

Neat Image

plug-in for Photoshop (Win)

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

Neat Image's noise filter offers a rich control set to let user adjust all settings and achieve the desired level of noise reduction. In addition, Neat Image includes a smart sharpening filter to make images look sharper without any degradation of image quality (which is usually inevitable with noisy images). The combination of the sharpening and noise filters makes such an effect possible.

Neat Image plug-in for Photoshop is currently produced in three editions: Demo, Home and Pro. All editions provide top-quality noise reduction and sharpening. The difference is the following:

- Demo plug-in is a free edition of the software with limited functionality
- Home plug-in processes only 8-bit images and does not support Photoshop actions
- Pro plug-in supports 8-bit, 16-bit and 32-bit images as well as Photoshop actions and smart filters

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.

Online examples of Neat Image noise reduction:
www.neatimage.com

1.2. Features

Photoshop plug-in

- To **selectively apply** noise reduction to layers, channels, selections (areas of interest)
- To **automate** your workflow using Photoshop actions including Neat Image noise reduction
- To enable noise reduction in Photoshop **action-based batches**
- **32-bit** and **64-bit** versions of Photoshop supported

Noise Reduction and Image Sharpening

- **Advanced noise filter** to reduce noise and grain in digital images
- **Smart sharpening filter** to make images look sharper without amplification of noise
- **8-bit, 16-bit and 32-bit image support** to fully utilize capabilities of modern image acquisition devices and support HDR post-processing workflows
- **CUDA** and **OpenCL** acceleration to speed up processing using computation-capable GPUs

Device Noise Profiles

- **Auto Profile** to build noise profiles for your camera or scanner on the fly
- Rich set of **pre-built noise profiles** in the online profile library
- **Auto Match** for selecting the most suitable pre-built noise profiles for input images

Some features are only available in the Home or Pro plug-in. Detailed feature map (page 40) explains the differences between editions of Neat Image plug-in for Photoshop.

1.3. Requirements

1.3.1. Hardware requirements

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 (clock frequency, number of cores/processors, cache size), memory speed and availability of CUDA-capable GPU.

Recommended system configuration to process photos produced by modern digital cameras:

- Multi-core Intel processor: Core i7, i5, i3, etc.; single or multi-processor
- 1 GB RAM or more
- True color display, resolution 1024x768 or more

Optional CUDA acceleration requires:

- CUDA-capable NVIDIA video card;
- Recent video driver supporting CUDA v4.2 or newer.
(you can download the latest versions of the video drivers from <http://www.nvidia.com>)

Optional OpenCL acceleration requires:

- Supported video card:
 - ATI Radeon HD 57xx/58xx/59xx;
 - AMD Radeon HD 67xx/68xx/69xx;
 - AMD Radeon HD 77xx/78xx/79xx;
 - AMD Radeon HD 87xx/88xx/89xx;
 - AMD Radeon R7 260X;
 - AMD Radeon R9 270X/280X/290X;
 - Another AMD/ATI GPU based on one of the following chip series:
Juniper, Cypress, Barts, Cayman, Cape Verde, Pitcairn, Tahiti, Bonaire, Hainan, Hawaii
- Latest version of AMD Catalyst Driver

1.3.2. 64-bit plug-in

Recommended OS:

- Windows 8.x 64-bit, Windows 7 64-bit, Vista 64-bit, Windows XP 64-bit

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

- Adobe Photoshop CC 2014 / CC / CS6 / CS5.x / CS4 (all 64-bit)
- Corel PHOTO-PAINT X7 / X6 (64-bit)
- Corel Paint Shop Pro X7 / X6 (64-bit)
- PhotoLine (64-bit)

The plug-in may be compatible with other 64-bit hosts as well.

1.3.3. 32-bit plug-in

Recommended OS:

- Windows 8, Windows 7, Vista, XP; 32-bit or 64-bit

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

- Adobe Photoshop CC 2014 / CC / CS6 / CS5.x / CS4 / CS3 / CS2 / CS / 7 / 6 / 5 (all 32-bit)
- Adobe Photoshop Elements 13 / 12 / 11 / 10 / 9 / 8 / 7 / 6 / 5 / 4 / 3 / 2
- Corel / Jasc Paint Shop Pro X7 / X6 / X5 / X4 / X3 / X2 / XI / X / 9 / 8 / 7
- CorelDRAW Graphics Suite / Corel PHOTO-PAINT X7 / X6 / X5 / X4 / X3 / 12
- Ulead PhotoImpact X3 / 12 / 11 / 10 / XL / 8
- Microsoft Digital Image Pro
- Microsoft Digital Image Suite 2006
- PhotoLine (32-bit)

The plug-in may be compatible with other 32-bit hosts as well.

1.3.4. Supported types of images

The following image types are supported:

- 8-bit / 16-bit / 32-bit per channel RGB images
- 8-bit / 16-bit / 32-bit per channel grayscale images

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.

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

The plug-in can work with images stored using any file format that can be opened by Photoshop: PSD, TIFF, RAW, JPEG, etc.

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 *Auto Profile* function in Neat Image builds a profile which describes the noise in these areas. Using this profile, Neat Image's noise filter can efficiently reduce noise in the whole image.

When several such profiles for different device modes are available, the *Auto Match* function 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.

Smart Profile combines the power of *Auto Profile* and *Auto Match* by preparing two candidate profiles and then selecting the better one for actual image processing. This improves automated image processing and helps to achieve great results in more cases.

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 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 because such noise usually uniformly covers the whole image area. 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 quality setting (low compression rate, larger file size) 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 plug-in

Normally, the Neat Image plug-in is **automatically** installed to Photoshop (or another compatible image editor) when you download and use the standard Neat Image install package corresponding to your version of Photoshop.

If for some reason the plug-in is not automatically installed, then you can install it manually using the guidelines below.

3.1.1. Manual installation: 64-bit version

To manually install Neat Image plug-in to 64-bit host application:

- ➔ Photoshop CC 2014 / CC / CS6 / CS5.x / CS4 64-bit

Copy the *NeatImage.8bf* file from the Neat Image installation folder (typically, *C:\Program Files\Neat Image for Photoshop*) into the *Plug-Ins*¹ subfolder inside the Photoshop folder.

Then re-start Photoshop (make sure you start the 64-bit version of Photoshop, as there may be two Photoshop versions available, 32-bit and 64-bit one) and find Neat Image in the menu:

Filter > Neat Image > Reduce Noise.

3.1.2. Manual installation: 32-bit version

To manually install Neat Image plug-in to 32-bit host application:

- ➔ 32-bit Photoshop / Photoshop Elements

Copy the *NeatImage.8bf* file from the Neat Image installation folder (typically, *C:\Program Files\Neat Image for Photoshop* in 32-bit Windows or *C:\Program Files (x86)\Neat Image for Photoshop* if you use 64-bit Windows) into *Plugins* or *Plug-Ins*¹ subfolder inside the Photoshop / Photoshop Elements folder.

Then re-start Photoshop and find Neat Image in the menu: Filter > Neat Image > Reduce Noise.

- ➔ Corel Paint Shop Pro

In Paint Shop Pro, open the File menu, select Preferences > File locations > Plug-ins (PSP8 or newer), Preferences > File locations (PSP7) or Preferences > Plug-in Filters (PSP4-6) and select the Neat Image installation folder (usually, *C:\Program Files\Neat Image for Photoshop* in 32-bit Windows or *C:\Program Files (x86)\Neat Image for Photoshop* if you use 64-bit Windows).

Press OK and then check the menu: Effects > Plug-in Filters > Neat Image > Reduce Noise.

- ➔ Other image editors (plug-in hosts)

Please refer to the documentation of the corresponding plug-in host to find the correct way to install

¹ If the language of Photoshop is not English, you may have to use another Plug-Ins folder, for example, "Modules externes" in French, "Zusatzmodule" in German version, "Insteekmodules" in Dutch, "Plug-In" in Italian, etc.

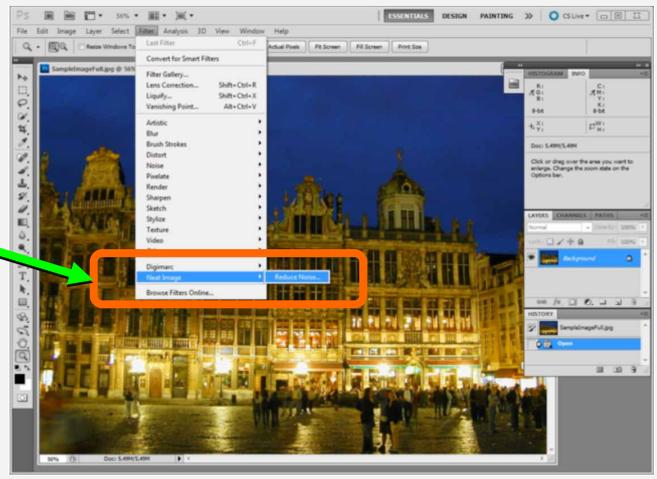
a third-party Photoshop-compatible plug-in (8BF-type). You can find the Neat Image plug-in itself (*NeatImage.8bf*) in the Neat Image installation folder.

4. Filtration process overview

4.1. Overview of Neat Image filtration process

1. Prepare image

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



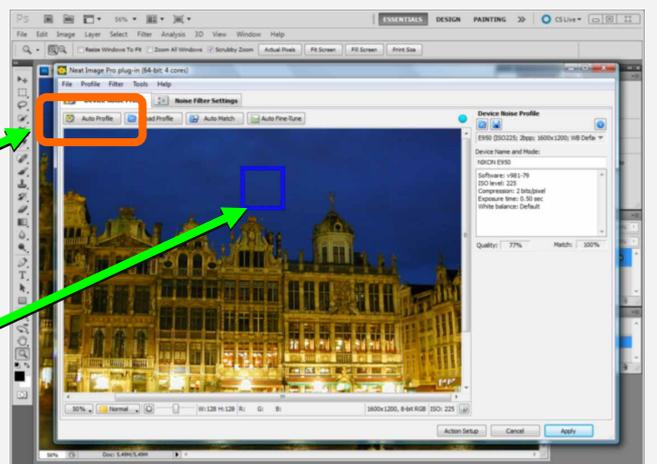
2. Prepare a *noise profile*

Build a new profile on the spot or load a pre-built one.

To build a new profile:

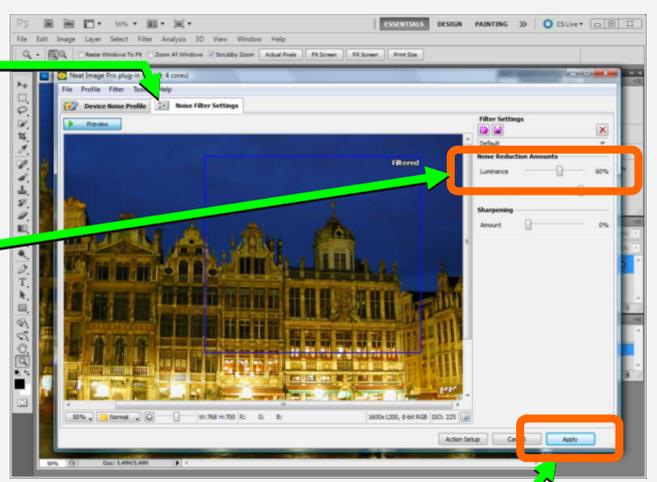
- click the **Auto Profile** button; this will automatically find, select and analyze a *featureless (noise-only)* image area;

if you see that the automatically selected area includes any important image details then move the selection to an area without details and click the **Auto Profile** button again;



3. Adjust the filter settings

- switch to the **Noise Filter Settings** tab;
- adjust the filter settings to achieve desired level of noise reduction:
- try to vary the setting: **Noise Reduction Amounts: Luminance** and see how the preview changes;



- 4. When you are happy with preview results, apply the filter to the image: click the **Apply** button.

4.2. Running Neat Image on a sample image

You can download a test-kit prepared to help you start using Neat Image plug-in: <http://www.neatimage.net/files/Testkit5.zip>, 250KB. Please download and unzip it to a new folder on the hard disk. The test-kit contains a sample image: *SampleImage.jpg*. This image is a part of typical photo taken with a digital camera. The detailed information about the test image is available in the *SampleImageInfo.txt* file.

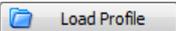
Please go through the stages below to see how the image can be improved by Neat Image:

Stage 1. Open the sample image in Photoshop and invoke Neat Image

1. Open the sample image (*SampleImage.jpg*) in Photoshop;
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. Select the Filter > Neat Image > Reduce Noise... menu in Photoshop to open Neat Image plug-in.

Stage 2. Load the sample noise profile in Neat Image plug-in

To reduce noise in the image Neat Image generally needs a noise profile describing the noise properties of the image. For this sample image, we have prepared such a noise profile in the test-kit in advance: *SampleProfile.dnp*. Using this profile, Neat Image can efficiently reduce the noise in the image.

1. In the Device Noise Profile tab  **Device Noise Profile**, click  (the Load Profile button);
2. Then in the Load Device Noise Profile dialog, navigate to the folder where the noise profile has been unzipped and select the *SampleProfile.dnp* file.

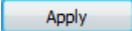
Now the sample noise profile is loaded and Neat Image is almost ready to filter the image. Usually, you would adjust the filter settings at this stage. To make things easier for the first run of Neat Image, we have prepared a sample preset with “good” settings to process the sample image.

Stage 3. Load the sample filter preset in Neat Image plug-in

1. Switch to the Noise Filter Settings tab  **Noise Filter Settings** and click  (the Load Filter Preset button) in the Filter Settings box;
2. Then 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 loaded and the filter settings are adjusted to process the sample image.

Stage 4. Apply the filter to the image

1. Click  in the bottom of the plug-in window and wait until the image processing is completed. Processing may take a few seconds. After that the filtered image is displayed in Photoshop. 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 using the Auto Profile function. Also, you can find ready-made noise profiles for many cameras and scanners in the Profiles section of the Neat Image web page:

<http://www.neatimage.com/win/photoshop/profiles.html>

The next sections – Filtration process details, page 9, and Device noise profiles, page 21, – contain detailed descriptions of the filtration and profiling processes. There are also examples of profiling and filtration in the Neat Image web page:

<http://www.neatimage.com/win/photoshop/examples.html>

5. Filtration process details

The Neat Image plug-in can be used in Photoshop to process one or several images. This section describes the key stages of using the Neat Image plug-in to process one image. There is also a way to automatically process many images (see the Using plug-in in actions and smart filters section, page 19).

5.1. Stage I. Invoke the plug-in from Photoshop

In Photoshop, open and select an image to be processed (it will be called 'input image' hereafter) and then invoke the Neat Image plug-in using the standard method:

- ➔ Select the Filter > Neat Image > Reduce Noise... menu item in Photoshop.

The Neat Image plug-in window will open and 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 mouse wheel when mouse is over the viewer;
- use the zoom control under the image viewer;
- use the Ctrl+Plus, Ctrl+Minus, Ctrl+0 (zero), Ctrl+Alt+0 (zero) keyboard shortcuts;

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. Auto Profile: to build a new profile by analyzing the input image (or a specially prepared test image);
2. Auto Match: to automatically select the most suitable device noise profile from a pre-built set of profiles (when it is available);
3. Smart Profile: to use both Auto Profile and Auto Match (with Auto Fine-Tune) to prepare two candidate profiles and then automatically select the better of two profiles;
4. Load Profile: 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 areas that contain noise but no visible or important details.¹ Auto Profile will try to 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.

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

- Profiles section of the Neat Image web page:
<http://www.neatimage.com/win/photoshop/profiles.html>
- Device noise profiles section of the 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 for your camera or scanner, you can easily build such profiles 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 image 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

¹ You can see some examples of featureless image areas in the Examples section, page 36.

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. You can find more details about profiling in the Device noise profiles section, page 21.

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.

Auto Profile: build a new profile using the input image

- ➔ Make sure you have switched to the Device Noise Profile tab:  **Device Noise Profile**
- ➔ Click  **Auto Profile** (the Auto Profile button) in the toolbar, or use the Profile > Auto Profile with Regular Image menu item, or press F2.

Neat Image will find and highlight the image area selected by Auto Profile for main analysis. Neat Image will then automatically analyze the noise in that area as well as in the whole image and will 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 finding a uniform featureless area in the input image and then the auto-selected area will contain some important image details. In such a case, move the selection to an area that does not contain any image details (you can make a new selection or resize the old one) 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, 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 21, to learn how to use the Calibration Target to build device noise profiles. You can also try to load some pre-built profile using one of the methods described below.

Auto Match: select matching noise profile from a pre-built profile set

- ➔ Click  **Auto Match** (the Auto Match button) or use the Profile > Auto Match menu item.

The Auto Match function uses the EXIF data fields of the input image to automatically select and load the device noise profile that matches the device mode of the image. The most matching profile is selected from profiles stored in a special folder. By default, this folder is in your *Documents*¹:
Documents\Neat Image for Photoshop\Profiles

Auto Match will look for matching profiles in that folder as well as all its subfolders (where you can place profiles built by you or downloaded from the Internet).

After a profile is loaded by Auto Match, the degree of match between the current input image and loaded noise profile is displayed in the Device Noise Profile box. Higher Match values mean better match, leading to more accurate filtration.

Smart Profile: prepare two profiles and select the better one

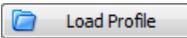
- ➔ Use the Profile > Smart Profile menu item, or press the F5 key.

Smart Profile uses both Auto Profile and Auto Match (with Auto Fine-Tune) to prepare two candidate profiles and then selects the better of two profiles. For Smart Profile to be fully efficient, the input image must contain flat featureless areas with noise for Auto Profile to analyze, and also there must be

¹ You can check and adjust the location of that folder using the menu Tools > Preferences > Matching.

several pre-built profiles to help Auto Match find the most matching noise profile, as described above. You can adjust settings of Smart Profile function in Preferences.

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

- ➔ Click  (the Load Profile button) or use the Profile > Load Profile... menu item. Then select a profile in the Load Device Noise Profile dialog.

or

- ➔ Click  (the drop-down button) in the Device Noise Profile box to open the popup menu with all available profiles and then select one of the available profiles.

Please note that you have either to build your own profiles or download some pre-built profiles and place them to the Neat Image's Profile folder to make this drop-down button and popup menu truly work. By default the Profile folder is located in the *Documents* folder¹:

Documents\Neat Image for Photoshop\Profiles

If you build or download some pre-built profiles, place (unzip the profile set if necessary) them to the above folder. Neat Image will recognize and display those profiles in the popup menu to help you quickly load any of them when needed.

When manually selecting a profile for input image, use the profile file names and sub-folder structure to guide your search. See Preparing profile set for different device modes: Stage III. Structuring profile set, page 29, for more information on profile set structuring.

To additionally fine-tune the loaded or matched profile

You may want to additionally fine-tune the profile after it has been loaded either automatically (using Auto Match) or manually (using Load Profile). Fine-tuning the profile to the current image usually makes the profile more accurate and better reflecting the image's 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.

- ➔ Click  (the Auto Fine-Tune button) or use the Profile > Auto Fine-Tune menu item to fine-tune the profile to the current input image.

There is no need to select any area in the input image because Auto Fine-Tune automatically analyzes the whole image.

Once you have loaded the profile that matches the input image or you have just built a new profile specifically for the current input image, proceed to process the image in the Stages III-V below.

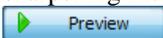
5.3. Stage III. Adjust filter settings

As soon as the noise profile is ready you can use the noise and sharpening filters. These filters have several adjustable settings. The default settings usually produce good results. You may want to additionally vary the filter settings to achieve the filtration results that look best to your eyes.

- ➔ Switch to the Noise Filter Settings tab: 

5.3.1. Use preview when adjusting filter settings

The image viewer in the Noise Filter Settings tab shows a part of the image processed by the noise and sharpening filters. If you change any filter settings then the preview is automatically updated (provided

 (the Preview button) in the toolbar is depressed). You can zoom in and out, drag, scroll

¹ You can check and adjust the location of the Profile folder using the menu Tools > Preferences > Folders.

and pan the image to see how the filtration affects different parts of the image. If you manually select an area in the image then only the selected area will be processed for preview.

When the preview is ready (the preview area shows “Filtered”), you can click inside the preview image area to temporarily switch back to the original for comparison.

5.3.2. Standard and Advanced modes

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

5.3.3. Adjust filter settings in Standard mode

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 these filters using the guidelines in the subsections below.

Adjusting noise filter settings in Standard mode

If you work with a color image then two major image components can be distinguished: the luminance and chrominance component. This distinction is very useful from the standpoint of noise reduction because it allows processing luminance and chrominance information separately.

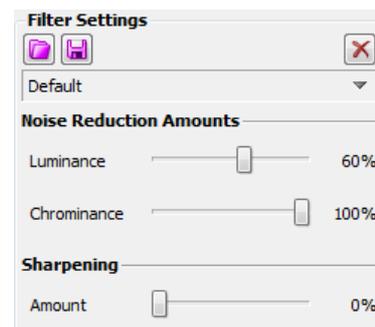
Some color images are represented in color spaces that enable direct separation of the luminance and chrominance components (for example, Lab, YCrCb, etc.). Other images (including RGB images that Neat Image takes as input) have to be converted to another representation to enable separation of the luminance and chrominance components. Neat Image applies an internal color space conversion to achieve that. Once luminance and chrominance components of the input image are separated, Neat Image can treat them individually. Neat Image provides separate luminance and chrominance settings in the noise filter (see the figure on the right).

In the Standard mode, the noise reduction applied to each image component (either luminance or chrominance component) is controlled by the corresponding *noise reduction amount* setting.

A noise reduction amount tells the filter how much of the detected noise should be reduced. For example, if the noise reduction amount is set to 50% then all image elements that are considered (by the filter) to be noise are reduced (made weaker or less visible) in half. The noise reduction amount value of 100% tells the filter to remove the detected noise completely.

The default noise reduction amounts usually produce good filtration results provided the noise profile is accurate¹. By default, the noise filter removes 60% of detected noise in the luminance component of the input image and 100% of noise in the chrominance component. Our experience shows that the default noise reduction amounts usually provide a good balance between noise removal and preserving natural (not over-processed) appearance of filtered images.

Decreasing the noise reduction amounts may have a positive effect if the input image contains some natural noise. For example, when you filter images of asphalt, sand, or anything else that contains fine natural noise-like features, it may be helpful to reduce amounts down to 30-50%.



¹ 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 current 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: Luminance and Chrominance sliders.

You can vary the noise reduction amount for both luminance and chrominance 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, especially in the luminance component, may lead to loss of fine details and unnaturally looking (over-smooth, plastic-like) results. Too low amounts may be not enough to sufficiently reduce the objectionable part of the noise. You have to balance the noise reduction amounts (most importantly, the amount of noise reduction in the luminance component) to get the result that looks best to your eyes.

As human vision is not very sensitive to variations of colors, strong filtration in the chrominance component does not noticeably distort image, but efficiently removes color noise.

Use preview

As you make changes in the noise filter parameters, check preview on different parts of the image to get a better feeling for the prospective results of noise reduction.

If the noise filtration looks too strong try to decrease the noise reduction amounts. If the noise filtration is not sufficient then increase the amounts.

Adjusting sharpening settings in Standard mode (optional)

The sharpening filter in Neat Image increases image sharpness without increasing the noise strength.

The sharpening filter is disabled (sharpening amount is set to 0%) by default. Increase the sharpening amount to sharpen the image. Like with any sharpening method, you have to balance the sharpening amount to avoid over-sharpening.

Use the preview when adjusting the sharpening settings.

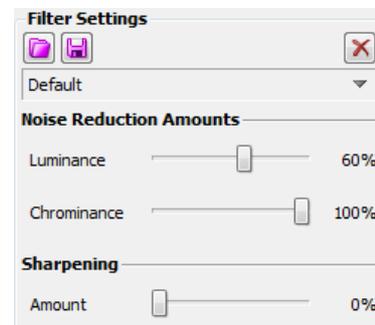
Adjust sharpening amount

- ➔ Use the Sharpening: Amount slider.

Specify how much sharpening should be applied to the input image.

Use preview

As you make changes to the sharpening setting, check 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 page 16), or directly to the Stage V. Apply filter, page 18.

5.3.4. Adjust filter settings in Advanced mode

As said above, Neat Image has two sets of filter controls, that are available in the Standard mode and Advanced mode (you can select the mode using the Tools > Standard mode and Advanced Mode menu items). The Standard mode described above provides a simple control set, recommended for beginners who just start using Neat Image. The Advanced mode provides the most complete control set with maximum manual control over noise profiling and filtration processes. The Advanced mode is recommended for power users. If you want to use the Advanced mode then please read this sub-section, otherwise skip it and proceed to page 16 for the next stage.

As compared with the Standard mode, the Advanced mode offers a more extensive set of filter controls.

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

There are also two filters – noise reduction filter and sharpening filter – but these have more settings now. Please follow the guidelines below to adjust both filters.

Adjusting noise filter settings in Advanced mode

In *Advanced mode*, the noise filter has separate settings for all frequency and channel components of the input image. There are also pairs of *noise level - noise reduction amount* controls for each of these image components. The meaning of each *noise level - noise reduction amount* pair is the following:

- a noise level control adjusts the threshold that determines which image elements are considered noise in the corresponding image component and which elements are considered not noise;
- a noise reduction amount control determines how much reduction is applied to the image elements identified as noise in the same image component.

In *Advanced mode*, you can adjust the noise levels as well as noise reduction amounts for each image component. The noise levels are adjusted relative to the noise levels of the current noise profile that have been measured during profiling.

For example, the noise level of the Y (luminance) channel could be measured in the noise profile at 8.55 units.¹ 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.

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 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 also 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:

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

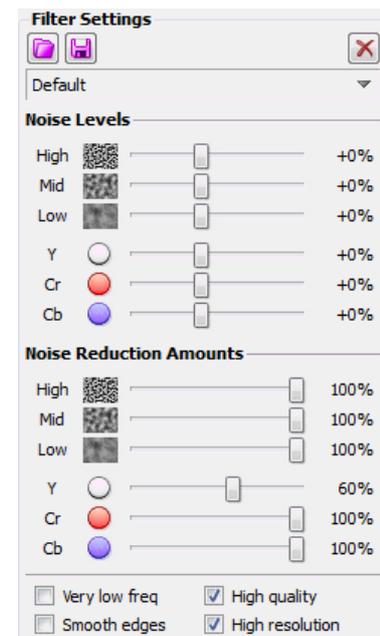
With this adjustment, the image elements in the Y channel that are weaker than 9.83 units are considered noise and reduced, and elements that are stronger than 9.83 units are preserved.

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 controls are relative to the device noise profile, the default filter settings usually produce good results when the noise profile is accurate². The noise level defaults are 0%, which means the noise levels are completely determined by the noise profile. When you adjust the level controls, the noise level estimations are raised or lowered accordingly. A noise level control 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 250% of the noise profile's noise level.

Noise reduction amounts can be in the range from 0% (none of the detected noise is removed) to 100% (all the detected noise is removed). By default, the noise filter removes 100% of detected noise in all but the luminance (Y) channel where only 60% of detected noise is removed.

Decreasing the noise reduction amounts can have a positive effect if the input image contains some natural noise. For example, when you filter images of asphalt, sand, or anything else that contains fine natural noise-like features, it may be helpful to reduce amounts down to 30-50%. Our experience shows that these values generally provide a good balance between preserving image details and noise removal.



¹ All measured noise levels are shown in the Profile Viewer (use the menu Profile > Profile Viewer to open it).

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 profile itself. The Match indicator shows how closely this profile corresponds to 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) 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.

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%.

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.

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



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 Filter Settings box).
- ➔ Check the Smooth edges checkbox to make edges and lines look smoother.
- ➔ 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.
- ➔ 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

As you make changes to the noise filter parameters, check preview on different parts of the image to get a better feeling for the results of noise reduction.

If the noise filtration looks too aggressive 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 (only 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: 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

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.

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 additionally fine-tune the device noise profile or simply rebuild the profile from scratch.

Adjusting sharpening settings in Advanced mode (optional)

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

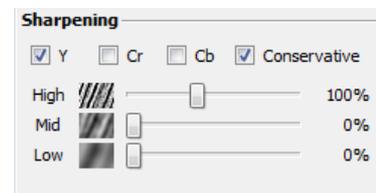
The default values of the sharpening settings should produce satisfactory results (when sharpening is enabled for any of the channel components) but you are encouraged to vary the settings to find values that produce the desired level of sharpness. Zero sharpening amounts will not sharpen the image at 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 to be sharpened

- ➔ Use checkboxes in the Sharpening section.

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 section.

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).

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 18.

5.3.5. Save filter settings into a preset (optional)

To save the current filter settings into a preset

- ➔ Click  (the **Save filter settings as preset...** button, pink disk) in the **Filter Settings** box or use the **Filter > Save Filter Preset...** menu item.

In the **Save Filter Preset As** dialog box, specify the name of the file to save the preset. The filter presets are stored as **.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, pink disk) in the **Filter Preset** box or use the **Filter > Load Filter Preset...** menu item. In the **Load Filter Preset** dialog box, specify the name of the filter preset to be loaded.

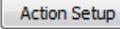
or

- ➔ Click  (the drop-down button) in the Filter Settings box to open the popup menu with all available presets and then select one of them.

There are several pre-written filter presets in the following sub-folder¹ in your *Documents* folder:
Documents\Neat Image for Photoshop\Presets

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).

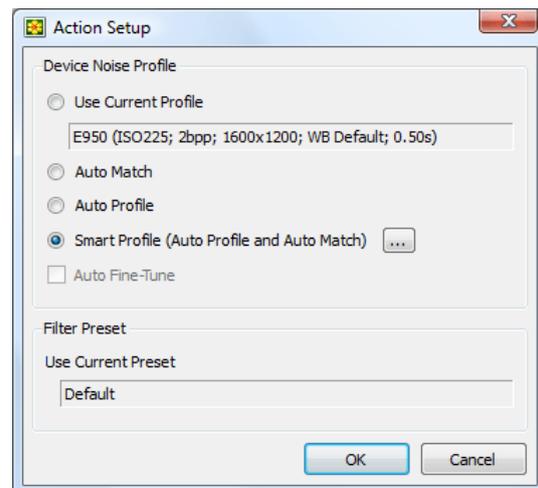
5.4. Stage IV. Adjust Action settings² (optional)

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 Setup settings accessible via 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 the plug-in.

The following options are available for noise profiles:

- Use Current Profile
Neat Image will use the currently loaded/built profile;
- Auto Match
Neat Image will use Auto Match to find and load the best matching profile from the profile set on the disk;
- Auto Profile
Neat Image will use Auto Profile to build a profile using the input image;
- Smart Profile (Auto Profile and Auto Match)
Neat Image will use both Auto Profile and Auto Match to prepare two noise profiles and then will select the better of two resulting profiles. This provides higher overall quality at expense of slightly longer processing time. To be fully efficient, this option also needs a pre-built set of noise profiles (for Auto Match to work). You can configure the behavior of the Smart Profile function using the settings link.
- Auto Fine-Tune
Neat Image 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);



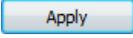
The plug-in will always use the current filter settings as the default filter preset for the next run.

¹ You can check and adjust the location of that folder using the menu Tools > Preferences > Folders > Preset folder.

² This subsection applies to Neat Image Pro plug-in only.

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).

Then the filtered output image is displayed in Photoshop and you can continue your Photoshop workflow.

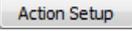
After filtration, the Neat Image plug-in will also automatically save the current settings such as device noise profile, filter preset, Action Setup settings, which will enable re-applying the plug-in (for example, using the `Ctrl+F` shortcut in Photoshop) with the same settings without re-doing the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

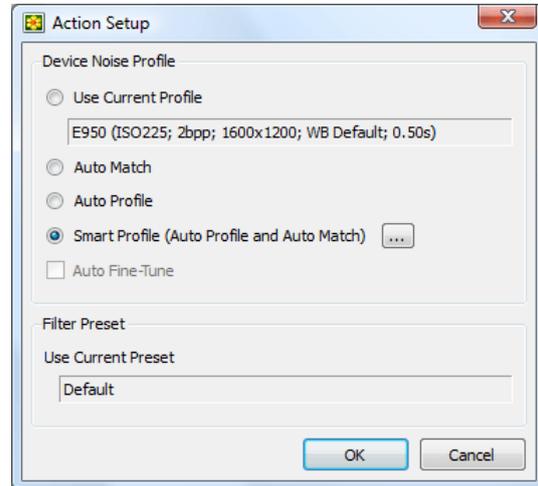
Neat Image is a processor-intensive image filter, so the processor's speed is the most important. On Core 2 Duo 2GHz, processing a 10-megapixel image takes about 5 seconds (Neat Image v7 plug-in for Photoshop). On a computer of typical configuration, the processing time is linear with respect to image size (when measured in megapixels).

6. Using plug-in in actions and smart filters¹

6.1. Configuring Neat Image in actions and smart filters

The Neat Image plug-in 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, the Preset parameter specifies which 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 and filter preset that should be used by the plug-in. To do that 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 specify how Neat Image should prepare noise profile(s) for the input image(s) processed by this action or smart filter, select one of the following options in the Device Noise Profile box:

- **Use Current Profile**
The plug-in will use a fixed noise profile that has been created or loaded into plug-in at the time of action recording (configuring the smart filter) and is currently available in the Device Noise Profile box in the main plug-in window; the plug-in will record that noise profile into the action or smart filter and will then always use it when the action is played or smart filter is (re-)applied.
- **Auto Match**
The plug-in will use Auto Match to search and load the best matching profile(s) for input image(s) from the profile set on the disk.²
- **Auto Profile**
The plug-in will use Auto Profile to build new noise profile(s) for the input image(s) when the action is played or smart filter is (re-)applied. The input image(s) must contain enough flat featureless noise-only areas suitable for noise analysis.
- **Smart Profile (Auto Profile and Auto Match)**
Neat Image will use both Auto Profile and Auto Match to prepare two noise profiles and then will select the better of two resulting profiles. This provides higher overall quality at expense of slightly longer processing time. To be fully efficient, this option also needs a pre-built set of noise profiles (for Auto Match to work). You can configure the behavior of the Smart Profile function using the settings link.
- **Auto Fine-Tune**
The plug-in will additionally apply Auto Fine-Tune to adapt the loaded profile(s) to the input image(s), to make the profile(s) more accurate. This option is available when you select Use Current Profile or Auto Match.

¹ Using the plug-in in Photoshop actions and smart filters is only supported in Neat Image Pro plug-in (Detailed feature map, page 40). Also, smart filters are only supported by the most recent versions of Photoshop.

² For this option to work, several noise profiles should be available on the hard drive. The profiles should be stored in the folder specified in Preferences (you can check and modify its location using the menu Tools > Preferences > Matching > Profile Matching). These can be profiles downloaded from the Neat Image online profile library or from other sources. You can also use profiles built by you. The input images as well as profiles in the profile set should contain the EXIF information to make profile-image matching possible. Most noise profiles available in the profile library in Neat Image website do contain the EXIF data. New noise profiles built with the latest versions of Neat Image plug-in will also contain the EXIF data (from the images used for profiling). Profiles built with older versions of Neat Image plug-in may not contain the EXIF data, so it may be useful to re-build them using the latest version.

- ➔ 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 be used when the action is played 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. You can change this preset using the controls in the **Filter Settings** box and then the new or modified preset will be recorded into the action or smart filter.

When you complete the adjustments in the **Action Setup** window, click the **Apply** button to save them in the action or smart filter that you currently record or configure.

6.2. Neat Image in action-based batch processing

The Neat Image plug-in for Photoshop can be used to process several images at a time using Photoshop's action-based batching facility.

To use this kind of batching you must do the following:

- 1) Pick one image from the series of images that you want to process and manually apply Neat Image filtration to this image to make sure you get the filtration results that you like. Then undo the changes done to the image.
- 2) Start recording a new action in Photoshop (if necessary consult Photoshop's documentation to check how you can create, record and play actions in your version of Photoshop).
- 3) While recording the action, repeat the step (1) and before applying the Neat Image plug-in click the **Action Setup** button in Neat Image plug-in window and make sure the settings there correctly describe the way you want Neat Image to prepare noise profile(s) and filter preset when the action will be played. After configuring the **Action Setup** settings, click the **Apply** button in the **Action Setup** window, and then click the **Apply** button in the main plug-in window.
- 4) Stop recording the action in Photoshop. You will now have a ready for use action that includes Neat Image with configured parameters.
- 5) In Photoshop, go to the menu **File > Automate > Batch**. This will open the **Batch** window where you can configure a new batch that will process your series of images.
- 6) In the **Set / Action** fields of the **Batch** window, select the action that you have just recorded.
- 7) Configure the rest of the **Batch** options according to the Photoshop user guide and then start the batch processing.

Photoshop's **Batch** tool will then process your images using the action that you have prepared. Since Neat Image is a part of that action, the **Batch** tool will apply Neat Image filtration to every image in the batch.

Since it is possible that some of the images may not be automatically processed by Neat Image (or other filters that may be used in your action) due to some errors, use the log options to save a log of the batch and then check which image(s) failed. If they failed because Neat Image could not process them, you can find out why that happened by manually running the action on one of those images. Make sure you run the action with **GUI/dialog** enabled to make Neat Image open its main window and display the error messages that will explain the problem to help you resolve it. After the problem is resolved, run the batch again using the steps 5-7 above.

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*. Neat Image can use profiles from such a set to process images produced in any of the modes covered by the set.

You can find some pre-built noise profiles or build your own profiles 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 pre-built profile sets for different cameras and scanners in:

- Profiles section of the Neat Image web page:
<http://www.neatimage.com/win/photoshop/profiles.html>
- Device noise profiles section of the 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.

To use a profile set from one of these sources, download the archive with profiles and unzip all profiles to the following folder¹ and/or its sub-folder(s) in your *Documents* folder:

Documents\Neat Image for Photoshop\Profiles

After that you can use individual profiles from this set in Neat Image to process images produced in device modes covered by this profile set.

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 a 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 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 the image, where there are no visually perceptible details (except the noise). Neat Image needs uniform featureless areas of around 128x128 pixels (the minimum

¹ You can check and adjust the location of the Profile folder using the menu Tools > Preferences > Folders.

is 32x32 pixels). You can see some examples of such areas in the Examples section, page 32.

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 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 and proceed to 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.

Open an alternative image in Photoshop 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 for Photoshop offers three ways of conducting the noise analysis (profiling): automatic, semi-automatic and manual 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 well or may produce less than perfect results. You can always override automatics and use semi-automatic or manual profiling.

- ➔ Make sure you use the Device Noise Profile tab:  **Device Noise Profile**

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  **Auto Profile** (the Auto Profile button) in the toolbar, or use the Profile > Auto Profile with Regular Image menu item, or press F2.

Neat Image will try to automatically find image areas suitable for analysis and will analyze them, first the primary selected area and then the rest of the image. If the primary selected area shown in viewer indeed contains no visible details then the resulting noise profile will be accurate.

To be sure, check the profile Quality indicator in the bottom of 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 70%) then you can be sure that the noise profile is accurate. Please proceed to Stage II. Documenting noise profile, page 26.

If the automatically-selected image area does contain visible details or the profile quality is not very high then try to 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 to find a uniform image area and then select this area for analysis.

If you cannot find a large enough 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 24).

2) Analyze selected image area

- ➔ Click  (the Auto Profile button).

Neat Image will automatically analyze the selected image area and the rest of the image.

The profile is now ready. Please proceed to Stage II. Documenting noise profile, page 26.

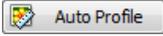
Case of manual profiling (Advanced mode only²)

1) Find a uniform featureless area

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

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

2) Analyze selected area

- ➔ Click  (the Auto Profile button).

Neat Image will automatically analyze the selected area and build a noise profile.

3) Additionally manually fine-tune the profile

Fine-tuning uses additional flat featureless frame areas to make the noise profile more accurate. You must manually select and analyze several such areas one after another.

1) Find and select a uniform featureless area

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

The size of an area may be from 16x16 to 256x256 pixels. Using larger areas makes fine-tuning more accurate. The selection edges will change their thickness according to the selection size.

¹ You can see some examples of uniform featureless image areas in the section Examples, page 36.

² You can enable Advanced mode using the Tools > Advanced Mode menu item.

2) Analyze selected area with Manual Fine-Tune

- ➔ Click  (the Manual Fine-Tune button) or use the Profile > Fine-Tune Using Selected Area menu item.

The analysis results will be shown in the noise profile equalizer: the graphs of the equalizer will change some of the values (see the picture on the right). You can switch from one channel to another in the equalizer to better see a specific channel's graph, or select to show them all together.

The goal of manual fine-tuning is to fill the equalizer with measured values (shown as graph-color knots) in all points of the graphs. The previous steps (specifically, the Auto Profile function) may have already filled some of the values. Manual fine-tuning can further improve the analysis by filling out the still missing or interpolated values (shown as yellow knots) and/or making some of already measured values more precise.



3) Repeat 1-2 above with other uniform areas of different brightness

To make the device noise profile more accurate, fine-tune it using several uniform image areas. Select areas of different brightness for best results. Try to choose and analyze uniform areas to cover all or most elements of the equalizer in all its color channels. The more elements of profile are analyzed, the higher is the quality of the profile.

4) Complete fine-tuning using Auto Complete

- ➔ Click  (the Auto Complete button) or use the Profile > Auto Complete menu item to automatically complete the fine-tuning by adjusting the unmeasured values using interpolation based on the measured data.

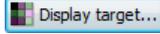
At this point the profile is ready. Proceed to Stage II. Documenting noise profile, page 26.

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 using the Calibration Target.

Step 1. Preparing the Calibration Target

To use the Calibration Target, go to menu Tools > Calibration Target and then click  (the Display target... button), or download the image of the Target from the Neat Image web page: <http://www.neatimage.com/win/photoshop/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. Also, try to avoid glares when using a monitor with a glass or glossy screen.

Case of shooting the Calibration Target off the screen

- ➔ Open the Calibration Target image on the screen (menu Tools > Calibration Target and then click the Display target... button). Then use the displayed Calibration Target in the Step 2 below.

Case of shooting the printed Calibration Target

- ➔ Open the Calibration Target image in an image editor and print out the image on a sheet of white

matte paper; make the image fill the whole page. Then use the printed target in the Step 2 below.

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

Having the shot or scan of the Calibration Target, Neat Image can build a noise profile automatically:

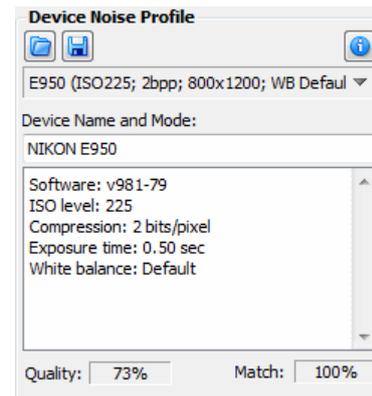
- ➔ Use the Profile > Auto Profile with Calibration Target menu item.

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. You may still want 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 Mode fields in the Device Noise Profile box).

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



- ➔ Use the Device Name and Mode fields in the Device Noise Profile box. 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 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 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 Mode fields).

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 Name and Mode fields.

7.2.4. Stage III. Saving the noise profile

- ➔ Use  (the Save Device Noise Profile As... button, blue disk) in the Device Noise Profile box or use the Profile > Save As... menu item.

In the Save Device Noise Profile As... dialog box, select the desired file name for this profile. 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 as **.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 29, for additional information.

A saved noise profile includes the complete noise analysis. Therefore, by re-opening the noise profile, you can reproduce exactly the same conditions for image processing later on.

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 covering different modes to enable accurate processing of arbitrary images produced by this device. If a 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, you can adjust its shooting mode and take test shots. Moreover, using your own set of profiles makes 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 for you¹.

7.3.1. Stage I. Selecting device parameters for profile set

To build a set of profiles for particular camera or scanner, you must identify the 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.

The tables below describe the parameters that appreciably affect noise characteristics (from the most to the less important ones) of 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 4288x2848), 1:2 (downsized in camera, e.g., 2144x1424), 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.

¹ ..and other people if you decide to share your results. Please do share because in this way you will help people with the same camera or scanner model. You can submit a set of profiles to the Neat Image team to publish the set in the profile library in www.neatimage.com (see Contacts, page 41) or just share them with other people directly.

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 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 are important for your needs. 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

Then 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 a profile for a device mode section, page 21. Using those guidelines, build a new profile for every combination of the device mode parameters included in your list as described in the 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 (please note that the Batch Profiler is **not** for regular images). To use this tool, you must prepare several shots (scans) and then analyze them all at once using 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 24.

Step 2. Preparing a shot or scan of the Calibration Target, see page 25.

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

Documents\Target Images

2. Preparing profiles

To prepare profiles using the images of the Calibration Target:

1. Select the Tools > Batch Profiler... menu item to 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. Click 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 described in the Stage III below.

7.3.3. Stage III. Structuring profile set

In the Stage II, you have prepared a set of profiles, they are now saved 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:

<ul style="list-style-type: none"> 📁 Olympus C5050Z C5050Z (ISO100; JPEG HQ; SharpNormal; 2560x1696).dnp C5050Z (ISO100; JPEG HQ; SharpNormal; 2560x1920).dnp C5050Z (ISO100; JPEG SHQ; SharpNormal; 2560x1696).dnp C5050Z (ISO100; JPEG SHQ; SharpNormal; 2560x1920).dnp C5050Z (ISO200; JPEG HQ; SharpNormal; 2560x1696).dnp C5050Z (ISO200; JPEG HQ; SharpNormal; 2560x1920).dnp C5050Z (ISO200; JPEG SHQ; SharpNormal; 2560x1696).dnp C5050Z (ISO200; JPEG SHQ; SharpNormal; 2560x1920).dnp C5050Z (ISO400; JPEG HQ; SharpNormal; 2560x1696).dnp C5050Z (ISO400; JPEG HQ; SharpNormal; 2560x1920).dnp C5050Z (ISO400; JPEG SHQ; SharpNormal; 2560x1696).dnp C5050Z (ISO400; JPEG SHQ; SharpNormal; 2560x1920).dnp C5050Z (ISO100; TIFF; SharpNormal; 2288x1712).dnp C5050Z (ISO100; TIFF; SharpNormal; 2560x1696).dnp 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 	<ul style="list-style-type: none"> 📁 – disk folder C5050Z – camera name ISO ### – ISO rate of camera mode JPEG SHQ / JPEG HQ / TIFF – file format and compression level Sharp##### – sharpness adjustment #### x #### – image size
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When the profiles are named like this, manual selection of a suitable profile is simple. You can check the device mode of the input image in Photoshop or in Neat Image (using  button in the bottom of the image viewer) and then select a profile for this mode from the popup menu.

There is also 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>
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In this case, the folder tree stores 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 selection of profiles, while automatic profile matching can handle both cases equally well.

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 select profiles manually. Therefore, we recommend 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 recommend to document the whole profile set with a plain text file explaining the following points:

- Author of the profile set and profiling date
- Device name, firmware version
- 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
- 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, September 26, 2014

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 the best match between profile and image. Profiles in a set usually correspond to different 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 to learn how to use Auto Match);
- To manually select the most suitable profile from a pre-built profile set based on mode comments (see page 10 for details).

When you select and load 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 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 (Neat Image displays that using the note "(AP)" in the Match indicator). 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 lower 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 input image or the Calibration Target shot in current device mode) would produce better noise reduction results.

Obviously it is preferable to build a new noise profile for each new input image (unless the image does not allow building a quality profile because it contains no large uniform areas for analysis), 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. Also, it may not always be possible to build an accurate profile using input image when it contains no flat featureless areas.

When using pre-built profiles, you may also want to pay attention to the Quality indicator in 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 70%) then you can be sure that the profile is accurate.

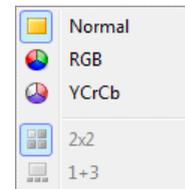
Both Quality and Match indicators should usually show high values for the noise reduction of the current input image using the current noise profile to be accurate.

8. Additional tools

8.1. Alternative modes of image viewer

The image viewer in Neat Image can show the currently processed image in several alternative modes to enable detailed examination of both channel and frequency components. Examining the components helps to find flat featureless image areas for noise analysis. Also, that allows to visually compare the original and filtered version of each component and to find optimum filter settings for the corresponding component easier and faster.

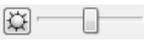
- ➔ Use  (Viewer mode button) in the viewer toolbar to select the desired viewer mode.



The viewer mode will change accordingly and will display the image components separately or as one composite image.

Examine individual channel and frequency components of the image, check the presence of noise in individual components. Working in the Noise Filter Settings tab, you can use the separately displayed components to identify those components that do not get enough (or get too much) noise reduction and adjust the corresponding filter settings.

You can also adjust the brightness of the viewer to easier see image details and noise in very dark or very bright areas of the image:

- ➔ Use  (the viewer brightness controls) in the viewer toolbar to adjust and/or reset the viewer brightness to better see the noise and details in very dark or very bright areas of the image.

Please note that this adjustment does not change the underlying image data in any way. The adjustment only affects the image viewer, i.e., the way the images are displayed in it.

8.2. Navigator

The image viewer has an additional Navigator panel, which offers an easy way to locate and navigate to an area of interest in a large image that does not entirely fit into the viewer, for example when you zoom into the image to see its fine details. When using Navigator you don't need to zoom out and then again zoom in (though such an approach to locating an area of interest can be used as well).

- ➔ Use  (the Navigator button in top-left corner of the viewer), the Tools > Navigator menu item or press F8 to open or close the Navigator panel.
- ➔ Use the mouse pointer to drag the visible area frame to the desired image position within the Navigator panel. This will make the main viewer navigate to the same position in the image.

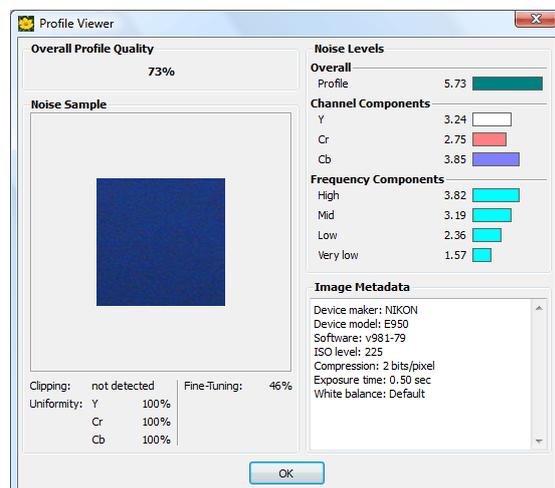
8.3. Profile Viewer

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

- ➔ Use  (the Profile viewer button) in the Device Noise Profile box in the Device Noise Profile tab to open the Profile Viewer window.

The Profile Viewer provides the following details:

- Overall Profile Quality – this is an estimation of the overall quality of the noise analysis contained in this profile. The higher this value the better this profile seems to be. A quality profile is necessary for quality noise reduction.



- **Noise Sample** – this is an optional noise sample (a crop from the image used to build this profile). The noise sample helps you visually evaluate the noise described by this profile. Also, you can easily see whether any details are present in this area, which makes the profile less accurate (only flat featureless areas without any details should be used for profiling, so the sample should contain no visible details).
- **Clipping** – this indicator tells whether there is any clipping in the analyzed image area. Clipping occurs when the sample contains pixels that are very close to or in fact are entirely white (or entirely black). Clipping reduces the overall profile quality.
- **Uniformity** – these values show how uniform the noise sample is in all color channels. The uniformity is low when any details are present in the area. Low uniformity reduces the overall profile quality.
- **Fine-Tuning** – this indicator tells how well this profile is fine-tuned. Fine-tuning is a part of profiling process (both automatic and manual) and the more complete and accurate the fine-tuning the higher the overall profiling quality. If you work with Neat Image in *Advanced* mode then you can see that the more equalizer values are filled in with measured data the higher the overall profile quality is. You can improve the profile quality by additional fine-tuning.
- **Noise Levels** – these figures show the actual noise levels measured by the noise analyzers during profiling. There are the overall noise level and noise levels in channel and frequency components. These figures are a good indication of how noisy an image source is.
- **Image Metadata** – this box contains the EXIF information associated with the image used to build this profile. This information is used by Neat Image to find a profile that matches an input image.

9. Preferences

There are several preferences that adjust the behavior of the Neat Image plug-in.

Use the **Tools > Preferences...** menu item to open the Preferences dialog box.

9.1. General preferences

Auto zoom to fit on image open

Check this option to make the image viewer automatically adjust zoom level to fit the image into the window.

Show hints over interface controls

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

Color theme

Normal brightness

Neat Image will display its interface elements using the current color theme of the OS.

Reduced brightness

Select this option to switch Neat Image to a custom color theme with reduced brightness.

9.2. Profiling preferences

Save noise samples in profiles

Enable this option to make Neat Image save a noise sample from the analyzed image area into device noise profile (*.dnp file). This will increase the size of the *.dnp file but will also improve the compatibility with the future versions of the software (Neat Image will be able to re-build the profile

using the saved noise sample).

Show warnings about selected image area

Enable this option to let Neat Image display warnings about selected image area during profiling. For example, Neat Image may warn you about clipping or non-uniformity detected in the selected area, thus helping you select a better area for profiling.

Smart Profile

Smart Profile is one of the possible ways to prepare a noise profile to process an input image. Smart Profile uses both Auto Profile and Auto Match (with Auto Fine-Tune) to prepare two candidate profiles and then selects the better of two profiles.

Use the settings in the Smart Profile box to configure the behavior of the Smart Profile function.

Automatically select the best profile

Use this option to let Neat Image automatically decide which noise profile to use.

Prefer profile prepared by Auto Profile

Let Neat Image preferably select the profile prepared by Auto Profile when it can find a good area for analysis in the input image. When the area is not very good then Neat Image will use the profile prepared by Auto Match with Auto Fine-Tune.

Prefer profile prepared by Auto Match and Auto Fine-Tune

Let Neat Image preferably select the profile prepared by Auto Match when it can find a matching profile among the pre-built noise profiles, even when Auto Profile provides a good profile as well.

9.3. Matching preferences

9.3.1. Profile Matching

Use profile matching preferences to adjust the way Neat Image matches noise profiles to input images.

Look for noise profiles in the following folder

If you select this option then Neat Image will look for matching noise profiles in the specified folder. If you have several sub-folders with profiles, select the topmost folder of all those subfolders to let Neat Image search in all of them.

By default, the folder used to store profiles (see the Folders > Profile folder setting in the same Preferences window) is used for matching. You can use any other (sub-)folder for profile matching as well.

Matching parameters priorities

To automatically match profiles to the input image, Neat Image compares the device parameters of the input image and candidate profiles selected from the folder specified by the above options. Different parameters usually have to be matched with different priorities. Using Matching parameters priorities controls, you can select the priorities of such parameters as Input device, ISO rate, Compression, Resolution, Sharpness, Exposure:

- Match – the parameter should match exactly;
- High – it is highly important that the parameter is very close or matches exactly;
- Low – it is preferable that the parameter is close or matches exactly;
- Ignore – the parameter is not important at all.

9.4. Performance preferences

The first group of settings in this tab selects the computing devices to be used for image processing. This group of settings is optional, it is shown only if at least one supported GPU (graphic processing unit) is available along with the regular CPU (central processing unit, or processor). This group includes the

following items:

Use CPU only

This option makes Neat Image perform all image processing using only CPU.

Use GPU only

This option makes Neat Image perform all image processing using only GPU.

Use CPU and GPU

If you select this option then Neat Image will process images using both CPU and GPU.

Depending on individual performance of each computing device (CPU and GPU), each of the above options may be the most efficient. You can try different settings and measure the resulting speed using the Benchmark tool below.

CPU

Number of used cores

This option adjusts the number of CPU cores used by Neat Image for processing. The number of used cores can go up to the total number of cores in all CPUs in your computer (like 2 cores in Core Duo, 4 cores in Core Quad, 8 cores in a desktop version of i7 with enabled hyperthreading, etc.). If the computer includes two physical CPUs then the number of cores is correspondingly higher. Ideally, using all cores should provide the best overall performance. In some cases however, processing speed may be even higher if fewer cores are used (especially on CPUs with hyperthreading). For example, using fewer than all 8 virtual cores in i7 is in some cases faster, so you may want to test different values of this setting.

GPU

In this box, you can specify which of the available computation-capable GPU devices (CUDA-capable NVIDIA cards and/or supported OpenCL-capable AMD/ATI cards) should be used for image processing (in addition to CPU or instead of CPU). When you have one or more GPUs, you can allow Neat Image to use it and specify how much GPU memory may be used for Neat Image's image processing. When you also have other software using the GPU, you may want to reserve only a part of the GPU memory for Neat Image and leave the rest free for other purposes. In any case, you can try different values and see which setting gives the best results.

Benchmark

Use the **Benchmark** button to measure the image processing speed with the current settings specified in the CPU and GPU boxes.

Optimize

Use the **Optimize...** button to open a specialized dialog designed to measure image processing speeds achieved with different combinations of the CPU and GPU settings. It allows to automatically benchmark all possible combinations of settings and to identify the best combination. This is the easiest way to optimize the performance of Neat Image for specific CPU and GPU hardware.

9.5. Folders preferences

Profile folder

Select the folder where Neat Image must look for device noise profiles. This should be the topmost folder of all the (sub)folders with device noise profiles. Neat Image will display all profiles (stored in all subfolders of the specified folder) in the popup menu in the **Device noise profile** panel of the plug-in window and in other parts of Neat Image.

By default, the **Profile folder** is located in your **Documents** folder:

Documents\Neat Image for Photoshop\Profiles

You can select another location to store and use your Neat Image profiles if you prefer.

Preset folder

Select the folder where Neat Image must look for filter presets. This should be the topmost folder of all the (sub)folders with filter presets. Neat Image will display all presets (stored in all subfolders of the specified folder) in the popup menu in the *Filter Settings* panel of the plug-in window and in other parts of Neat Image.

By default, the *Preset folder* is located in your *Documents* folder:

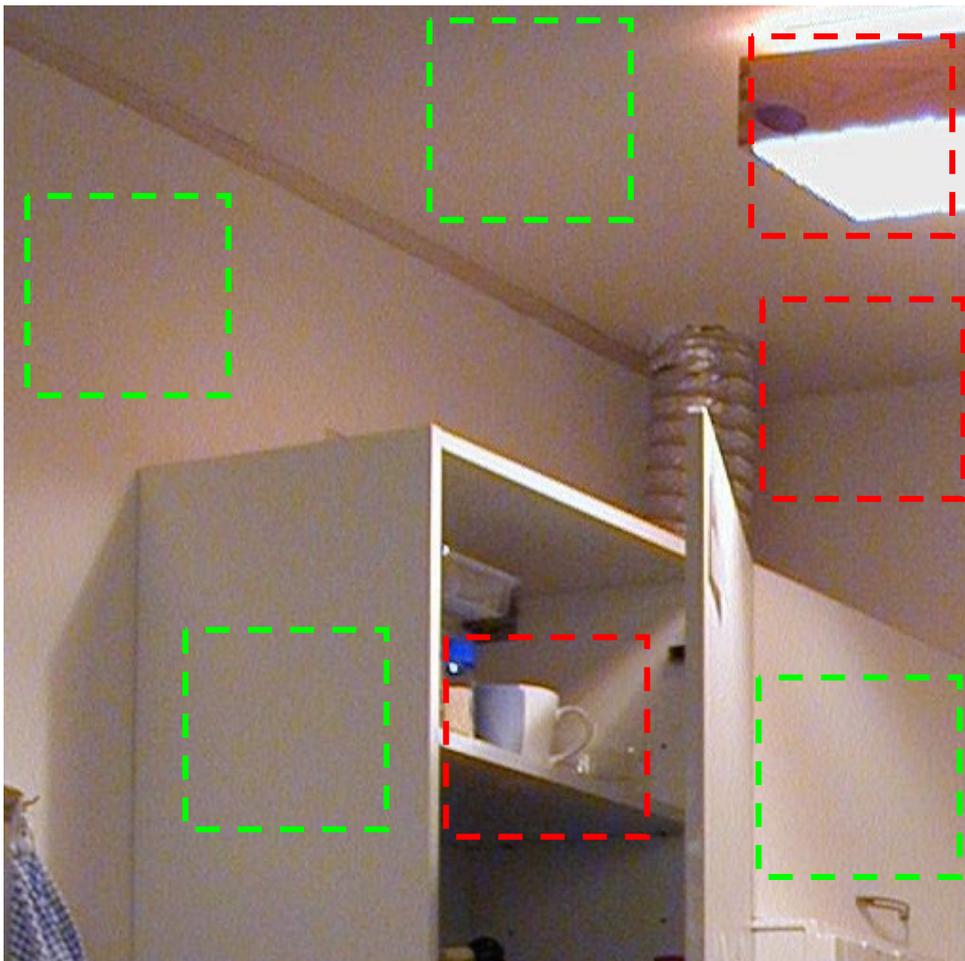
Documents\Neat Image for Photoshop\Presets

You can select another location to store and use your Neat Image presets if you prefer.

10. Examples

10.1. 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 the image because building a profile using an area with details produces an inaccurate profile that will then lead to very inaccurate filtration. In such a case, you have to use either an alternative image with flat featureless areas or to use the Calibration Target to produce test images with flat featureless areas.



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

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



– **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)

10.2. Filtration results

Here are some examples of Neat Image performance.



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



This image was also taken with a digital camera. Along with the strong 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 in the Neat Image web page:
<http://www.neatimage.com/win/photoshop/examples.html>

11. Questions and answers

11.1. General questions

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

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 and 32-bit images. The Pro plug-in (unlike Demo and Home) also supports Photoshop actions and smart filters (in the recent versions of Photoshop). Please also see the Detailed feature map, page 40, 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; it will replace the old version.

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

A Please use the online bug report form: <http://www.neatimage.com/win/photoshop/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 40, and about bug fixes in the *WhatsNew.txt* file supplied with the software. Also see the history section in the Neat Image web page for the most up to date information: <http://www.neatimage.com/win/photoshop/history.html>

11.2. 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. Using a more accurate profile usually helps. 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 channel to 50% or lower. 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 How to filter only the color noise (not the brightness noise)?

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

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.

12. Tips and tricks

12.1. 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 – using two layers in Photoshop. For example, the following steps can be used:

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).

13. Information

13.1. Issues and bugs

Please report any bugs or issues you encounter while working with Neat Image. Use the online bug report form: <http://www.neatimage.com/win/photoshop/brf.html>

Your feedback will greatly help us improve the software and provide you with newer and better versions of Neat Image.

13.2. Plans

The current version of Neat Image plug-in for Photoshop is going to be further improved in the consequent updates. 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 for you. Participate in discussions in the Neat Image community forum, express your opinion, make suggestions, and ask questions. The more people that ask for a feature the more likely that it will be implemented.

13.3. Detailed feature map

Features		Edition		
		Demo plug-in	Home plug-in	Pro plug-in
Images	8 bit/channel (24-bit RGB, 8-bit Grayscale)	+*	+	+
	16 bit/channel (48-bit RGB, 16-bit Grayscale)	–	–	+
	32 bit/channel (96-bit RGB, 32-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	+		
	Automatic matching profiles to images	+		
Noise reduction	Channel-wise (Lum/Chr; 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.

13.4. 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
- photoshop@neatimage.com — for inquiries regarding use of Neat Image for Photoshop (Win)
- sales@neatimage.com — for 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;
- contacts and general comments.

Web page

<http://www.neatimage.com/win/photoshop/index.html>

13.5. Legal information

Copyright

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License agreement

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same major version) and edition of the software without time limitations provided you observe this license agreement.

A license for a certain major version of the Home or Pro edition of Neat Image may be extended to a higher major version. By decision of the Neat Image team, ABSOFT, this extension may be automatic and free or may involve an upgrade fee.

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The authors make no warranty or representation, either express or implied, with respect to this software, its quality, accuracy, merchantability, or fitness for a particular purpose. This software is provided "as is", and you, its user, assume the entire risk as to its quality and accuracy.

Distribution

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

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

13.6. Registration

By becoming a registered user of Neat Image plug-in for Photoshop you will:

- Encourage the authors to further develop and improve the software;
- Get access to advanced functionality of Neat Image (see the Detailed feature map, page 40);
- Be able to use Neat Image 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 versions 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!

13.7. Acknowledgments

Thank you to all the users who have contributed to Neat Image plug-in for Photoshop by proposing improvements and new features.

Thanks to all the people who help us to find and fix bugs in Neat Image plug-in for Photoshop.

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

Neat Image wouldn't be neat without all of you!

Neat Image team, ABSOFT

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