

Neat Image /Mac

plug-in for Photoshop and Photoshop Elements

To make images look better.

User guide

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1. Introduction

1.1. Overview

Neat Image is a digital filter software designed to reduce visible noise in digital photographic images.

Neat Image detects, analyzes, and reduces image noise. The filtration quality is higher than that of other methods because Neat Image takes into account specific characteristics of particular image acquisition devices, making the filtration more accurate. Using device noise profiles, Neat Image adapts itself to almost any input device – digital camera, scanner, etc. Neat Image incorporates the most advanced noise reduction algorithms in the industry.

Noise is a serious problem that hinders high-quality digital image processing. In digital photography, the consumer- and prosumer-level cameras produce images with an easily noticeable noise component. This component is especially strong in images shot at high ISO rates. The noise reduces the visual quality of digital images and resulting printouts. Some image processing operations, like sharpening, make quality of noisy images even worse.

The rich control set allows you to easily achieve the desired level of noise reduction. In addition, Neat Image can make images look sharper without any degradation of image quality (which is usually inevitable with noisy images). The combination of the sharpening and noise filter makes such an effect possible.

See online examples of Neat Image noise reduction:
www.neatimage.com

Neat Image /Mac is currently produced in three editions: Demo, Home and Pro plug-in. All editions are Photoshop-compatible filter plug-ins and provide top-quality noise reduction and sharpening.

- Demo plug-in is a freeware edition of the software with slightly-limited functionality
- Home plug-in only processes 8/24-bit images and is intended for home users
- Pro plug-in provides professional users with 16-bit image processing capabilities and Photoshop action support for unlimited scripting and batching

1.2. Features

Noise Reduction and Image Sharpening

- **Advanced noise filter** to reduce noise and grain in digital images
- **Complete control** over the filter settings to achieve the desired level of noise reduction
- **Smart sharpening filter** to make images look sharper without amplification of noise
- **16-bit image support** to fully utilize capabilities of modern image acquisition devices

Photoshop plug-in

- To **selectively apply** noise reduction to layers and channels
- To **streamline** use of noise reduction in your workflow
- To **automate** workflow using Photoshop actions with Neat Image noise reduction

Device Noise Profiles

- **Auto profiling** to build noise profiles for your camera or scanner on the fly
- Rich set of free **pre-built noise profiles** in the online profile library
- **Profile matcher** for automatic matching of pre-built noise profiles to images
- **Profile viewer** to inspect noise profiles

Preview

- **Embedded preview** for any selected image area

Some features are only available in the Home or Pro plug-in. Detailed feature map (page 34) explains the differences between Neat Image editions in details.

1.3. Requirements

Recommended system configuration to process 8-10-megapixel images is:

- Intel Core / PowerPC G4 or G5 processor, single or multi-processor
- Mac OSX
- Photoshop or compatible plug-in host
- 256 MB RAM or higher
- True color display with 1024x768 resolution or higher

Minimum system requirements are:

- PowerPC G3 processor
- Mac OSX
- Photoshop or compatible plug-in host
- 160 MB RAM or higher
- True color display with 800x600 resolution

The plug-in is compatible with the following plug-in hosts:

- Adobe Photoshop CS4 / CS3 / CS2 / CS / 7 / 6
- Adobe Photoshop Elements 6 / 4 / 3 / 2

The plug-in may be compatible with other hosts as well.

System requirements for practical use of Neat Image depend on size of input images. The more system RAM is available the larger the images that can be handled. The processing speed is determined primarily by the processor number-crunching power and memory speed.

Minimum size of an input image is 40x40 pixels; maximum size is usually limited by the amount of system RAM available.

The following image types are supported:

- 24-bit RGB
- 48-bit RGB
- 8-bit grayscale
- 16-bit grayscale

Color input images are supposed to be in a flavor of RGB color space, like AdobeRGB, sRGB, etc. If an input image is in some flavor of RGB color space then Neat Image produces the output image in exactly the same flavor of RGB color space.

The plug-in supports any file format that can be handled by the plug-in host, for example, PSD, TIFF, RAW, JPEG, etc., in case of Photoshop.

2. Key concepts

2.1. What it can do – functionality of Neat Image

Neat Image is a digital image filter. Its main function is to *reduce noise* in digital images.

Neat Image can work with images produced by any imaging devices – digital cameras, scanners, etc. Neat Image 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 featureless image areas that contain no visible (or important) details. Usually the software can find such areas completely automatically. In a difficult case, you can assist it and select featureless areas manually. Finding such areas is very easy for human eyes but may sometimes be a bit difficult for software.

By analyzing found or specified featureless areas, the *noise analyzer* builds a profile which describes the noise in these areas. With this profile, Neat Image can efficiently reduce noise in the whole image.

When several such profiles for different device modes are available, the *profile matcher* can automatically select the profile that matches given input image. In this way, you can skip noise analysis and simply re-use one of profiles built earlier. Alternatively, a new profile can be built for every new image using automatic or manual profiling.

The noise filter processes images in three *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 components of the input images.

In addition to the noise filter, there is the *smart sharpening filter*, which only sharpens important image 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 input images

Neat Image is designed to reduce noise in images produced by digital cameras and scanners, and can also be used to process images from other sources. An input image should satisfy the following requirements:

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

Neat Image works fine, for example, on images with high ISO noise. However, ‘hot’ or ‘dead’ pixels (produced by single ‘broken’ elements of image sensor) do not satisfy the uniformity condition and, therefore, are not efficiently removed by Neat Image.

Another frequent source of noise is JPEG compression. The JPEG noise is approximately uniform when high compression quality (low compression rate) is used. However, low compression quality makes noise non-uniform. Therefore, we recommend using the highest quality levels whenever possible. Try to avoid visible artifacts (‘squares’ or ‘blocks’ introduced by JPEG compression) in input images beginning from the early stages of image processing. If you can, use lossless file formats such as TIFF or RAW (any file format supported by Photoshop can be used with the Neat Image plug-in in Photoshop environment).

- **Noise should be concentrated in high and medium spatial frequencies**. This condition is usually met by images produced by modern digital cameras. This condition may not be completely satisfied if you use the strong (e.g., x2-x3 and more) digital zoom features of digital cameras.

3. Installing the plug-in

In most cases, the Neat Image plug-in is installed automatically to Adobe Photoshop and Photoshop Elements image editors. If for some reason the plug-in is not automatically installed, then you can install it manually using the guidelines below.

To manually install Neat Image plug-in to...

... Adobe Photoshop / Photoshop Elements

➔ Method 1 (traditional one):

Make an alias for the *NeatImage.UniversalBinary* (for Photoshop CS4 / CS3 or Photoshop Elements 6) or *NeatImage.PowerPC* (for Photoshop CS2 / CS / 7.x or Photoshop Elements 4 / 3 / 2) package from the Neat Image installation folder (typically, */Applications/NeatImage/*). Put the alias into the */Plug-ins/* subfolder in Photoshop / Photoshop Elements folder. Then re-start Photoshop or Photoshop Elements, and find Neat Image in the Filter menu.

➔ Method 2 (an easier one, available in Photoshop CS4 / CS3 / CS2 / CS / 7.0 and in Photoshop Elements):

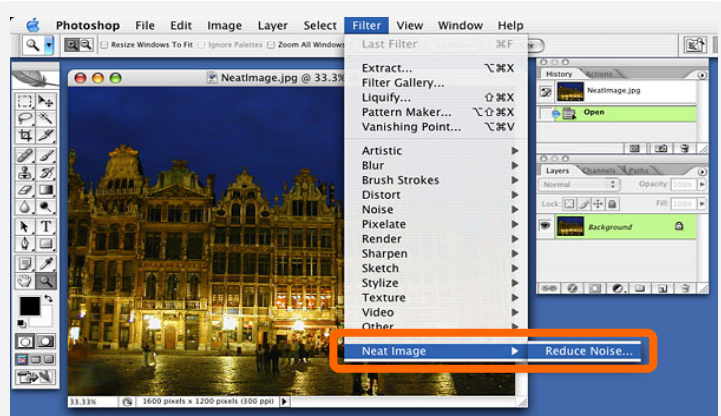
In Photoshop, go to the menu Preferences | Plug-ins and Scratch Disks and set Additional Plug-ins Directory to the Neat Image installation folder (typically, */Applications/NeatImage/*). Then re-start the image editor, and find the Neat Image plug-in in the Filter menu under the Neat Image submenu.

4. Filtration process overview

4.1. Overview of Neat Image filtration process

1. Open Neat Image plug-in

- in the image editor, open the image to be processed;
- with this image, use the Filter > Neat Image > Reduce Noise menu item in Photoshop.

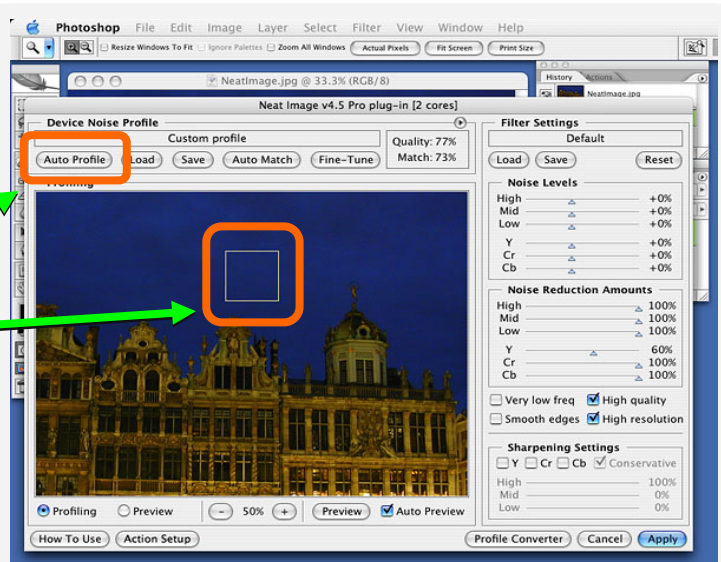


2. Prepare a *device noise profile* necessary to filter the image

You can load a pre-built one or build a new profile on the spot.

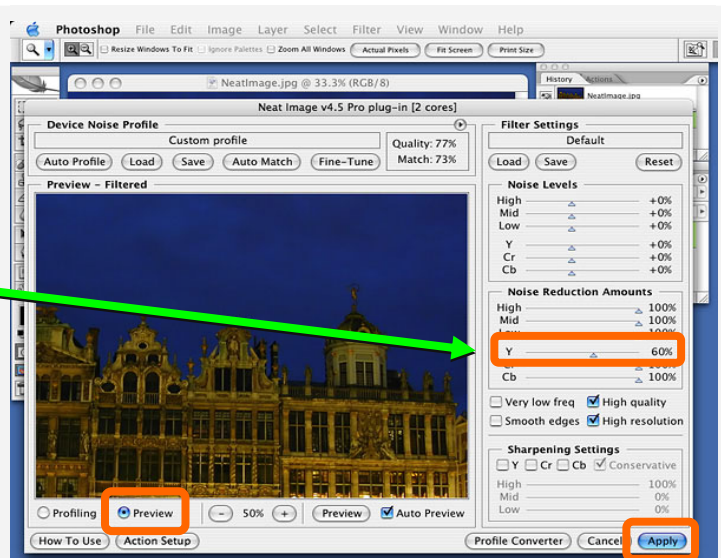
To build a new profile:

- click the Auto Profile button; this will automatically find, select and analyze a *featureless* (noise-only) image area (if you see that automatic selection includes any important image details then move the selection to a featureless area and click the Auto Profile button again)



3. Adjust the Filter Settings to achieve desired level of noise reduction and sharpening

- select the Preview mode (radio button under the image);
- adjust the filter settings: start by varying Noise Reduction Amount: Y and observe how the preview changes;
- adjust other noise reduction amounts if necessary;
- adjusting noise levels is usually NOT necessary if the noise profile is accurate;



4. Apply the filter to the image: click the Apply button.

4.2. Running Neat Image on a sample image

There is a test-kit prepared to help you start using Neat Image /Mac. You can download it from the Neat Image web page: <http://www.neatimage.net/files/TestKitMac.zip> (250KB). Having downloaded, please unzip it to a new folder on the hard disk.

The test-kit contains a sample image: the *SampleImage.jpg* file. This image is a part of typical photo taken with digital camera (Nikon CoolPix 950 in this case). Detailed information about the test image is available in the *SampleImageInfo.txt* file.


Please go through the stages below to see how the image can be improved by Neat Image:

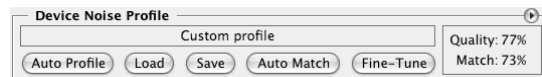
Stage 1. Open the sample image

1. Open the sample image (*SampleImage.jpg*) in your image editor;
You will see that there is strong noise in the image, especially in the sky area (use zoom and scroll to better see it). This is the typical noise produced by a digital camera. The task of Neat Image is to reduce this noise.
2. Invoke the Neat Image > Reduce Noise... filter for this image.

Stage 2. Load the sample noise profile


To reduce noise in the image the Neat Image plug-in generally needs a noise profile describing the noise properties of the image. 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 Image can efficiently reduce the noise in the image.

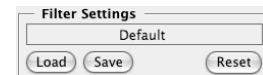
1. Click  (Load Profile) in the Device Noise Profile box of the plug-in window;
2. In the Load Device Noise Profile dialog, navigate to the folder where the sample device noise profile has been unzipped and select the *SampleProfile.dnp* file.



Now the sample device noise profile is opened and Neat Image is almost ready to filter the sample image. Usually, you would adjust the filter settings at this stage. To make things easier for the first run of Neat Image, we have prepared a sample preset with “good” settings to process the sample image.


Stage 3. Load the sample filter preset

1. Click  (Load Preset) in the Filter Settings box on the right panel;
2. In the Load Filter Preset dialog, navigate to the folder where the sample filter preset has been unzipped and select the *SamplePreset.nfp* file.



Now the sample filter preset is opened and the filter settings are adjusted to process the sample image.

Stage 4. Apply the filter

1. Click  in the bottom of the plug-in window and wait until the progress indicator disappears.

Processing may take a few seconds. Then the filtered output image is displayed in the image editor and you can compare it with the original using Undo/Redo commands of the editor. Notice that the noise – especially in the sky – has been significantly reduced while the real image details have been preserved.

Please be aware that the sample noise profile and sample filter preset supplied with the test-kit are suitable only for images taken with that particular digital camera working in that particular mode. Neat Image can perform similar noise reduction on images captured or acquired by any other camera (or scanner) working in any mode. To be able to do that Neat Image needs device noise profiles that describe the noise characteristics of those devices. The software can build these profiles on the fly. Also, you can find ready-made device noise profiles for many digital cameras and scanners in the Profiles section of Neat Image web page: <http://www.neatimage.com/mac/profiles.html>

The next sections – Filtration process details, page 9, and Device noise profiles, page 18, – contain detailed descriptions of the filtration and profiling processes. There are also several examples of profiling and filtration in the examples section of Neat Image web page: <http://www.neatimage.com/mac/examples.html>

5. Filtration process details

The Neat Image plug-in can be invoked from your image editor to process the selected area in a layer or a channel of the current image. This section describes the key stages of using the Neat Image plug-in.

5.1. Stage I. Invoke the plug-in from the image editor

In the image editor, select a layer (or a channel) in the image that should be processed (it will be called 'input image' hereafter). In this layer (channel), select an area to be filtered. The whole layer (channel) will be filtered if no area is selected.

Invoke the Neat Image plug-in using the standard way of invoking filter plug-ins in your image editor.

In Photoshop / Photoshop Elements:

- ➔ Select the Filter | Neat Image | Reduce Noise... menu item.

The Neat Image plug-in window will open and will show the input image.


To scroll and pan the image

- press the spacebar and drag the image with the left mouse button.

To change the image zoom level

- use the zoom controls under the image viewer;
- use the Cmd+Plus, Cmd-Minus, Cmd+0 (zero), Cmd+Alt+0 (zero) keyboard shortcuts;
- use the Cmd+Shift keys to temporarily change zoom to fit the image to window.

To change the Neat Image window size

- use the Maximize Window, Larger Window, Smaller Window, Minimize Window commands in the popup menu (click the button  to open the popup menu).

5.2. Stage II. Prepare a device noise profile

To filter the input image, Neat Image needs to know the characteristics of noise produced by the image acquisition device (digital camera, scanner, etc.) that the image 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 that suits the input image:

1. To build a new profile by analyzing the input image or a specially prepared test image;
2. To automatically select the most suitable device noise profile from a pre-built set of profiles using the automatic profile matcher;
3. To manually select a suitable profile from a pre-built set of profiles.

The first option is often the easiest one provided the input image includes uniform featureless image areas that contain noise but no visible or important details. Neat Image can automatically find such image areas and analyze them to build a noise profile. When the image does contain featureless areas, this automatic way of preparing a noise profile is the most accurate and therefore recommended. If the input image includes no such areas, another image with featureless areas can be used to build a profile. You can see some examples of featureless image areas in the Examples section, page 29.

The last two options are available once you have a pre-built reusable set of profiles. You can find some free profile sets for different cameras and scanners in:

- Profiles section of Neat Image web page: <http://www.neatimage.com/mac/profiles.html>
- Device noise profiles section of Neat Image community forum: <http://www.neatimage.net/forum/viewforum.php?f=5>
- Other digital imaging forums and web pages from users of Neat Image.

If you cannot find a pre-built set of profiles, you can easily build profile(s) yourself. Moreover, please be aware that using profiles built by other people may produce less than optimal results with your images because of possible slight differences in noise properties of cameras (scanners) as well as due to different imaging processing workflows used. Therefore, we advise to use profiles built by others only

as a starting point to learn how to use Neat Image. To achieve better results consider building your own reusable profiles.

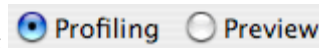
You can build a set of profiles for different device modes or just one profile to process one image. See the Device noise profiles section, page 18, for detailed instructions on profiling.

Once you have a set of profiles for different modes of your imaging device, you can (automatically or manually) select a profile that matches the input image. Or if you have just built a single profile specifically for the input image, then you can directly use the profile to process the image in the Stages III-V below.

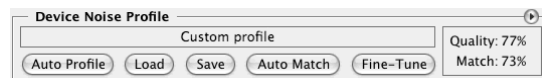
To build a new profile using the input image

- ➔ Make sure you use the Profiling mode.

Select the Profiling radio button under the image area:



- ➔ Click **Auto Profile** (the Auto Profile button) in the Device Noise Profile box.



Neat Image will find and highlight the image area selected for analysis (see the selection in the Profiling box). Neat Image will then automatically analyze the noise in that area and whole image and build a new noise profile.

To build a profile, Neat Image is looking for a flat uniform featureless area in the input image. In difficult cases, Neat Image may have trouble with finding a uniform featureless area in the input image. You may notice that the selected area, for example, contains some important image details. In such a case, move the selection to an area that does not contain any image details (double-click in that area and the selection frame will move to the area automatically) and then click the same Auto Profile button again.


After the profile is built, check the Quality indicator in the Device Noise Profile box. A profile built using a uniform and featureless image area will 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, you can consider the noise profile ready and proceed to Stage III. Adjust filter settings, page 11.

If the quality is not high, try to select another uniform image area and use Auto Profile once again. That may not help still, especially if the input image contains only a few featureless areas. In this case, consider building a noise profile using an alternative image or special test image prepared with the Calibration Target. Please see the Device noise profiles section, page 18, to learn how to use the Calibration Target to build device noise profiles.

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

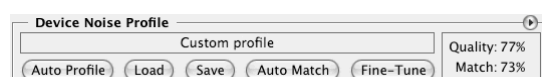
- ➔ Click **Auto Match** (the Auto Match button) in the Device Noise Profile box.

The Auto Match function uses the EXIF data fields of the input image to automatically select and open the device noise profile that best matches the device mode of the image. The most matching noise profile is selected from the set of profiles stored in */Applications/NeatImage/Profiles/* (and its subfolders).

The degree of match between the current input image and current noise profile is displayed in the rightmost frame inside the Device Noise Profile box. To find more details about the image-profile match use the Image-Profile Match Details... item in the popup menu (click the button  to open the menu). This will open the Image-Profile Match Details... window that will show device information from the input image and profile that was used for matching.

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

- ➔ Click **Load** (the Load device noise profile... button) in the Device Noise Profile box. Select a



profile in the file open dialog box.

When manually selecting a profile that matches the device mode of the input image, use the profile file names and folder structure to guide your search. See Preparing profile set for different device modes: Stage III. Structuring profile set, page 25, for more information on profile set structuring.

To additionally fine-tune the loaded profile

You may want to additionally fine-tune the profile loaded either automatically (using Auto Match) or manually. You can fine-tune this profile to the current input image by using **Fine-Tune** (the Fine-Tune button). There is no need to select any area in the input image because the fine-tuning function automatically analyzes the whole image.

Fine-tuning the profile to the current image usually makes the profile more accurate and better matching the image noise properties.

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

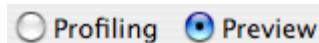
Once you have selected the profile that matches the input image or you have just built a single profile specifically for the input image, you can use it to process the image in the Stages III-V below.

5.3. Stage III. Adjust filter settings

As soon as the noise profile is ready you can use the noise and sharpening filters in Neat Image plug-in. The filters have several settings that you can adjust. Default noise reduction settings are based on (are relative to) the noise analysis provided by the noise profile; this usually produces good filtration results. You may want to additionally vary the filter settings to achieve the filtration results that look best to your eyes.

- ➔ Make sure you use the Preview mode.

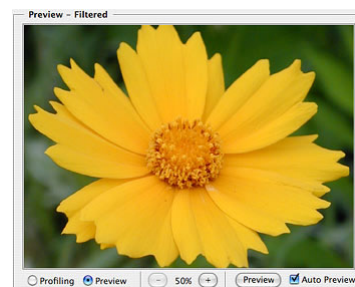
Select the Preview radio button under the image area:



5.3.1. Use preview when adjusting filter settings

The Preview box shows a part of the input image processed by the noise and sharpening filters. If you change any filter settings then the preview is automatically updated (provided the Auto Preview setting is enabled) or you can manually update it using the Preview button. You can drag the image in the Preview box to see how the filtration affects different parts of the image. If the selection is enabled in the Preview box then only the selected area is processed for preview purposes.

When the preview is ready, you can click inside the preview area to temporarily switch back to the original image for comparison.



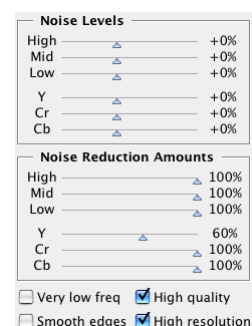
5.3.2. Adjust filter settings

There are two main filters in Neat Image: noise reduction filter and sharpening filter. These two filters can be used together and each of them can be used independently. You can enable / disable and adjust both filters using the guidelines in the subsections below.


Adjusting noise filter settings

The noise filter has separate settings for all (spatial) frequency and channel components of the input image.

Noise reduction applied to one image component is controlled by two settings: *noise level* and *noise reduction amount*. Such a pair of settings associated with an image component – either a channel or frequency component – is



fundamental for Neat Image 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 Image measured levels of noise in each component of the analyzed image. The noise level of an image component can be low or high depending on the strength of the visible noise in this component. Neat Image 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 (the Profile Viewer window is accessible via the Profile Viewer... menu item in the popup menu invoked via the button ).

For example, the noise level of the Y (luminance) channel could be measured at 8.55 units. This number tells the noise filter which image elements should be considered noise and which – image details: the image elements that are weaker than 8.55 units are considered noise and reduced by the noise filter; the image elements that are stronger than 8.55 units are considered details and not reduced.¹

If you do not change the default noise filter settings (Noise Levels: Y: +0%) then noise reduction in the Y channel is completely determined by the above measured number from the noise profile (8.55 units). However, if you do adjust the filter setting for the Y noise level then this adjustment is taken into account. For example, if you set the Noise Levels: Y control to +15% then what is considered by the noise filter as the actual noise level is:

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

With this adjustment, the image elements in the Y 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 image component tells the noise filter what should be considered noise (the elements below the noise level) and what – important image details (the elements above the noise level) in this component.

The *noise reduction amount* related to the same image component tells the noise filter how much of the found noise (the elements below the noise level) should be reduced. For example, if the noise reduction amount is set to 50% then all image 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 component of the input image and *how much of this noise should be reduced*. You have access to six such pairs – three for channel components (Y, Cr, Cb) and three for spatial frequency components (High, Mid, Low) of the input image.

Because the noise level estimations used by the filter are based on the noise profile, the default filter settings usually produce good filtration results provided 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%, which means no image elements are considered noise, and therefore, no noise reduction is applied in the corresponding image component; to +150%, which means noise reduction is applied to the image 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 image 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 Y channel of the input image and 100% of noise in the Cr and Cb channels as well as in all frequency components. 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 the image.

Decreasing the noise reduction amounts may have a positive effect if the input image contains some natural noise. For example, when you are filtering images of asphalt, sand, or anything else that contains fine natural noise-like features, it may be helpful to reduce amounts down to 40-50%.

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 Quality and Match indicators in the Device Noise Profile box to estimate the accuracy of the profile. The Quality indicator shows how accurate and complete is the noise analysis itself. The Match indicator shows how closely this profile corresponds to the noise properties of the input image. Both indicators have to show high values for the noise reduction to be accurate.

Adjust noise reduction amounts¹

- ➔ Use the Noise Reduction Amounts: High, Mid, Low; Y, Cr, Cb sliders.

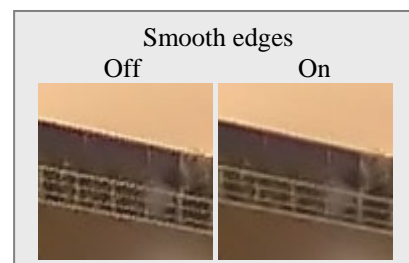
You can vary the noise reduction amount for each frequency and channel component of the input image. The higher a certain noise reduction amount, the more of the detected noise is removed in the corresponding image component. Be careful, setting the noise reduction amounts too high can lead to unnaturally looking (over-smooth, plastic-like, see page 32) 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 an image, but efficiently removes color noise.

If the input image has only fine (high frequency) noise then you can 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 input image contains strong low frequency noise (for example, a very coarse-grained color splotches) then you may want to switch on 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 (see an example on the right).
- ➔ Check the High quality checkbox to enable the 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 filtration of the whole image.
- ➔ Check the High resolution checkbox to enable the higher-resolution noise filter. This may be useful when processing images with very fine details that should be better preserved by the filter.



Use preview

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

After you have made any changes to the noise filter parameters, the plug-in automatically recalculates preview for the image area shown in the Preview area. Use the preview on different parts of the image 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 or frequency components. If the noise filtration is not sufficient then increase the amounts.

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 inaccurate noise profile (providing inaccurate estimations of actual noise levels). This may be compensated by adjusting (increasing) the noise levels in the filter settings.

- ➔ Use the Noise Levels: High, Mid, Low; Y, Cr, Cb sliders.

The noise filter has access to three frequency components and three channel components of the input image. The corresponding sliders adjust the estimated noise levels of these components.

The higher a certain noise level, the more image elements in the corresponding image component are considered noise. Be careful, setting a noise level setting too high can lead to removal of important image details. Setting a noise level setting too low can lead to incomplete filtration:

¹ We recommend disabling the sharpening filter when adjusting the noise filter. To disable the sharpening filter, uncheck all channels in the Sharpening Settings box.

residual noise and compression artifacts can stay in the output image.

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 input image 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 input image 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 visible in the preview and output image, probably the device noise profile is not good at all. Return to Stage II, page 9, and rebuild the profile from scratch.

Adjusting sharpening settings (optional)

The sharpening filter is designed to increase image sharpness without increasing the noise strength.

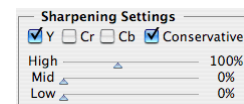
The default values of the sharpening settings should produce satisfactory results (when sharpening is enabled for any of the channel components) but you are encouraged to vary the settings to find values that produce the desired level of sharpness. Zero sharpening amounts will not sharpen the image at 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 image details. As with any other sharpening method, you have to balance the amounts to avoid over-sharpening.

Use the preview when adjusting the sharpening settings.

Select color channels where sharpening should be applied

- ➔ Use checkboxes in the Sharpening Settings box.

Usually you only want to sharpen the luminance channel – Y.



Select sharpening mode

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

The standard sharpening settings used by many graphic editors are 100% for high frequency and 0% for medium and low frequencies (used by default).

Use preview

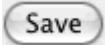
- ➔ Use the preview when adjusting the sharpening settings.

After you have made changes to the sharpening settings, do not forget to check the preview. Use the preview on different parts of the image 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 the subsection below), or directly to the Stage V. Apply filter, page 15.

5.3.3. Save filter settings into a preset (optional)

To save the filter settings into a preset

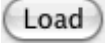
- ➔ Click  (the Save filter settings as preset... button) in the Filter Settings box.

In the Save Filter Preset 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 filter settings later on. Also, you can exchange filter presets with other users of Neat Image. Together, a device noise profile and a filter preset can be used to precisely reproduce the filtration results.

To load a previously saved filter preset

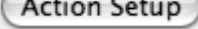
- ➔ Click  (the Load filter preset... button) in the Filter Settings box. In the Load Filter Preset dialog box, specify the name of the filter preset to be opened.

There are several pre-written filter presets in the */Applications/NeatImage/Presets/* folder. 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).

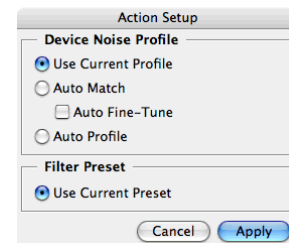
5.4. Stage IV. Adjust Action settings¹ (optional)

At this point in the workflow, the noise profile is ready, filter settings are adjusted and, therefore, the filter is ready to be applied to the image.

However, before applying the filter, you may want to adjust the Action

settings accessible using the Action Setup button: .

These settings specify which noise profile and filter preset should be used by the plug-in on startup when you use the plug-in next time. For example, you can have Neat Image automatically build a new noise profile using Auto Profile when you open it.




The following options are available:

- Use Current Profile - the plug-in will use the current noise profile used in the plug-in;
- Auto Match - the plug-in will use profile matching to find and load a profile from the profile set on the disk;
- Auto Fine-Tune - the plug-in will additionally apply Auto Fine-Tune to adapt the loaded profile to the input image; this option is available when you use either Use Current Profile or Auto Match (Auto Profile applies Auto Fine-Tune automatically);
- Auto Profile - the plug-in will use Auto Profile to build a profile using the input image;
- Use Current Preset - the plug-in will use the current filter settings.

5.5. Stage V. Apply filter

To apply filter to the image

- ➔ Click  (the Apply button in the bottom of the plug-in window).

The plug-in window will be closed and filtration will start. Processing may take some time (from seconds to minutes, depending on the speed of your computer's processor and size of the image). During this time, the image editor will display the filtration progress window.

Neat Image is a processor-intensive software, and in the current implementation, the processor's speed is the most critical. On Core Duo 2 GHz, processing a 10-megapixel image takes about 10 seconds (Neat Image v4.6 plug-in /Mac). On a computer of typical configuration, the processing time is linear with respect to image size (in megapixels).

¹ This subsection applies to Neat Image Pro plug-in only.

After filtration, the Neat Image plug-in will automatically save the current settings such as device noise profile, filter preset, Action settings, which will enable re-applying the plug-in (for example, using the `Cmd+F` shortcut in Photoshop) with the same settings without re-doing the stages II-III. Also, you can open the plug-in manually and continue work with the last used parameters.


6. Using the plug-in in PS actions and smart filters¹

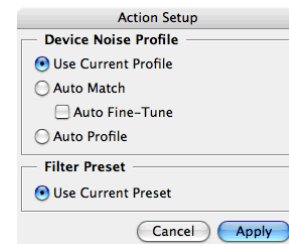
The Neat Image plug-in /Mac can be used in Photoshop actions and smart filters along with the built-in Photoshop filters. The plug-in has two parameters when used in an action or smart filter: Profile and Preset. The Profile parameter tells Neat Image which device noise profile should be used within this action or smart filter. The Preset parameter specifies which noise filter preset should be used.

When you record an action or configure a smart filter that includes the Neat Image plug-in, you can select the source of noise profile that should be used by the plug-in. There are three options:

- 1) to use a fixed noise profile created or loaded into plug-in at the time of action recording (or configuring the smart filter);
- 2) to automatically select the best matching profile from a profile set using Auto Match;
- 3) to automatically build a new profile by analyzing the processed image using Auto Profile.

To select any of these options when recording an action or configuring a

smart filter click  (the Action Setup button) in the main plug-in window and then select the corresponding options in the Action Setup window. You can later return and check which options are selected in the current action or smart filter using that window.



To use (1), select the Use Current Profile option in the Action Setup window. The plug-in will record the current noise profile into the action or smart filter and will then always use it when the action is run or smart filter is (re-)applied. When used in an action, the Profile parameter contains the name of that noise profile. The profile name is also shown in the Device Noise Profile box in the main plug-in window.

To use (2), select the Auto Match option in the Action Setup window. To let this option work, several noise profiles should be available to the Auto Match function: the profiles should be stored in */Applications/NeatImage/Profiles/* (and its subfolders). Also, the input image as well as profiles in the set should contain the EXIF information to make matching possible.² An action using profile matching will contain “Auto match profile” in the Profile parameter.

In cases (1) and (2), you can additionally choose to auto fine-tune the fixed or matched noise profile to current input image (this usually produces more accurate filtration results). To use this possibility check the Auto Fine-Tune option in the Action Setup window. An action using fine-tuning will additionally contain “Auto fine-tune” in the Profile parameter.

To use (3), select the Auto Profile option in the Action Setup window. No pre-built profiles are required in this case; the plug-in will automatically build a new profile for every new input image using the image itself. The only requirement is that the input image should contain enough flat featureless noise-only areas suitable for noise analysis. An action using auto profiling will contain “Auto profile image” in the Profile parameter.

Since there is only one option in the Filter Preset box, the action or smart filter will use the filter preset created or loaded into plug-in at the time of action recording (or configuring the smart filter). This filter preset will be recorded into the action or smart filter and will then always use it when the action is run or smart filter is (re-)applied. When used in an action, the Preset parameter contains the name of that preset. The preset name is also shown in the Filter Settings box in the main plug-in window.

¹ Using the plug-in in Photoshop actions and smart filters is only supported in Neat Image Pro plug-in (Detailed feature map, page 34). Also, smart filters are only supported by the most recent versions of Photoshop.

² Most noise profiles available in the profile library at Neat Image website do contain the EXIF data. New noise profiles built with Neat Image v4.x plug-in /Mac will also contain the EXIF data from the images used for profiling. Profiles built with older versions of Neat Image plug-in /Mac do not contain the EXIF data.

7. Device noise profiles

A *device noise profile* (or *noise profile*, or simply *profile*) describes the properties of noise produced by an imaging device (e.g., digital camera, scanner, etc.) working in a certain mode. Several noise profiles corresponding to different modes of a device constitute a *profile set* that can be used by Neat Image to process images produced in any of these modes.

You can find some pre-built noise profiles or build your own ones for your camera or scanner. Learn how to find, build and use device noise profiles in Neat Image in the subsections 7.1-7.4 below.

7.1. Getting ready-made noise profiles

You can find some free profile sets for different cameras and scanners in:

- Profiles section of Neat Image web page: <http://www.neatimage.com/mac/profiles.html>
- Device noise profiles section of Neat Image community forum: <http://www.neatimage.net/forum/viewforum.php?f=5>
- other digital imaging forums and web pages from users of Neat Image.

Once you have downloaded and installed¹ a set of profiles for different modes of your imaging device, you can select an appropriate profile from the set to process a given input image.

Please be aware that using ready-made profiles built by other people may produce less than optimal results with your images because of possible slight differences in noise properties of cameras (scanners) as well as due to different imaging processing workflows used. Therefore, we advise to use ready-made noise profiles built by others only as a starting point to learn how to use Neat Image. To achieve the best results consider building your own profiles as explained in the subsections below.

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

In this subsection, you will find out how to build a single noise profile for an image produced in a certain shooting or scanning mode (such a profile can also be called “a profile for a certain mode of the device”).

Building a new noise profile using the current version of Neat Image plug-in /Mac generally consists of three stages:

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

The Stage I, building a profile, can be done with the use of a *regular image* (for example, the image that you want to denoise or any other regular image) or with the use of the *Calibration Target*. These two cases are described as two alternative versions of the Stage I:

- Stage I. Case of building a profile using a regular image
- Stage I. Case of building a profile using the Calibration Target

You may want to follow the case of building a noise profile using a regular image if you only need a single-use profile to process selected input image. In this case, the input image (or an alternative regular image from the same series; it should be produced by the same device working in the same mode) should contain enough uniform featureless areas for noise analysis.

A uniform area (with minor variation in all channels of the image) may be overcast sky, clear sky (without clouds and birds), or any other part of an image, where there are no visually perceptible details (except the noise). Neat Image needs uniform featureless areas of around 128x128 pixels (minimum is 32x32 pixels). You can see some examples of uniform featureless image areas in the Examples section, page 29.

If the input image does not contain such areas and you have no suitable alternative regular image that contains such areas, you can prepare a special test image and follow the case of building a noise profile

¹ To install a profile set: unzip the profiles from the downloaded archive to the folder you use to store noise profiles (normally it is */Applications/NeatImage/Profiles/* and its subfolders).

using the Calibration Target. That is also recommended if you want to prepare a reusable noise profile for a certain mode of your camera or scanner.

7.2.1. Stage I. Case of building a profile using a regular image

To build a noise profile using a regular image you have to take 2 steps:

- Step 1. Preparing a regular image for noise analysis;
- Step 2. Analyzing the image noise.

Step 1. Preparing a regular image for noise analysis

To analyze noise in a regular image, you can use the input image or an alternative regular image that was produced by the same camera (or scanner) in the same or similar shooting (scanning) mode. Using the input image usually produces most accurate noise profile that perfectly matches the noise properties of this input image. However, if there are not enough flat featureless areas in the input image then you have to use an alternative regular image.

Case of using the input image

In this case, simply open the input image in the plug-in.

To build a profile, work with this image in the step 2 below.

Case of using an alternative image

If there is no large enough uniform featureless areas in the input image, use an alternative image. The alternative image is supposed to be produced by the same device working in the same or similar mode. This can be just another image from the same series; the image should contain at least one large enough uniform featureless area suitable for analysis.

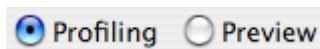
Find and open an alternative image using the image editor and then open this image in Neat Image plug-in for analysis below.

Step 2. Analyzing image noise (profiling)

Analyzing noise is the main part of building a noise profile for an imaging device working in a certain mode. The current version of Neat Image plug-in /Mac offers two ways of conducting the noise analysis (profiling): automatic and semi-automatic one. Using automatic profiling is easier and therefore recommended for beginners. In difficult cases (for example if Neat Image cannot automatically find a uniform featureless area in analyzed image), automatic profiling may not work or produce less than perfect results. You can always override automatics and use semi-automatic profiling.

- ➔ Make sure you use the Profiling mode.

Select the Profiling radio button under the image area:



Case of automatic profiling

To analyze noise properties, Neat Image uses uniform image areas that contain noise but no visible or important details. With automatic profiling, Neat Image tries to find one such area automatically and then uses this area to analyze image noise.

- ➔ Click  (the Auto Profile button).

Neat Image will automatically find image areas suitable for analysis and will analyze them automatically. If the selected image area shown in the Profiling box indeed contains no visible details then the resulting noise profile will be accurate.

At this point the profile is ready. Please proceed to Stage II. Documenting noise profile, page 21.

If the automatically selected image area does contain visible details then use the semi-automatic profiling instead (see below).

Case of semi-automatic profiling

1) Find a uniform featureless image area

- ➔ Manually find and select an image area that contains no visible details.¹

The area should be at least 32x32 pixels large. That is the minimum size; the recommended size is 128x128 pixels or more (you can resize the selection frame).

Scroll, pan, zoom the image in the Profiling box to find a uniform image area. Set the selection frame to the found uniform area. Double-click in the area to automatically bring the selection frame to the area.

If you cannot find a uniform area in the input image, consider using an alternative regular image or use the Calibration Target as explained in the next section (Stage I. Case of building a profile using the Calibration Target, page 20).

2) Analyze selected image area

- ➔ Click  (the Auto Profile button).

Neat Image will automatically analyze the selected image area.

At this point the profile is ready. Please proceed to Stage II. Documenting noise profile, page 21.

7.2.2. Stage I. Case of building a profile using the Calibration Target

The Calibration Target is specially designed to enable easy profiling of various imaging devices. It can be used to build a single profile for a certain device mode or a set of profiles for different modes.

Follow the steps below to prepare a single profile.

Step 1. Preparing the Calibration Target

To use the Calibration Target, download the image of the Calibration Target from Neat Image web page: <http://www.neatimage.com/mac/testtarget.html>

There are two ways of using the Calibration Target: you can open it on the screen and take a shot (with a digital or film camera, depending on your workflow) or you can print it out and shoot the hardcopy.

Shooting the Calibration Target off the screen is faster, especially with a digital camera. However, be careful when shooting it off the screen of a CRT monitor because you may occasionally capture scan bands. These bands may spoil a part of the shot. If you cannot avoid these bands, prepare a printed version of the Calibration Target or shot it off an LCD monitor, which does not produce this effect.

Case of shooting the Calibration Target off the screen

1. Open the Calibration Target image on the screen.
2. Use the displayed Calibration Target in the Step 2 below.

Case of shooting the printed Calibration Target

1. Open the Calibration Target image in your image editor and print out the image on a sheet of white matte paper; make sure the image fills the whole page;
2. Use the printed target in the Step 2 below.

¹ You can see some examples of uniform featureless image areas in the Examples section, page 29.

Step 2. Preparing a shot or scan of the Calibration Target

Case of digital camera

Use the displayed or printed Calibration Target to prepare a test shot for building a device noise profile for your camera:

1. Set the camera to a certain shooting mode (ISO level, etc.) you want to build a profile for;
2. **Important:** set the focusing system on infinity or in macro mode to get a slightly-out-of-focus image of the target;
3. Make sure the Calibration Target fills the whole frame and make a shot;
4. Open the resulting shot in Neat Image plug-in.

Case of flatbed scanner

Use the printed Calibration Target to prepare a test scan for building a device noise profile for your flatbed scanner:

1. Set the scanner to a certain scanning mode (resolution, light level, etc.) you want to build a profile for;
2. If possible set the scanner slightly out of focus (an out of focus scan is preferred for profiling); a possible way to achieve this is to raise the page over the scanner glass a bit;
3. Scan the printed Calibration Target;
4. Open the resulting scan in Neat Image plug-in.


Case of slide scanner

Use the displayed or printed Calibration Target to prepare a test scan for building a device noise profile for your film scanner:

1. Set the camera to a certain shooting mode (film type, exposure, etc.) you want to build a profile for;
2. **Important:** set the focusing system on infinity or in macro mode to get a slightly-out-of-focus image of the target;
3. Make sure the Calibration Target fills the whole frame and make a shot;
4. Develop the slide and put it into the scanner;
5. Set the scanner to a certain scanning mode (resolution, light level, etc.) that you want to build a profile for and scan the slide;
6. Open the resulting scan in Neat Image plug-in.

Step 3. Analyzing image noise


With the shot or scan of the Calibration Target, Neat Image can build a device noise profile completely automatically once you open it in the plug-in.

- ➔ Use the Auto Profile with Calibration Target menu item in the popup menu (click the button  in the Device Noise Profile box to open the menu).

After the analysis is completed, proceed to the Stage II below.

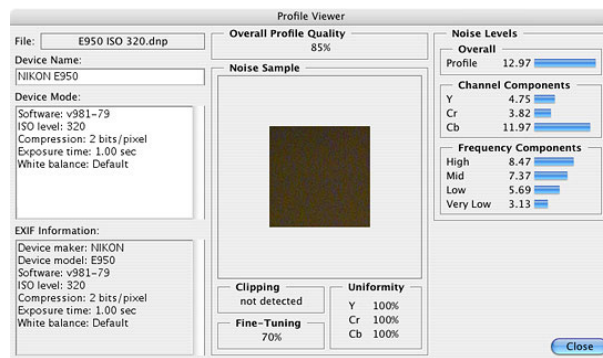
7.2.3. Stage II. Documenting noise profile

At this point of building the noise profile for your camera or scanner, the noise analysis is done and all important noise characteristics are gathered in the profile. However, you may still have to manually document the profile if Neat Image has not done this automatically. With most images from digital cameras, Neat Image is able to automatically extract the crucial information about the camera mode from the EXIF data fields of the analyzed image and put this information to the noise profile (you can

see that in the Device name and Device mode fields in the Profile Viewer window; the Profile Viewer window is accessible via the Profile Viewer... menu item in the popup menu invoked via the button .

If Neat Image has not automatically placed any information to the Device name and Device mode fields after noise analysis, you can fill out these fields manually.

- ➔ Use the Device name and Device mode fields in the Profile Viewer window. Here, you can specify the model of the image acquisition device and describe the device mode, which can be something like the data in the picture on the right.



About the Device name and Device mode notes

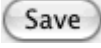
It is highly recommended to specify these details to keep record of devices, device modes, and corresponding device noise profiles that you use.

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 helps you keep track of them when you do manual profile matching, i.e., when you manually select a suitable profile to process an image.

Automatic profile matching available in Neat Image uses the EXIF information from the image files and profiles, not the Device name and Device mode fields, so filling out these fields may not be necessary for automatic profile matching. However, filling out these fields is highly advisable both for the clarity purposes and for the cases of EXIF-less input images (in such cases, you have to manually select a suitable profile based on the Device name and Device mode fields).

Please see the Preparing profile set for different device modes section below to learn more about camera and scanner parameters that may need to be documented in the Device mode field.

7.2.4. Stage III. Saving the noise profile

- ➔ Use  (the Save device noise profile as... button) in the Device Noise Profile box.

In the Save Device Noise Profile dialog box, select the file name to save the profile to. The default name is based on the device name and device mode when these are available from the EXIF data fields of the analyzed image. If the EXIF data are not available then the default profile name is based on the name of analyzed image file. Use the suggested default or change the name of the file to store the device noise profile. Device noise profiles are saved in **.dnp* files.

File naming considerations

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

See Preparing profile set for different device modes: Stage III. Structuring profile set, page 25, for additional information.

Saved noise profile includes complete noise analysis. Therefore, by re-opening the noise profile, you can reproduce exactly the same conditions for image processing later on. Also, you can exchange noise profiles with other Neat Image users.

7.3. Preparing profile set for different device modes

Usually an imaging device can work in several different modes. Therefore, there should be several device noise profiles, corresponding to each mode to enable accurate processing of arbitrary images produced by this device. If the set of profiles covers all modes of the device then any image from this device can be processed by using one of the profiles from the set.

This subsection explains how you can prepare a reusable set of profiles for a range of modes of an imaging device.

As an owner of a certain imaging device you are in perfect position to prepare a profile set because you have direct access to the device hardware. Moreover, using your own set of profiles will make noise reduction more accurate because such profiles better reflect the specifics of the camera or scanner as well as the workflow you use.

When building a set of profiles, please follow the guidelines below that will help you structure the profile set in such a way as to make consequent reuse of the set easy.

7.3.1. Stage I. Selecting device parameters for profile set

To build a set of profiles for particular camera or scanner, you have to identify different device parameters that affect the noise characteristics and that you will take into account during profiling. There may be many device parameters but not all of them influence image noise and those that do differ by the strength of their influence. Naturally, you are only interested in those parameters that appreciably affect noise. Different noise profiles should be prepared for different values of important parameters, so you have to identify these parameters in the first place.

In the tables below, those parameters are described that appreciably affect noise characteristics (from the most to the less important ones) for digital cameras and scanners:

Digital camera parameters in the order of decreasing importance		
ISO rate	50, 100, 200, 400, etc.; depends on a camera	Higher ISO rate produces more noise.
Camera noise reduction	High, Normal, Low, etc.; depends on a camera	In-camera noise reduction can reduce levels of noise in photos (usually at expense of some details).
Sharpness adjustment	Low, Normal, High, etc.; depends on a camera	Internal sharpness adjustment of a camera makes noise more intensive. Using no internal sharpness adjustment produces least noise.
Compression	1:1 (or Uncompressed), 1:5 (or Fine), 1:10 (or Normal), 1:20 (or Basic), etc. or 2 bits/pixel, 4 bits/pixel, etc. depends on a camera	Strong JPEG compression typically produces more JPEG artifacts and destroys image elements including noise; weaker compression preserves more image elements including noise created by the image sensor. It is preferable to use the lowest amount of compression for the best results.
Resolution	1:1 (original resolution, like 1600x1200), 1:2 (downsized in camera, e.g., 800x600), 2:1 (digital zoom, 2x), etc.	Camera's internal interpolation (both downsizing and upsizing, e.g., that of <i>digital zoom</i>) changes many characteristics of noise.
White balance	Sun, Cloudy, Incandescent, Fluorescent, etc.; depends on a camera	White balancing changes characteristics of noise (mainly of color noise) slightly.
Exposure	1/16s, 1.0s, 16s;	Longer exposures produce more hot-pixel noise; also, some cameras switch on the automatic noise reduction when exposure is longer than a certain threshold – this may affect the noise levels.

Scanner / camera parameters in the order of decreasing importance		
Film type	For example, Kodak Tmax 400, Kodak Tri-X Professional 320, Fuji Superia 200, etc.	Every film type produces specific grain pattern, which depend on film materials. Strength of the grain depends on ASA/ISO rate of the film.
Scanning resolution	For example, 300 dpi, 3200 dpi, 4000 dpi, etc.	Higher scanner resolution emphasized film grain and makes it more evident in the scanner image.
Number of scan passes	Single pass, 2x pass, 4x pass, etc.	Multi-pass scanning can potentially produce less grainy images.

If two images were captured in the same or similar conditions (most of the above device mode parameters are the same) then the noise of these two images should be very similar. If you have built a device noise profile using one of these images, you can use this profile to filter both images with good results. If however, the shooting or scanning conditions were different then the noise in two images could be significantly different. In this case, cross-use of one noise profile is not recommended. Instead, two different profiles should be built and used to filter these two images.

Based on these considerations and tables above, identify the device mode parameters of your camera or scanner that (1) are important from the noise standpoint and (2) are changed in your imaging tasks. For example, if you never change the sharpness adjustment of your digital camera then there is no need to build profiles for different values of the sharpness adjustment parameter. On the other hand, if you do shoot with different ISO rates then you have to build profiles for every ISO rate you use. Some parameters are less important (for example, the White Balance or Exposure) and you may simply choose to ignore the difference in noise characteristics caused by such device mode parameters.

Identify and make a list of the device mode parameters that, in your opinion, are important. For example, you could include the ISO rate: ISO 100, 200, 400; and JPEG compression level: HQ, SHQ. Then it is straightforward to write down all combinations of the selected parameters:

JPEG HQ, ISO 100
 JPEG HQ, ISO 200
 JPEG HQ, ISO 400
 JPEG SHQ, ISO 100
 JPEG SHQ, ISO 200
 JPEG SHQ, ISO 400

Now you have to prepare an individual profile for each combination from this list. Please proceed to the Stage II to build profiles for all combinations.

7.3.2. Stage II. Building individual profiles

To build individual profiles for the profile set, you can either use the standard profiling procedure described earlier, or employ a special Neat Image tool – the Batch Profiler.

Using standard profiling procedure

To build individual profiles using the standard profiling procedure, follow the guidelines of the Building profile for a device mode section, page 18. Using those guidelines, build a new profile for every combination of the device mode parameters as listed in Stage I above. The resulting set of noise profiles (several *.DNP files on the disk) can be further structured as explained in the Stage III below.

Using Batch Profiler

The Batch Profiler is a dedicated tool that can automatically build several noise profiles using shots or scans of the Calibration Target (the Batch Profiler is not for regular images). To use this tool, prepare several shots (scans) of the Calibration Target and analyze them all at once with the Batch Profiler.

1. Preparing set of images of the Calibration Target

To prepare shot or scan of the Calibration Target for every combination of device mode parameters, please follow the two initial steps of Stage I. Case of building a profile using the Calibration Target:


- Step 1. Preparing the Calibration Target, see page 20.
- Step 2. Preparing a shot or scan of the Calibration Target, see page 21.

Do the Step 2 for every combination of device parameters in your list. Then place all resulting image files to a new folder (and subfolders if necessary) on the hard drive, for example:

/Target Images/* .JPG

2. Preparing profiles

To prepare profiles using the images of the Calibration Target:

1. Select **Batch Profiler...** menu item in the popup menu (click the button  in the Device Noise Profile box to open the popup menu). This will open the **Batch Profiler** window.
2. In the **Batch Profiler** window, specify the folder with images of the Calibration Target and the folder where the **Batch Profiler** should save prepared device noise profiles.
3. Click the **Start** button to initiate profiling process.
When profiling is finished, new noise profiles are saved in the selected target folder.
4. Use the **Close** button to close the **Batch Profiler** window.

As the result, you have a set of noise profiles (several ***.DNP** files on the hard drive) that can be further structured as explained in the Stage III below.

7.3.3. Stage III. Structuring profile set

In the Stage II, you have prepared a set of profiles on the disk. You have assigned names to these profiles that reflect the device modes they correspond to.

For example, profiles for Olympus C5050Z could be named like the following:

 Olympus C5050Z	 – disk folder
C5050Z (ISO100; JPEG HQ; SharpNormal; 2560x1696).dnp	C5050Z
C5050Z (ISO100; JPEG HQ; SharpNormal; 2560x1920).dnp	– camera name
C5050Z (ISO100; JPEG SHQ; SharpNormal; 2560x1696).dnp	ISO ###
C5050Z (ISO100; JPEG SHQ; SharpNormal; 2560x1920).dnp	– ISO rate of camera mode
C5050Z (ISO200; JPEG HQ; SharpNormal; 2560x1696).dnp	JPEG SHQ / JPEG HQ /
C5050Z (ISO200; JPEG HQ; SharpNormal; 2560x1920).dnp	TIFF
C5050Z (ISO200; JPEG SHQ; SharpNormal; 2560x1696).dnp	– file format and
C5050Z (ISO200; JPEG SHQ; SharpNormal; 2560x1920).dnp	compression level
C5050Z (ISO400; JPEG HQ; SharpNormal; 2560x1696).dnp	Sharp#####
C5050Z (ISO400; JPEG HQ; SharpNormal; 2560x1920).dnp	– sharpness adjustment
C5050Z (ISO100; TIFF; SharpNormal; 2288x1712).dnp	#### x ####
C5050Z (ISO100; TIFF; SharpNormal; 2560x1696).dnp	– image size
C5050Z (ISO100; TIFF; SharpNormal; 2560x1920).dnp	
C5050Z (ISO200; TIFF; SharpNormal; 2288x1712).dnp	
C5050Z (ISO200; TIFF; SharpNormal; 2560x1696).dnp	
C5050Z (ISO200; TIFF; SharpNormal; 2560x1920).dnp	
C5050Z (ISO400; TIFF; SharpNormal; 2288x1712).dnp	
C5050Z (ISO400; TIFF; SharpNormal; 2560x1696).dnp	
C5050Z (ISO400; TIFF; SharpNormal; 2560x1920).dnp	

When the profiles are named like this, manual selection of an appropriate profile is simple. You can check the device mode of the input image (using the image editor) and then select a profile for this device mode from the list of profiles.

There is another way to select profile for an image, based on structuring the profile set using the disk folders. For example, the above Olympus C5050Z profile set could be structured like this:

<pre> Olympus C5050Z ├── TIFF │ ├── 2288x1712 │ │ ├── ISO 100.dnp │ │ ├── ISO 200.dnp │ │ └── ISO 400.dnp │ ├── 2560x1696 │ │ ├── ISO 100.dnp │ │ ├── ISO 200.dnp │ │ └── ISO 400.dnp │ └── 2560x1920 │ ├── ISO 100.dnp │ ├── ISO 200.dnp │ └── ISO 400.dnp ├── JPEG │ ├── HQ │ │ ├── 2560x1696 │ │ │ ├── ISO 100.dnp │ │ │ ├── ISO 200.dnp │ │ │ └── ISO 400.dnp │ │ └── 2560x1920 │ │ ├── ISO 100.dnp │ │ ├── ISO 200.dnp │ │ └── ISO 400.dnp │ └── SHQ │ ├── 2560x1696 │ │ ├── ISO 100.dnp │ │ ├── ISO 200.dnp │ │ └── ISO 400.dnp │ └── 2560x1920 │ ├── ISO 100.dnp │ ├── ISO 200.dnp │ └── ISO 400.dnp </pre>	<p>– disk folder</p> <p>Olympus C5050Z, JPEG / TIFF, #### x #### - the names of disk subfolders containing device noise profiles for corresponding device modes;</p> <p>ISO ###.dnp - device noise profiles;</p> <p>Note that constant parameter (Sharpness adjustment) is not reflected in the folder structure. However, if there were profiles with different values of these parameters then additional subfolder should be added.</p> <p>Parameters that can be disregarded, such as exposure time, are not reflected in the folder structure too.</p>
--	--

In this case, the folder tree enables storing device noise profiles in a structured way, which helps to select one profile from the set given the device mode of the input image.

Note that the automatic profile matching provided by Neat Image does work well in both cases: you can keep the whole set of profiles as a flat list of files in one folder, or you can structure the files into subfolders. This choice only affects the convenience of manual profile selection, while automatic profile matching can handle both cases.

If the automatic profile matching is not available (for example, if the images or profiles contain no EXIF information or the available EXIF details are incomplete) then you have to use manual profile matching. Therefore, we advise to structure profiles according to one of the methods above to make your manual work easier.

7.3.4. Stage IV. Documenting profile set

Along with the text comments inside the device noise profiles and their file names, we advise to document a profile set with a plain text file explaining the following points:

1. Author of the profile set and profiling date
2. Device name, firmware version
3. Device modes that have been profiled in this set
 - Device mode parameters that change within the profile set
 - Device mode parameters that are constant for all profiles in the set
4. Post-processing applied (after receiving image from imaging device and before Neat Image)

An example of such a description is below:

Olympus C5050Z noise profiles
by John Smith, October 10, 2008

A set of profiles for Olympus C5050Z TIFF and JPEG files. The profiles were built using shots of the Calibration Target for the following file formats and image sizes:

TIFF: 2048x1536 / 2288x1712 / 2560x1696 / 2560x1920
JPEG HQ / SHQ: 2560x1696 / 2560x1920

For each file format and image size above, shots with different ISO rates (100, 200 and 400) were made and used to build profiles.

Default camera settings were used for Sharpness, Contrast, and Saturation. In-camera noise reduction was switched off. The white balance was set to daylight.

No post processing was applied; the calibration target shots directly from the camera were opened in Neat Image to build profiles.

Such kind of summary would help you figure out any set of profiles you prepared as well as let other people understand your results if you decided to share your profiles.

7.4. Using noise profiles

When you have a set of profiles for your camera or scanner, you can directly use these profiles to process images in Neat Image. Usually there is only one profile that is most suitable to process a given input image. Therefore it is very important to select the right profile, which would provide best match between profile and image. All profiles in a set have been built for different device modes of the imaging device. To make a perfect match between a profile and image, the device mode of a profile should be the same or very close to the device mode used to capture the image.


There are two ways to select a device noise profile that matches the input image:

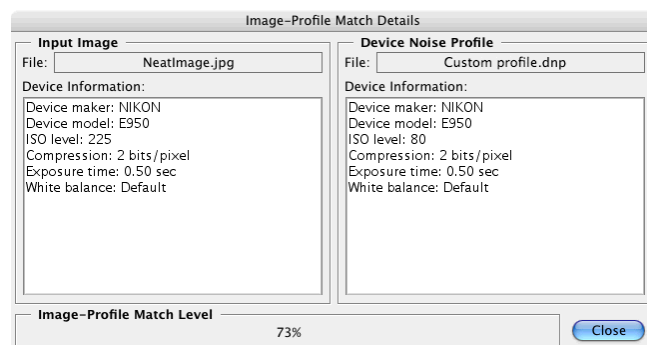
- To automatically select the most suitable profile from a pre-built set of profiles using Auto Match (see page 10 for details);
- To manually select the most suitable profile from a pre-built set of profiles using their device mode comments.

When you select and open a profile in either way, Neat Image shows the degree of match between the profile and input image. This degree is shown by the Match indicator in the rightmost frame inside the Device Noise Profile box. The match degree is calculated on the basis of the image and profile's metadata (the EXIF data fields). If the profile's device mode is exactly the same as device mode used to capture the image then the match is 100%. There is always 100% match between an image and profile built using this very image. If the device modes of a profile and image are very close then the match degree is close to 100%. The more different the device modes of profile and image are, the smaller the match degree is. Use the match degree as an indication of match accuracy. If the match degree is low then it is likely that building a new profile (using the current image or the Calibration Target shot in current device mode) would produce better noise reduction results.

Quality: 77%

Match: 73%

You can find more information about the profile-image match in the Image-Profile Match Details window accessible via the Image-Profile Match Details... command in the popup menu invoked by  (see the picture on the right).



Obviously it is preferable to build a new noise profile for each new input image, because such a profile would perfectly match the noise of that image.

Nevertheless, any noise profile can, with some degree of accuracy, be used to process other images captured by the same device working in the same or similar mode. This is less accurate than building a profile for each image but saves time because building a new quality profile can take more time than

re-using a pre-built one. This is especially important if one profile is re-used many times, for example to process a series of images produced in one device mode.

When using pre-built profiles, you may also want to pay attention to the profile *Quality* indicator in the rightmost frame inside the *Device Noise Profile* box. A properly-built and fine-tuned profile will 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 itself is accurate.

Both profile *Quality* and *Match* indicators have to show high values for the noise reduction with this profile to be accurate.

7.5. Profile Converter

Device noise profiles built with previous versions of Neat Image can, with certain limitations, be used in the current version. Building new profiles directly with the current version is of course preferred (this may potentially provide a higher accuracy of noise reduction) but, if necessary, older profiles can be converted to the new format using the *Profile Converter* tool.

The *Profile Converter* is a dedicated tool that can automatically convert several noise profiles built with Neat Image v2.x /Mac (as well as Neat Image v2.1-4.x /Win) to the new format used by the latest versions of Neat Image. Only those profiles can be converted that contain embedded noise samples (all profiles built with the Mac version of Neat Image do include noise samples while some profiles built with the Windows version may not).

To convert profiles

1. Click the *Profiler Converter* button in the bottom of the plug-in window. This will open the *Profile Converter* dialog window.
2. In the *Profile Converter* window, specify the source folder with old profiles and the destination folder where the *Profile Converter* should save converted device noise profiles. If the source folder contains structured subfolders with profiles then the *Profile Converter* will re-create the same subfolder structure in the destination folder.
3. Click the *Start* button to initiate the conversion process.
When conversion is finished, the converted noise profiles are saved in the destination folder.
4. Click the *Close* button to close the *Profile Converter* window.

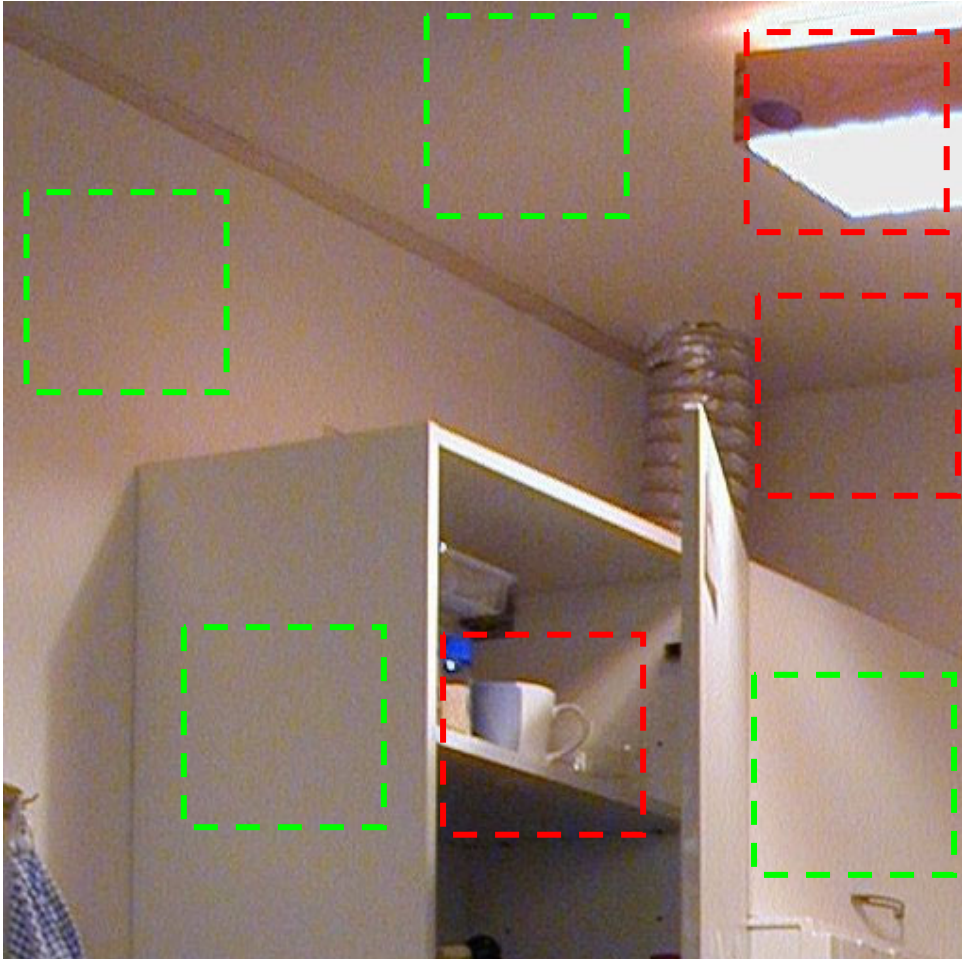
As the result, you have a set of converted noise profiles (several new **.DNP* files on the disk) that can be directly used in the current version of Neat Image.

If you open an older profile, Neat Image will try to automatically (on-the-fly) convert it before use. This however takes additional time during opening a profile and it may be better to convert all profiles using the *Profile Converter*: you convert old profiles once and then use the converted profiles with no additional conversion overhead.

8. Examples

8.1. Images to build a noise profile

The image below contains examples of areas that are “good” and “bad” from the standpoint of profiling. Here, “good” image areas are highlighted in green, these should be at least 32x32 pixels large, preferably more than 128x128 pixels; “bad” ones are highlighted in red. If the input image you have does contain similar ‘good’ flat featureless noise-only areas as shown in the example then you can be sure that automatic profiling will produce an accurate noise profile. However if there are no such flat



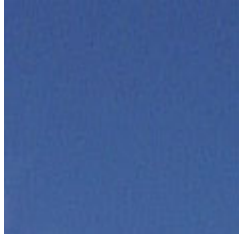
featureless areas in the input image, then automatic profiling will not work well with this image. In such a case, you have to use either an alternative image with flat featureless areas or an image of the Calibration Target.

Additional comments regarding the “good” and “bad” areas in this example are available on the next page.

These image areas are good to build device noise profiles, as they contain no visible details in all frequency ranges:

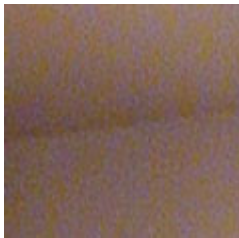


– **GOOD**, because this area contains no important details



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

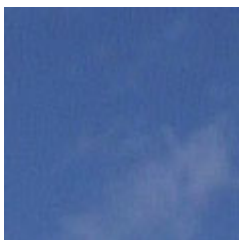
Examples of “bad” areas that contain visible details:



– **NOT RECOMMENDED**, because this area contains a detail: corner – junction of wall and ceiling



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



– **NOT RECOMMENDED**, because this area contains some details: clouds (this area is from another image)

8.2. Filtration results

Here are some examples of Neat Image performance.



This is a small portion of a digital photo taken with a Nikon CoolPix 950 digital camera. The original image contains easily visible noise. In this case, the source of noise is the camera's image sensor (CCD) put in high ISO mode.



This image was taken with a Kodak DC 210 digital camera. Along with the strong CCD high ISO noise, there is an image degradation caused by the JPEG compression. Even though Neat Image tries to do its best to clean up such images, please avoid using strong JPEG compression!

See more filtration examples on the Neat Image web page:
<http://www.neatimage.com/mac/examples.html>

9. Questions and answers

9.1. General questions

Q What is the difference between Demo, Home and Pro plug-in /Mac?

A The Demo plug-in is limited by size of image area that can be processed: it only processes a part of the input image if the image is larger than 1024x1024 pixels. The Home plug-in is not limited by size of image area but only processes 8-bit images. The Pro plug-in additionally supports 16-bit images. Please also see the Detailed feature map, page 34, for more details.

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

A That is not necessary. The Home / Pro plug-in can be installed over the Demo plug-in.

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

A Usually that is not necessary. A newer version can be installed over the older one.

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

A Please use the online bug report form: <http://www.neatimage.com/mac/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 Issues subsection, page 33, and about bug fixes in the *WhatsNew.txt* file supplied with the software (also see the history section on the Neat Image web page for the most up to date information: <http://www.neatimage.com/mac/history.html>).

Q What about batch processing?

A You can batch-process images with the Neat Image Pro plug-in in the following way: record an action with the plug-in and then run this action within the Photoshop batching mechanism to process many images one after another.

9.2. Filtration-related questions

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

A Presence of many residual noise elements is usually a consequence of using a poorly built noise profile or a profile built for another device and/or device mode.
The crystal-like artifacts (usually these are the residual JPEG compression artifacts) look like thin lines in the filtered image. They can be easily eliminated by increasing the high frequency noise level in the filter settings.

Q Filtered image looks 'plastic'. Why?

A The reason is that too much filtration was applied. Let Neat Image keep some noise to produce 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 image 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 Image to denote image elements (both important details and noise) of specific size.
High frequency corresponds to image elements of smallest size. *Medium (mid) frequency* corresponds to elements of medium size. *Low frequency* corresponds to image elements of (relatively) large size.

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** Set the value of the luminance (Y) channel noise reduction amount to 0%. This will disable filtration in the luminance (brightness) channel.

Q Is processing via Neat Image 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 image. Therefore, filtering before or after makes little difference – as long as the noise profile is built and applied at the same stage of image processing. For example, do not use a device noise profile built with an unprocessed (with the color correction not yet applied) image to filter a processed image.

Some digital cameras apply some color correction internally. Other cameras allow access to unprocessed RAW data. Neat Image is a generic filter, which can be applied in both cases. The only requirement is to use profile that matches the device mode of the input image.

On the other hand, image sharpening applied to a noisy image makes it much noisier. It is best to apply Neat Image filtration before sharpening. However, the sharpening and noise filters of Neat Image can be used together because the sharpening is applied AFTER noise filtration.

If you are not sure, try to use Neat Image as close to the source of the input image as possible.

10. Tips and tricks

10.1.Preventing banding

In some cases, the banding effect may appear when applying the noise filter to images with faint brightness gradients. This effect is quite rare for normal images, especially when viewed on a true color display (it can be more visible on hi-color displays).

To avoid banding, try to reduce the noise reduction amount for the high frequency component to 50%.

Another option is to process the image in 48/16 bits bitdepth.

10.2.Partial filtration

Some images contain both noisy and clean areas and it may be preferable to filter only noisy areas. This can be manually done by combining two images – original and filtered one – in an image editor. For example, the following steps can be followed:

1. Open the input image in your image editor;
2. Copy the input image in a new layer on top of the original image;
3. Apply Neat Image noise reduction to the top layer;
4. Adjust the transparency of the top layer so that noisy areas look fine;
5. Select and delete the areas of the top layer where filtration is not necessary or excessive (you may want to use the eraser tool with adjustable transparency and shape).

11. Information

11.1.Issues and bugs

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

11.2.Plans

The current version of Neat Image plug-in for Mac is going to be further improved to match the functionality of the Window version of Neat Image.

In particular, we are planning to add such functionality as:

- Component viewer

Also, 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 Image better. Participate in the discussion on the Neat Image community forum, 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		Edition		
		Demo plug-in	Home plug-in	Pro plug-in
Image processing	8 bits/channel (24-bit RGB, 8-bit Grayscale)	+*	+	+
	16 bits/channel (48-bit RGB, 16-bit Grayscale)	+*	–	+
Workflow	Support for Photoshop actions and smart filters	–	–	+
	File formats supported	all formats supported by plug-in host		
Device noise profiles	Automatic and semi-automatic profiling of cameras and scanners	+		
	Automatic matching profiles to images	+		
Noise reduction	Channel-wise (Y, Cr, Cb)	+		
	Frequency-wise (High, Mid, Low, Very low)	+		
Smart sharpening	Channel-wise (Y, Cr, Cb)	+		
	Frequency-wise (High, Mid, Low)	+		
Filter presets (reusable filter settings)		+		

* - a limited part of the input image is processed if the image is larger than 1024x1024 pixels.

11.4.Contacts

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

E-mails

info@neatimage.com — for general inquiries

MacSupport@neatimage.com — for any inquiries regarding use of Neat Image plug-in /Mac

sales@neatimage.com — for any inquiries regarding purchase of licenses for Neat Image

Community forum

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

- announcements of new and updated versions of the software;
- questions about use of Neat Image;
- examples of Neat Image performance with comments and suggestions;
- feedback from Neat Image users: suggestions of new features and improvements;
- polls: what OS, processor, camera types are used with Neat Image;
- contacts and general comments.

Web page

<http://www.neatimage.com/mac>

11.5. Legal information

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Distribution

Neat Image Demo plug-in /Mac may be distributed unmodified provided any charge is to cover distribution costs only.

Neat Image Demo plug-in /Mac may be placed on magazine CDs, etc. as long as the Neat Image team is informed.

11.6. Registration

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

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

By becoming a registered user of Neat Image you will:

- Encourage the authors to further develop and improve the software;
- Get access to advanced functionality of Neat Image /Mac (see the Detailed feature map, page 34);
- Be able to use Neat Image /Mac for commercial and other purposes;
- Get free access to updates of the software with the same major version number (at least);
- Enjoy reduced upgrade prices for new major future modifications of Neat Image or will get a free upgrade;
- Receive the primary attention of Neat Image support group;
- Receive the primary attention of Neat Image development group (tell us what you want to see in the next version).

Message from the Neat Image 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 Image better for YOU!

11.7.Acknowledgments

Thank you to all the users who have contributed to Neat Image by proposing improvements and new features.

Thanks to all the people who help us to find and fix bugs in Neat Image /Mac.

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

Image wouldn't be Neat without all of you!

Neat Image team, ABSOft

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