menu item. The window will pop up to show the components of the frame area selected in the main viewer of the plug-in (make a selection in the current tab in the plug-in window).

Using the Component Viewer in the Noise Filter Settings tab, you can switch between the original and filtered frame (or a channel / frequency component of the frame) by clicking on one of the viewers in the Component Viewer window. The picture above corresponds to using the Component Viewer in the Noise Filter Settings tab.

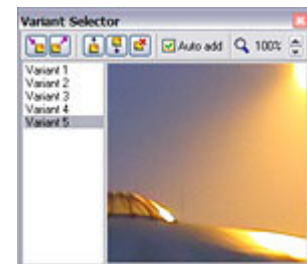
Examine individual channel and frequency components of the frame (use the radio-button selectors in the Component Viewer). When used in the Noise Filter Settings tab, you can easily identify the components that do not get enough noise reduction and adjust the corresponding filter settings.



You can resize the Component Viewer window by dragging its right edge. The orientation of the window can be changed with  (the Rotate window button).





The viewers can be adjusted with the zoom and contrast controls as well as with the Auto Gray Level control: .

7.2. Variant Selector

The Variant Selector helps to do side-by-side comparisons of several variants of filtration applied to a selected area of the frame. When you consecutively adjust the filter settings you get several variants of filtration. To save all these variants and then select the best one use the Variant Selector.

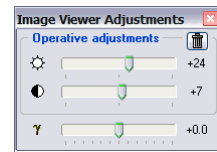


- ➔ Open the Variant Selector by clicking on  (the Variant Selector button) on the toolbar or by selecting the Tools | Variant Selector menu item. The window will pop up to enable adding, sorting, deleting and selecting the variants.
- ➔ To add a filtration variant to the Variant Selector, select an area in the frame in the Neat Video plug-in window and let Neat Video prepare a preview for this area (this is usually done by Neat Video automatically). As soon as the preview is ready, this new variant of filtration is added to the Variant Selector. This happens automatically if Auto add is checked in the Variant Selector window. To manually add a new variant, click  (the Add new variant button). If you change any filter setting then one more filtration variant is prepared and added to the Variant Selector by Neat Video.
- ➔ When several variants are listed in the Variant Selector, click any variant to see the filtration result in the viewer area of the Variant Selector. Click on the viewer there to temporarily switch to the unfiltered version. Move to other variants (using the mouse wheel or arrow keys) to compare filtration variants.

- ➔ Click  and  (the Move variant up / down buttons) or drag and drop variants in the list to sort them according to the visual quality (for example, move the best variants to the top of the list to group them for easier comparison).
- ➔ Click  (the Delete variant button) or press the Del key to remove the selected variant(s) from the list.
- ➔ Click  (the Select variant button) or press Enter or double-click a variant to select it as the best one and send it to the filter (the filter settings will be automatically adjusted to produce this variant of filtration).


7.3. Viewer Adjustments

The Viewer Adjustments window helps to adjust the Neat Video viewers. In particular, you can operatively adjust the brightness and contrast of the viewers to explore interesting areas of the frame (for example a flat featureless areas in a very dark part of the current frame) easier and faster. Instead of trying to increase the hardware brightness of the display, you can adjust the software brightness using these controls.



Please note that these adjustments do not change the underlying frame data in any way. The adjustments only affect the viewers in Neat Video, i.e., the way the frames are displayed.

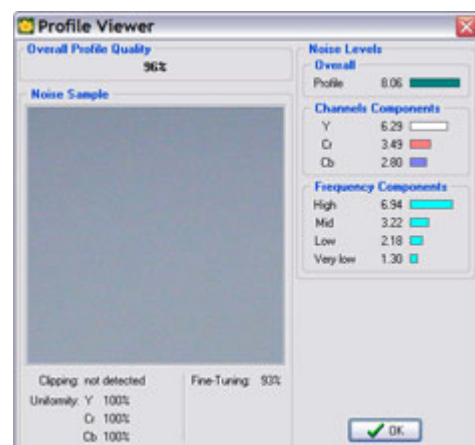
Also, you can adjust the assumed gamma of Neat Video viewers. By default, the viewers display frames assuming their gamma to be 2.2. If your video sequences are encoded with another gamma then you may want to use this adjustment.

- ➔ Use  (the Viewer adjustments button) in the Neat Video plug-in window to open the Viewer Adjustments window.
- ➔ Use the available controls to adjust the brightness, contrast and gamma.

7.4. Profile Viewer

The Profile Viewer provides detailed information about the currently used noise profile. The Profile Viewer provides the following details:

- Overall profile quality – this is an estimation of the overall quality of the noise analysis represented by this profile. The higher this value the better this profile seems to be. A quality profile is necessary for quality noise reduction.
- Noise sample – this is an optional noise sample (a crop from the frame used to build this profile). The noise sample helps you visually evaluate the noise described by this profile. Also, you can easily see whether any details are present in this area, which makes the profile less accurate (only flat featureless areas without any details should be used for profiling).
- Clipping – this indicator tells whether there is any clipping in the analyzed noise sample. Clipping occurs when the sample contains pixels that are very close to or in fact are entirely white (or entirely black). Clipping reduces the overall profile quality.



- **Uniformity** – these values show how uniform the noise sample is in all color channels. The uniformity is low when any details are present in the area. Low uniformity reduces the overall profile quality.
- **Fine-tuning** – this indicator tells how well this profile is fine-tuned. Fine-tuning is a part of profiling process (both automatic and manual) and the more complete and accurate the fine-tuning the higher the overall profiling quality. If you work with Neat Video in *Advanced mode* then you can see that the more green shadings are present in the noise profile equalizer the higher the overall profile quality. You can improve the profile quality by additional fine-tuning.
- **Noise levels** – these figures show the actual noise levels measured by the analyzers during profiling. There is the overall noise level and noise levels corresponding to channel and frequency components of the video sequence. These figures are a good indication of how noisy a video capturing device is.

8. Options

The Neat Video plug-in has several options that you can change to adjust its behavior.

In the Neat Video plug-in window, use the Tools | Options... menu item to open the Options dialog box.

8.1. General options

Auto zoom to fit on frame open

Check this option to make Neat Video viewers automatically adjust their zoom level to fit the currently selected frame into the window.

Show hints over interface controls

This option switches on/off the hints. The hints are displayed when the mouse pointer is placed over any control in the plug-in.

Enable multiprocessor support

Check this option to let Neat Video use all available processors when running on a multiprocessor computer, on a processor with HyperThreading, or on a dual-core / multi-core processor.

8.2. Profiling options

Default color space

This is the working color space selected by default when Neat Video is added to be used by Pinnacle Studio to process a video sequence. You can always change working color space later on, if necessary; this option provides a default choice.

The working color space is a color space used by Neat Video to analyze and process the video sequence. There are three working color spaces available: RGB, YCrCb and YCrCb Symmetric. We recommend the use of YCrCb for color video sequences and YCrCb Symmetric for grayscale (halftone) sequences.

Save analyzed frame area in profile

Turn this option on to make Neat Video save analyzed noise sample into device noise profile (a *.*dnp* file). This will increase the size of the *.*dnp* file but will also improve the compatibility with the future versions of the software (Neat Video will be able to load and re-build the profile using the saved noise sample).

Show warnings about selected frame area

Turn this option on to let Neat Video display warnings about selected frame area during profiling. For example, Neat Video may warn about clipping or non-uniformity detected in the selected area.

8.3. Filtration options

Auto recalculate preview

This option enables/disables automatic recalculation of the intra-frame preview in the Neat Video plug-in window. When enabled, the preview is recalculated every time you select a new area in the frame or change the filter parameters. Preview recalculation is done only when the Noise Filter Settings tab is used.

Delay N second(s)

This is the delay in seconds between a change of the filter parameters and a consequent preview recalculation.

8.4. Folder options

Use independent open and save folders

This option enables using two independent folders for opening and saving files (profiles and presets). If this option is selected then Neat Video will remember two independent folders (otherwise, only one folder) for opening and saving files using open and save dialogs.

Use independent folders for profiles and presets

This option enables using two independent folders for working with noise profiles and filter presets. If this option is selected then Neat Video will remember two independent folders (otherwise, only one folder) for profiles and presets when open or save them using open or save dialogs.

Profile folder

Select the folder where Neat Video will look for device noise profiles. This should be the topmost folder of all the (sub)folders with device noise profiles. In this way, Neat Video will be able to display all the profiles (stored in all the subfolders of the specified folder) in the popup menu in the Device Noise Profile panel of the Neat Video plug-in window.

By default, the **PROFILES** subfolder of the Neat Video installation folder is used.

Preset folder

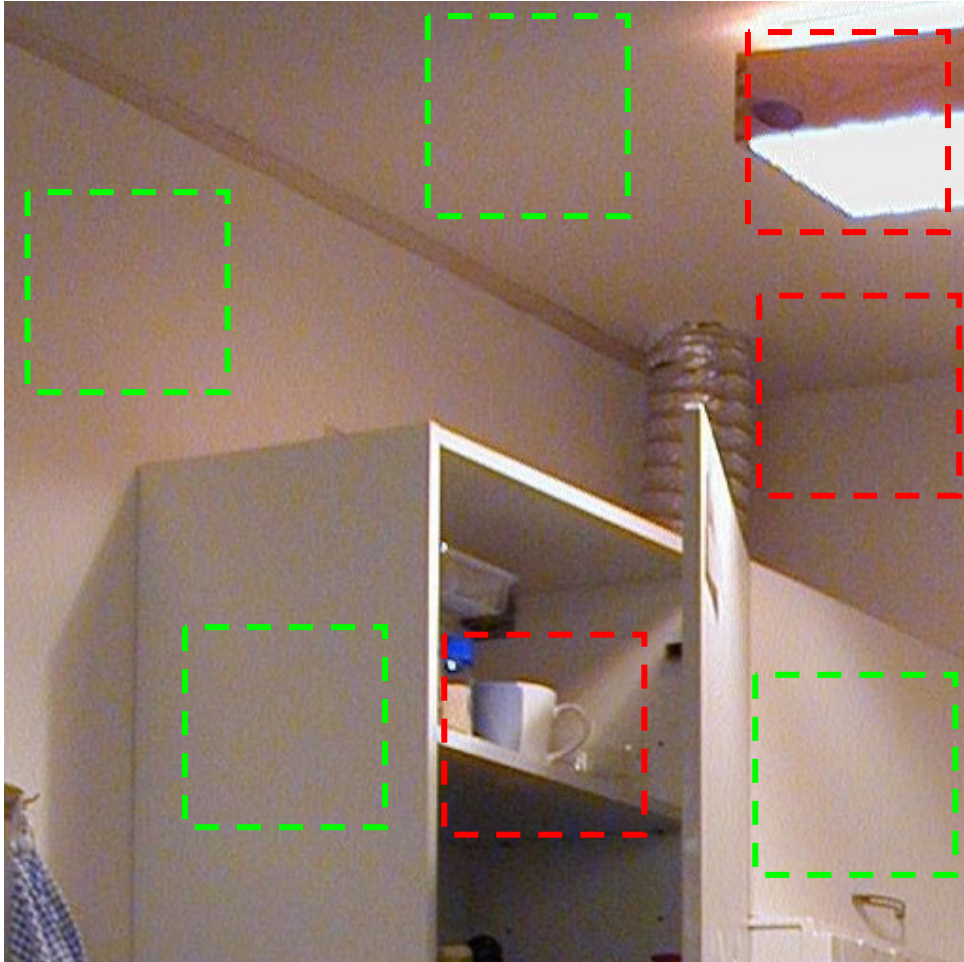
Select the folder where Neat Video will look for filter presets. This should be the topmost folder of all the (sub)folders with filter presets. In this way, Neat Video will display all the presets (stored in all the subfolders of the specified folder) in the popup menu in the Noise Filter Settings panel of the Neat Video plug-in window.

By default, the **PRESETS** subfolder of the Neat Video installation folder is used.

9. Examples

9.1. Building a noise profile

See the picture below for examples of areas that are good and bad for building device noise profiles. Here, the areas suitable for profiling are highlighted in green; those that should not be used are highlighted in red. Note that a frame area suitable for building a device noise profile should be at least 32x32 pixel large (preferably more than 128x128 pixels).

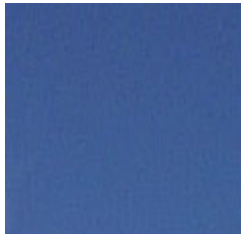


Additional comments regarding these areas are available in the next page.

These areas **can be used** to build device noise profiles (for automatic profiling based on these areas, for manual rough profiling and manual fine-tuning), as they contain no visible details:



– **GOOD**, because this area contains no important details



– **GOOD**, no important details (this area is from another frame)

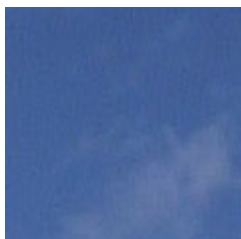
The following areas **should not be used** to build device noise profiles, because they do contain visible details:



– **BAD**, because this area contains a detail: corner – junction of wall and ceiling



– **UNACCEPTABLE**, because this area contains many details



– **BAD**, because this area contains some details: clouds (this area is from another source)

9.2. Fine-tuning a noise profile

In this subsection, you can find examples of featureless areas to be used for manual fine-tuning.

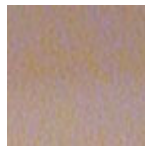
9.2.1. Large size areas

In areas larger than 64x64 pixels, high, medium and low frequencies are analyzed.

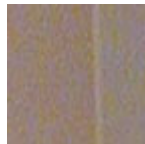
The examples are essentially the same as in the case of building a device noise profile. See examples in subsection 9.1, page 32.

9.2.2. Medium size areas

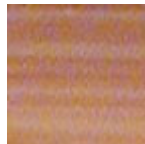
In areas larger than 32x32 and smaller than 64x64 pixels, high and medium frequencies are analyzed:



– **GOOD**, because this area contains no important details



– **BAD**, because there are medium frequency details (a vertical stroke)



– **UNACCEPTABLE**, because there are many medium frequency details (horizontal strokes)

9.2.3. Small size areas

In areas larger than 16x16 and smaller than 32x32 pixels, only high frequencies are analyzed:



– **GOOD**, although this area contains low frequency details, they are not taken into account because the area is small



– **BAD**, because this area contains high frequency details (a vertical stroke)



– **UNACCEPTABLE**, because this area contains various details

9.3. Filtration results

Please see examples of noise reduction applied to video sequences in the Neat Video web page:

<http://www.neatvideo.com/examples.html>

10. Questions and answers

10.1. General questions

Q What is the difference between Neat Video Demo, Home and Pro plug-in?

A The Demo plug-in has some functional limitations. For example, it can only process short video sequences with limited frame size. Please see the Detailed feature map, page 37, for more details.

Q Should I uninstall Demo plug-in prior to installing the Home / Pro plug-in?

A This is not necessary. You can install the Home / Pro plug-in over the Demo plug-in. If you would still like to uninstall the Demo plug-in use the Uninstall shortcut in the Windows Start menu: Start menu | Programs | Neat Video | Uninstall.

Q Should I uninstall the older version of Neat Video prior to installing a newer one?

A This is not necessary. You can install a newer version of Neat Video over the older one.

Q I think I have found a bug. How can I submit a bug report?

A Please use the online bug report form: <http://www.neatvideo.com/brf.html>
Please fill it out to let us know all the details necessary to reproduce the problem.

See more information about bugs in the Known issues section in Neat Video webpage (<http://www.neatvideo.com/bugs.html>) and about bug fixes in the *WhatsNew.txt* file supplied with the software – use the Help | What's New menu item to open that file (also see the history section on the web page for the most up to date information: <http://www.neatvideo.com/history.html>).

10.2. Filtration-related questions

Q Why do I receive some crystal-like artifacts in the filtered frame?

A The crystal-like artifacts (usually these are the residual compression artifacts or residual noise) look like thin lines in the filtered frame. They can be easily eliminated by increasing the high frequency noise level in the filter settings.

Note: presence of many residual artifacts is usually a consequence of using a poorly built, inaccurate noise profile or a profile built for another device and/or device mode.

Q Filtered frame looks 'plastic'. Why?

A The reason is that too much filtration was applied. Let Neat Video keep some noise to have natural-looking results. Adjust the noise reduction amounts; for example, reduce the noise reduction amount in the luminance (Y) channel to 50-70%. Also, make sure the device noise profile does match the video sequence processed. Using an incorrectly chosen or poorly built profile can either produce plastic-looking results or leave residual artifacts (see the previous question).

Q What is frequency?

A The term (spatial) *frequency* is used in Neat Video to denote elements of a video sequence (both important details and noise/grain) of certain size.

High frequency corresponds to elements of smallest size. *Medium (mid) frequency* corresponds to elements of medium size. *Low frequency* corresponds to elements of (relatively) large size.

For reference, see the noise samples of different frequencies in the Noise Filter Settings tab of the Neat Video plug-in window.



Q The filtration process is not very fast, is this normal?

A This is normal, because the filtration algorithm is quite complex. We work on further optimization to provide better performance.

Q How to filter only the color noise (not the brightness noise)?

- A** When the YCrCb working color space is used, set the value of the luminance (Y) channel noise reduction amount to 0%. This will disable filtration in the luminance (brightness) channel.

Q What is YCrCb?

- A** YCrCb is the name of a family of color spaces widely used in digital imaging, television, video, etc. In 'YCrCb', 'Y' corresponds to the luminance channel, 'Cr' - to the Cr chrominance channel covering the red to blue-green color range, 'Cb' - to the Cb chrominance channel covering the blue to yellow color range. Because this space enables easy separation of the luminance and chrominance information, it is very suitable to conduct noise reduction.

Q Is processing via Neat Video best done before or after any other processing (i.e. tonal/color correction)?

- A** Such operations as tonal/color correction are quite conservative from the standpoint of noise, i.e., they do not significantly change the noise characteristics of the video sequence. Therefore, filtering before or after makes little difference – as long as the noise profile is built and applied at the same stage of your workflow. For example, don't use a device noise profile built with an unprocessed (the color correction is not yet applied) video sequence to filter the same sequence with the color correction applied.

On the other hand, certain effects, like sharpening or resampling, applied to a noisy video sequence may considerably change its noise properties. In this sense, it is generally better to use Neat Video filtration before applying such effects.

11. Information

11.1. Issues and bugs

We try to keep Neat Video as free of bugs as possible. Please report any bugs or issues (even those already reported before) you encounter while working with Neat Video. Use the online bug report form on the Neat Video web page: <http://www.neatvideo.com/brf.html>. Your feedback will greatly help us to improve the software and provide you with even better versions of Neat Video.

11.2. Plans

The current version of Neat Video is the result of our ongoing research on noise filtration. We continue to work on the core noise reduction algorithms to improve the quality and speed of noise reduction.

Please let us know if you have ideas that can make Neat Video better. Participate in the discussion on the Neat Video message board, express your opinion, make suggestions, and ask questions. The more people that ask for a feature the more likely it is that it will be implemented.

11.3. Detailed feature map

Features		Neat Video		
		Demo plug-in	Home plug-in	Pro plug-in
Video sequence	File formats supported (24-bit RGB video data)	all formats supported by plug-in host		
	Maximum size / length of filtered video data	640x480 pixels 30 minutes	720x576 pixels unlimited length	unlimited size unlimited length
	Neat Video label added to filtered sequence	added	not added	
Intra-frame and temporal filter		+		
Noise reduction	Channel-wise (Y, Cr, Cb; R, G, B)	+		
	Frequency-wise (High, Mid, Low, Very low)	+		
Smart sharpening	Channel-wise (Y, Cr, Cb; R, G, B)	+		
	Frequency-wise (High, Mid, Low)	+		
Device noise profiles	Automatic and manual profiling of any video-capturing device	+		
Filter presets (reusable filter settings)		+		

11.4. Contacts

We really appreciate your opinion of Neat Video. Please let us know what you think about the software. Feel free to ask questions regarding Neat Video. To share your opinion or to receive support regarding Neat Video, use any of the following means:

E-mails

info@neatvideo.com — for general inquiries

support@neatvideo.com — for any inquiries regarding use of Neat Video software

sales@neatvideo.com — for any inquiries regarding purchase of Neat Video software

Forum

Register in Neat Video community forum (<http://www.neatvideo.com/nvforum/>), and participate in discussions on the use and development of Neat Video. Such topics are covered in the forum as:

- announcements of new and updated version of the software;
- questions about use of Neat Video;
- examples of using Neat Video with comments and suggestions;
- feedback from the users: suggestions of new features and improvements;
- contacts and general comments.

Web page

<http://www.neatvideo.com>

11.5. Legal information

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License agreement

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Distribution

The Demo edition of Neat Video may be distributed unmodified provided any charge is to cover distribution costs only.

The Demo edition of Neat Video may be placed on magazine CDs as long as the Neat Video team is informed.

11.6. Registration

To become a registered user and to get a fully functional edition of Neat Video Home or Pro plug-in for Pinnacle Studio you have to purchase a license (a single- or multi-user license). This can be done through an online software shop. Please find the detailed information in the purchase section of the Neat Video web page: <http://www.neatvideo.com/purchase.html>

After you have purchased a license, you will receive an e-mail from the Neat Video team with detailed download and registration instructions. These instructions will help you download and become a registered user of the Neat Video software.

By becoming a registered user of Neat Video Home or Pro plug-in for Pinnacle Studio you will:

- Encourage the authors to further develop and improve the software;
- Get access to all functions of Neat Video Home or Pro plug-in for Pinnacle Studio (see the Detailed feature map, page 37);
- Be able to use Neat Video Home or Pro plug-in for Pinnacle Studio for commercial and other purposes;
- Get free updates of the software (minor modifications with the same major version number, for example, updates from the version v2.0 to any v2.x);
- Enjoy reduced upgrade prices for new major future modifications of Neat Video Home or Pro plug-in for Pinnacle Studio or will get a free upgrade;
- Receive the primary attention of Neat Video support group;
- Receive the primary attention of Neat Video development group (tell us what you want to see in the next version).

Message from Neat Video team

By becoming a registered user you are helping us to further develop and improve the software.

Become a registered user and we will make Neat Video better for YOU!

11.7. Acknowledgments

Neat Video utilizes the IJG JPEG library.

Neat Video utilizes the openTIFF library.

Neat Video utilizes the Windows XP Theme Manager by Mike Lischke.

Thank you to all the users who contribute by proposing improvements and new features.

Thanks to all the people who help us to find bugs in Neat Video.

Thank you to all the users who stimulate the development of Neat Video by their word and deed.

Neat Video team, ABSOft

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