Reference Handbook

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[BETA release]

Versión 0.1. April 2020

imageqa.jpereira.net

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This handbook has been automatically translated, so there may be grammatical and syntactical errors that make it difficult to understand. In future versions I will try to improve this translation.

Contract Terms

ImageQA is currently released under a BETA development license. This means that the software is under development and testing and is supplied "as is" which probably means that there are defects and bugs in the development.

The purpose of that version is to obtain information about performance and usability from potential users.

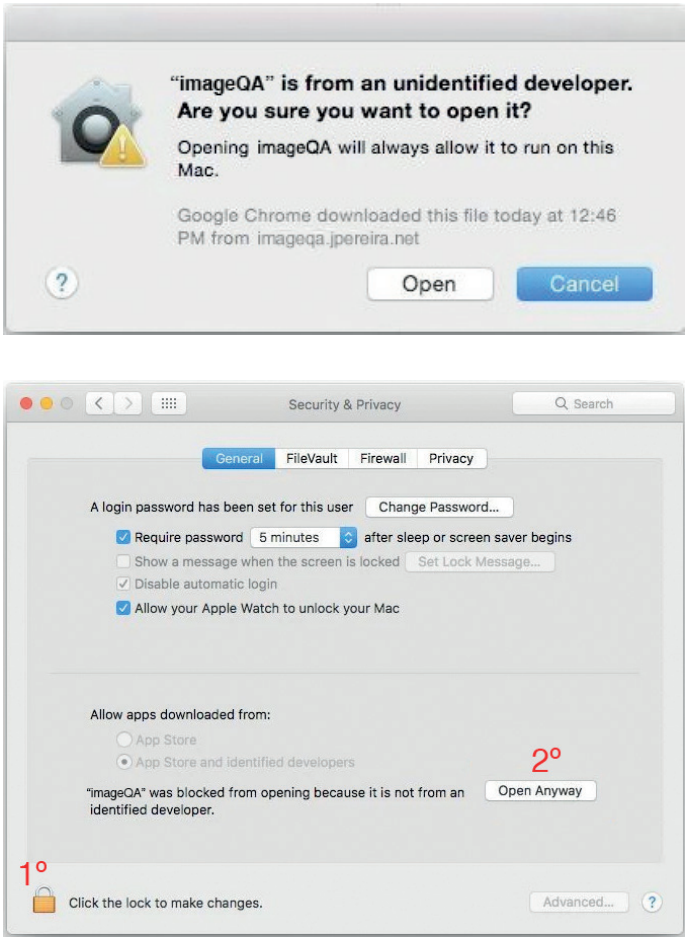
ImageQA does not install any kind of tool that accesses personal data or sensitive parts of your computer, all files needed for its operation are included in the installer itself, so its operation and removal should not pose any problem for the stability of your computer. Nevertheless, THIS TOOL, AS A DEVELOPMENT VERSION, IS DISTRIBUTED WITHOUT ANY WARRANTY OR SUPPORT REGARDING ITS OPERATION, INSTALLATION OR DISINFRAMEMENT AS WELL AS ANY INCIDENCE THAT MAY APPEAR DURING ITS INSTALLATION OR DISINFRAMEMENT ON YOUR EQUIPMENT. Do not use ImageQA in its BETA version for any professional task as the algorithms implemented so far may contain errors or lack of precision.

If you need support a group has been enabled in the social network Facebook:

https://www.facebook.com/groups/674482120019374/

In order to establish discussions and contribute errors about the operation of ImageQA. You can also contact *imageqa@jpereira.net* with any comments you may have on how the tool works.

Installation



From the System Preferences panel, we must access Security and Privacy and from there accept the execution of imageQA

Requirements in MacOs

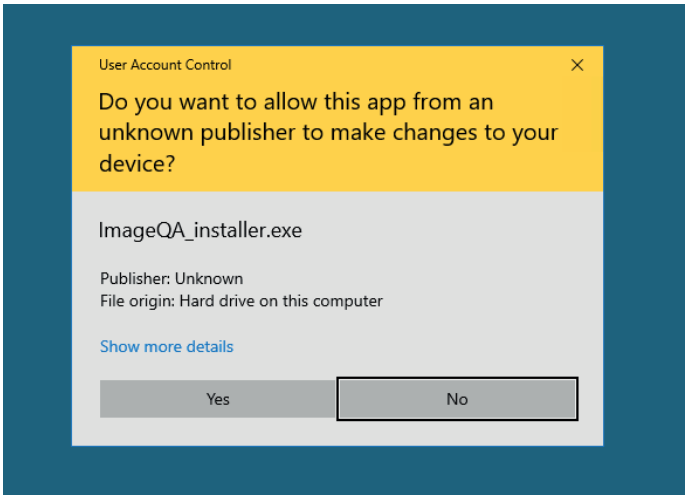
ImageQA is distributed in the version for Mac OsX and Windows, at the moment it has only been tested in OsX versions higher than 10.11 (El Capitan) without being tested yet in the last distribution 10.15 (Catalina).

The OsX version is packaged in a DNG file. Although ImageQA can be run inside the DMG itself it is convenient to drag the ImageQA directory with the program to the Applications directory, or any other directory. Inside the ImageQA directory there is a small program called ImageQA.app that is a launcher for the "home" program inside the "program" directory. If you want to debug some kind of error in the program, if the "home" program is executed directly, the terminal will open and we will be able to access the errors shown by the program execution.

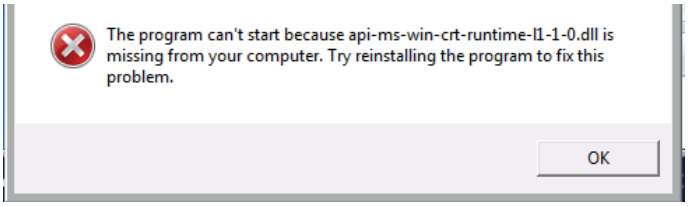
In order to be able to execute the program it is probable that our operating system will launch a security alert of unidentified developer. To do this, we must go to System Preferences, and in Security and Privacy, accept the execution of the program, for which we must previously unlock the panel with our password.

To uninstall the program, just drag the ImageQA directory to the trash. The program will leave a .plist file with its configuration, if we want to delete it this is in the directory:

/Users/[usuario]/Library/Preferences/com.jpereiranet.imageQA.plist



Al igual que en MacOs debemos pemitir la instalación de heramientas hechas por desarrolladores no identfi-cados



If we get the error "api-ms-win-crt-runtime-l1-1-o.dll", we must install the libraries "Visual C++ Redistributa-ble for Visual Studio 2015

Windows requirements

On Windows ImageQA has been successfully tested in version 7 and 10.

During the installation in Windows it can appear the error indicating that ImageQA cannot start because the DLL "api-ms-win-crt-runtime-l1-1-o.dll" is mis-sing, to solve this error it is necessary to install the tools "Visual C++ Redistributable for Visual Studio 2015" from the own page of Microsoft:

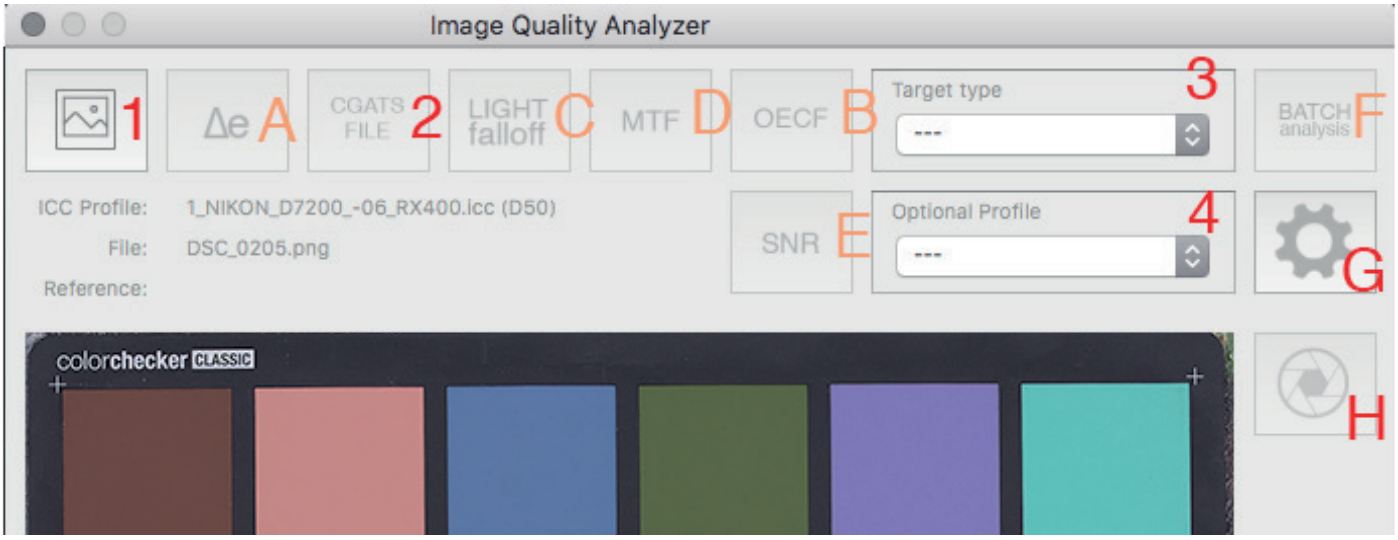
https://www.microsoft.com/es-es/download/details.aspx?id=48145

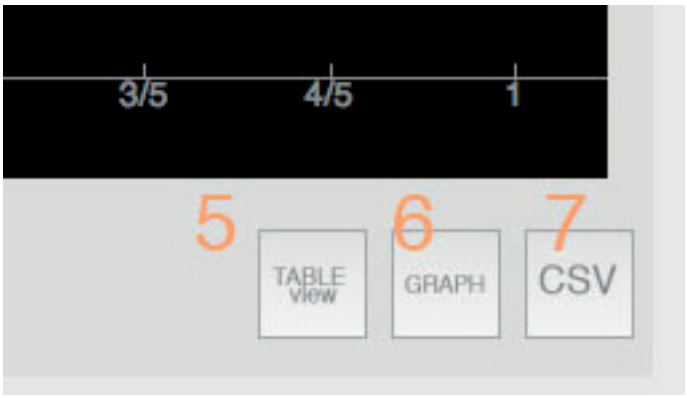
In the version for Windows the program is provided in an installer that will copy the files of ImageQA to the directory C:\Program Files (x86)\jpereira_net\ ImageQA, as well as create a shortcut on the desktop and the start menu. Within that path is the uninstall.exe which will remove that directory and the links created. However, certain entries will remain in the registry, which for security reasons cannot be re-moved. If we want to delete them, we must use the Registry Editor "Regedit" and go to the path HKEY_CURRENT_USER > Software > jpereiranet > ima-geQA, deleting manually all the jpereiranet entry.

Before the installation we must accept the securi-ty alert of unknown developer that windows may launch our operating system

To debug possible ImageQA errors we can launch imageQA.exe from the Windows terminal.

Instrucciones





From each analysis we have several display options:

View the data of the graph or test in table form.

6.- Export our graph as a PNG image

7.- Export the data in CSV format

1.- Open Images. One image or multiple images are accepted
2.- Upload reference file in CGATS format
3.- Select the type of target or pattern to use to identify the area of interest
4.- Load optional ICC test profile

A.- Delta-e analysis
B.- OECF Analysis
C.- Light Falloff
D.- MTF Analysis
E.- SNR Analysis (Noise)
F.- Batch Analysis
G.- Settings
H.- Camera information

Load images

ImageQA supports TIFF, JPEG and PNG images in RGB or grayscale mode, but the latter format is only used for MTF and LightFall analysis. For OECF and Noise it is in development.

Load reference documents

Supported reference documents must be in IT8/CGATS format and contain the colorimetry in Lab mode, other spaces such as XYZ will be discarded, and ImageQA does not convert from XYZ to Lab at this time. The illuminant must be D50 as this is the default, it can be adjusted later.

Select a Target Type

The cards supported at the moment are:

- Colorchecker family (Classic, Mini, Passport, etc)
- Colorchecker SG
- Kodak Q13
- IT8
- ROI

The ROI (Region Of Interest) pattern is used to calculate the Light Falloff and determine the area for calculating the MTF.

For Colorchecker targets a reference file is attached by default, although it is equally recommended to upload our own file. For IT8 targets and Q13 scales it is necessary to upload our reference files. The default reference files are stored in the "reference" directory in the program folder.
There is a target type called "GS Colorchecker Classic" which is for studies on the gray scale of the Colorchecker Classic, in order to study the OECF and Noise.

Optional Profiles

ImageQA supports color management, so it interprets the ICC profiles embedded in the image itself, as well as other input profiles we have installed in our system. By default ImageQA looks for such profiles in the default directories of Windows and MacOs:

Windows:

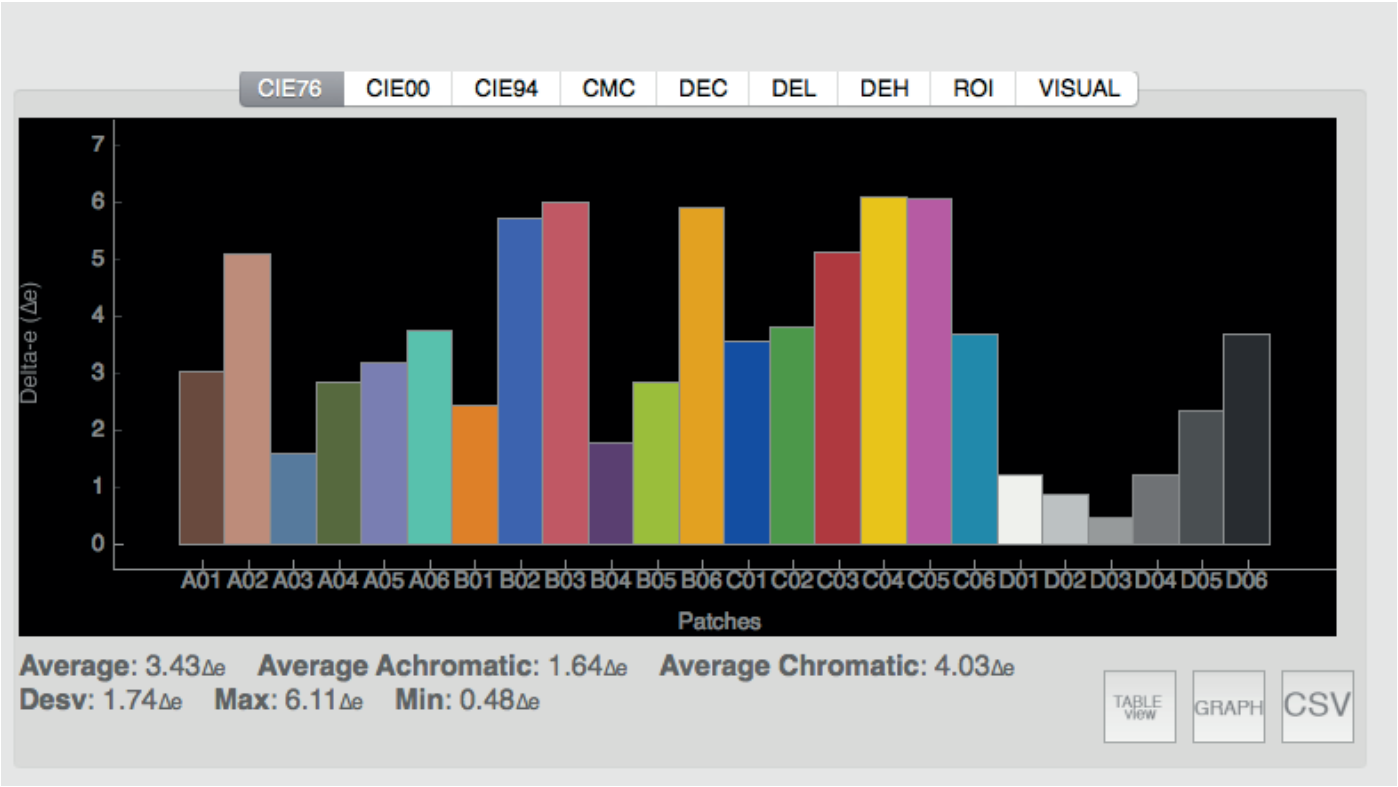
C:\Windows\System32\spool\drivers\color

MacOs:

Library/ColorSync/Profiles/
or
/Users/[usuario]/Library/ColorSync/Profiles/

However in the settings button we can select another route where we store our ICC profiles for testing purposes. Only input ICC profiles are accepted

Delta-e



Using Delta-e metrics we calculate the difference between two colors, i.e. the difference between a sample color, taken from our image, and a reference color taken from a document (reference document in CGATS format) that describes the colorimetry of our color target.

In this way, after photographing a color target, with its colorimetry known as a Colorchecker family target, and subjecting it to a particular workflow, we can easily estimate the color difference between the reality and its digital representation.

For delta-e analysis it is necessary to have images in RGB mode and target patterns that include patches with a color hue. CMYK and grayscale images cannot be used.

The implemented metrics are:

CIE76: which is the oldest metric, but also the most used in a lot of standards and recommendations

CIE00: o CIE 2000 is the most up-to-date version of the estimation of the difference between colours, with the difference from CIE 76 being perceptually uniform, i.e. the differences are estimated on the basis of human perception rather than mere Euclidean distance as in CIE76

CIE94: is a disused metric, resulting from the evolution towards a perceptually uniform metric that was left behind by the ICD00 proposal

CMC: is a metric of the Color Measurement Committee related to the world of printing and textile inks. It is the first perceptually uniform metric, but has only been used in the field of the textile industry.

In addition to the metrics that estimate the stimulus difference, or error in color, a detailed representation for each color attribute of the LCH space is added.

DEC (Delta Chroma) where the error in chromatism is expressed.

DEL (Delta Lightness) where the clarity error is expressed.

DEH (Delta Hue) where the error in hue is expressed The following statistics are extracted from each metric:

Average: or average error, where the errors of all the patches are averaged.

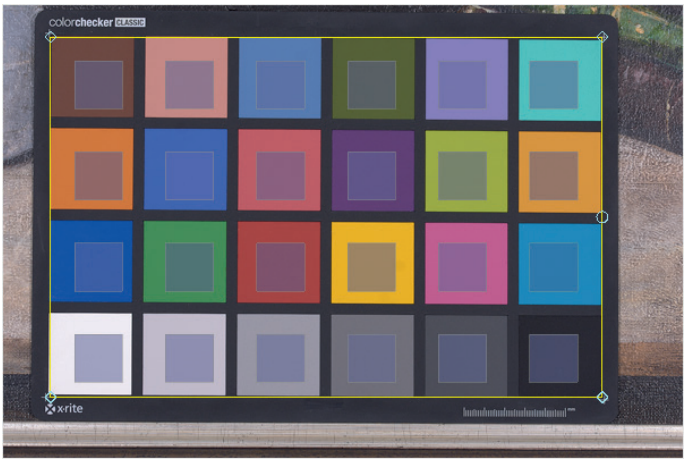
Average Achromatic and Average Chromatic: here the error is separated between chromatic patches (patches with a color shade, and achromatic or neutral patches. This is necessary because often neutral patches accumulate less error, and cause the Delta-e mean to drop, giving unrealistic error means with the color deviation for samples with a certain chromaticity.

Max and Min: show the maximum and minimum error. In particular, the maximum error must be taken into account, since if our works have a shade close to the samples that accumulate more error, our average will not be representative of the quality of the resulting work.

Finally, several representations are shown:

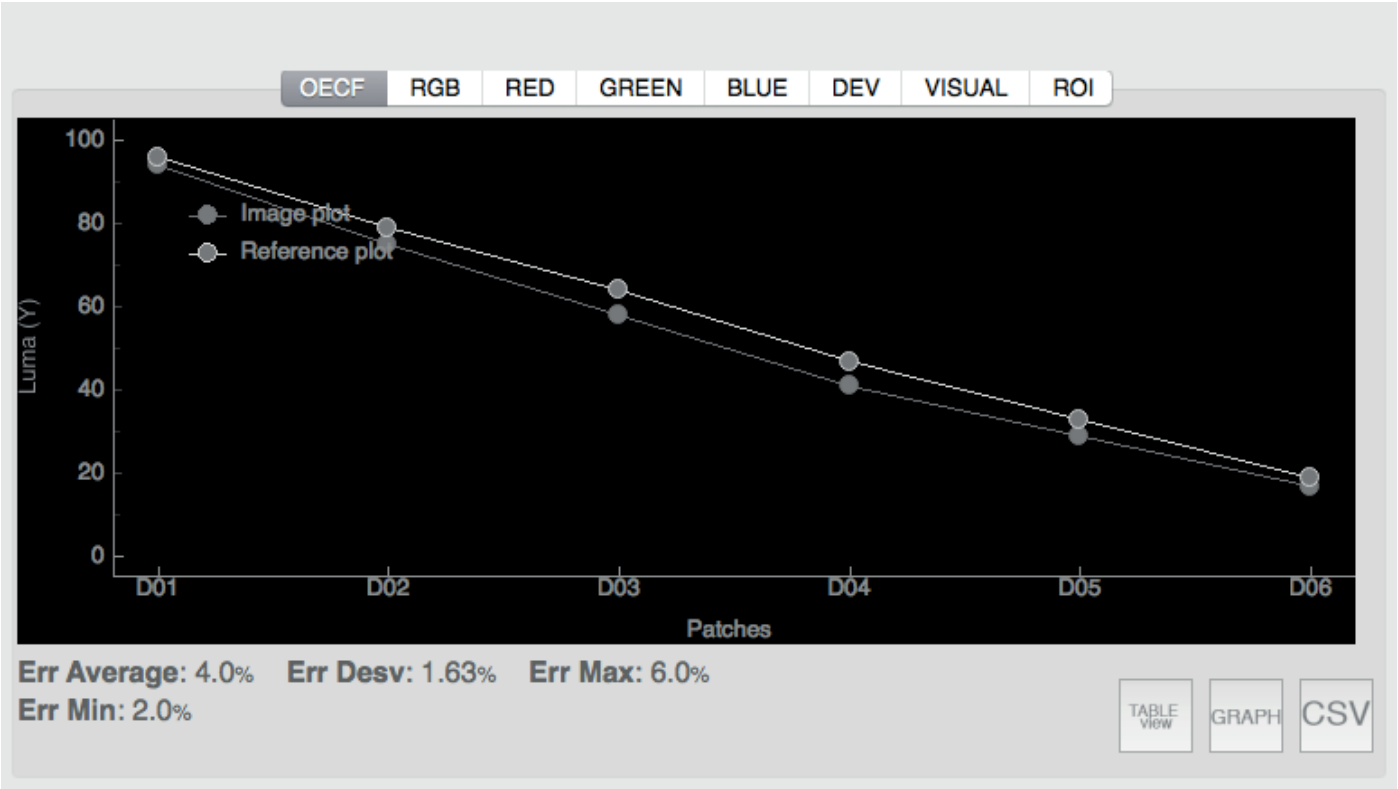
ROI (Region Of Interest) leaves testimony where the samples have been taken on the image.

VISUAL: it generates a patch with the colorimetry of the target on the image, to estimate its visual difference. If the error is low, this estimate will be difficult to perceive.



Example of the Colorchecker Classic card type with its 24-patch identification pattern.

OECF



The OECF (Opto Electronic Conversion Function) metric tells us about the relevance of the tone transfer, between the scene (our target) and the image, and evaluates whether each area of the image (highlights, half-lights and shadows) is in place.

The OECF allows us to make estimates about the relevance of the camera exposure, presence of curves introduced during image processing or to evaluate the neutrality, or balance between the different RGB channels.

Unlike Delta-e evaluation, the OECF is only done on neutral patches and is especially oriented for use with densitometric scales. Since the OECF has to be related to a reference, it is necessary to load a reference document in CGATS format with the colorimetry of the samples to be studied.

For the OECF only the densitometric or grey scale is studied. For the calculation of the OECF on a Colorchecker Classic color chart, the chart type GS Colorchecker Classic (GS, Grey Scale) is used. It is necessary to include a reference file with the Lab mode colorimetry of the gray scale to be studied, in ImageQA a default file of the gray scale of the Colorchecker Classic is incorporated.

The implemented metrics have been expressed as follows:

OECF: represents the transfer of everything in relation to the reference provided in the reference document. The Y-axis is expressed in the standardized Luma in percent.

RGB: The average for each sample is shown graphically for each R, G and B channel so that we can discern the channel balance for each sample

RED, GREEN and BLUE show the OECF for each channel compared to its reference. The Y axis is expressed in CV or Count Values for 8 bits (0-255 units)

DEV: expresses the exposure error in terms of EV, i.e. how much error we have made in the exposure (relationship between camera and processing) when generating the image. In an image, where there are no tone curves applied, all samples should have an approximate error, in images with tone curves, high lights and shadows will have disparate errors.

The statistics shown along each metric are as follows:

Err Average: shows the average difference between the values of each sample and its reference.

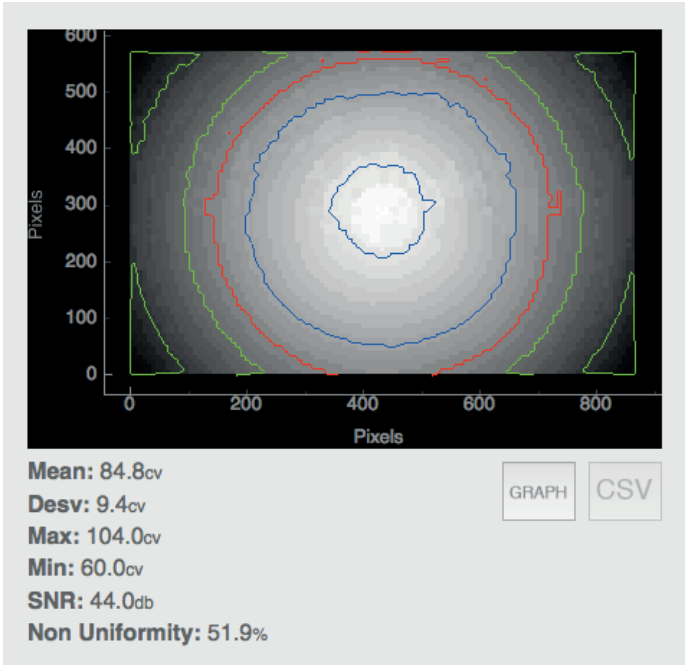
Err Dev: is the standard deviation of the average error for each sample.

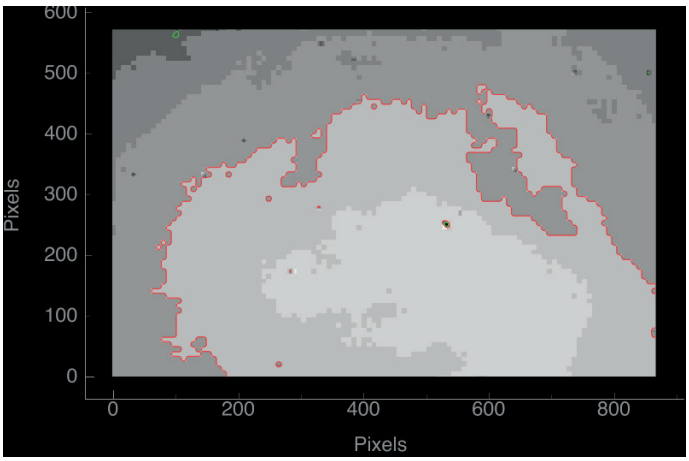
Err Max and Err Min: are the maximum and minimum errors in the set of patches studied.

Avg Dev, Max Dev and Min Dev: they only appear in the RGB panel and indicate the maximum and minimum average deviation for each sample. The higher the average deviation, the more error in neutrality there is in our samples.

Example of the Colorchecker Classic card type with its 24-patch identification pattern.

Light Falloff





Light Falloff allows us to quantify the variation of light intensity along a uniform surface in reflectance.

Light falloff allows us to quantify lens vignetting for different apertures as well as uniformity of illumination along a plane if we discount light falloff from lens vignetting.
The study of light falloff is essential before the capture of our charts, to ensure that the light falloff does not affect our chart in an uneven way causing errors when quantifying the OECF or Delta-e.

The fall of light has been represented by isolines, where red represents the average zone, green the zone of less intensity and blue the one of more intensity. The distance between curves is equivalent to a variation of 10 hp, so 5 isolines will be equivalent to a light drop of 50 hp along the image.

For the fall of light it is necessary to have an image or photograph of a uniform area, without gradients or textures, in order to study only the distribution of the light and that this is not distorted by textures, it is convenient to slightly defocus the image.
To determine the area to be studied, the ROI (Region Of Interest) type pattern is used. This can occupy the whole image, or a part of it.

The statistics shown on the uniformity are:

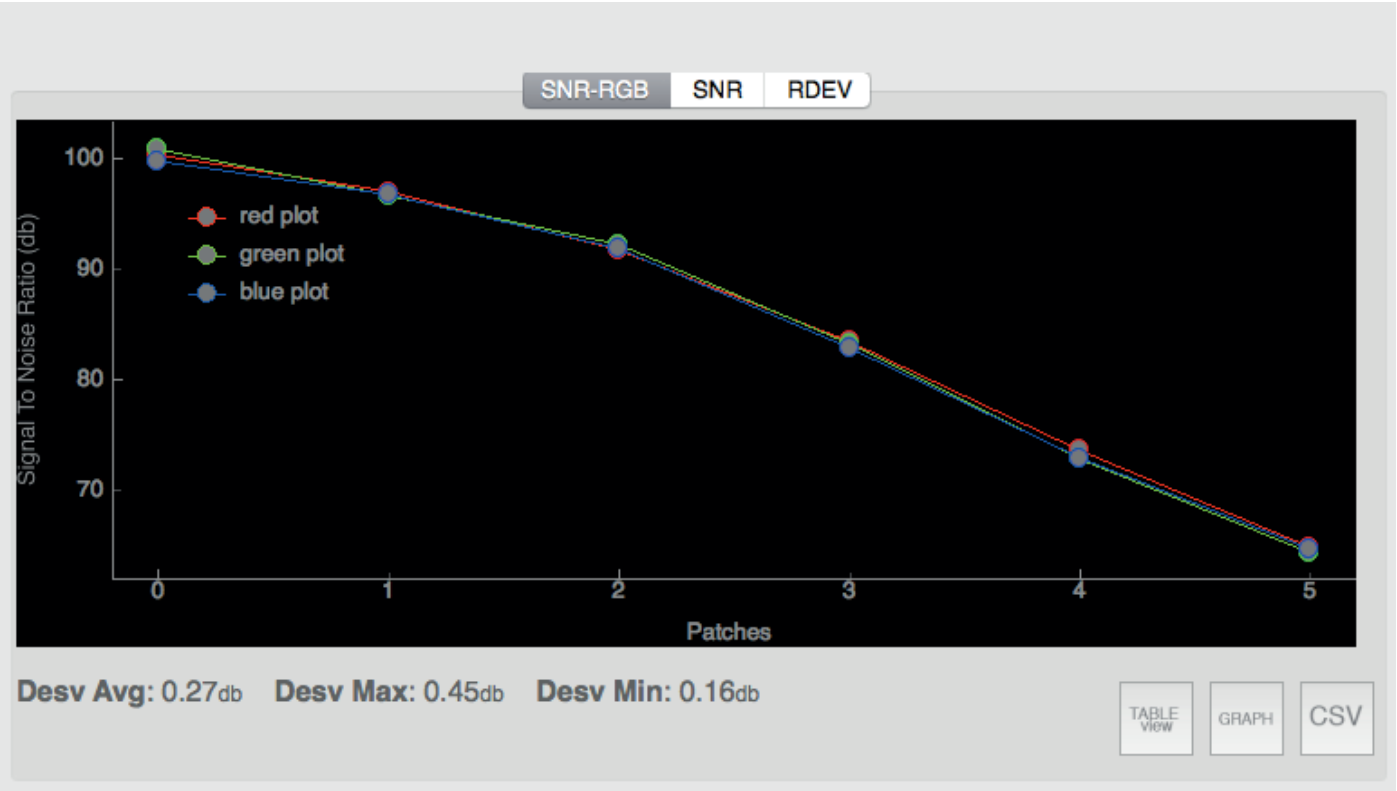
Mean: or average of the pixels in the scene

Dev: the standard deviation.

Max and Min: the maximum and minimum values of the scene

SNR: the signal-to-noise ratio of the image.
Non Uniformity: this is in relation to ISO 17957:2015 and indicates in % the lack of uniformity, the more value the more light drop.

Noise



The noise, measured in db (decibels), quantifies the Signal to Noise Ratio, i.e. the amount of signal as a function of the amount of noise. In this way, the higher the SNR, the greater the signal, which implies the absence of noise. Characteristically, any SNR graph taken on a tonal or densitometric scale will present less noise towards the high lights, and more noise towards the shadows. The lack of coherence in this evolution can inform us of noise reduction processes during image processing or defects in the signal processing of our equipment.

The noise is studied on a densitometric scale or gray scale as the OECF, therefore the same type of pattern is used as the OECF. For the noise calculation, it is recommended a slight blur in the image, to avoid that the possible texture or lack of uniformity of the scale is studied deviating the estimation of the SNR.

The SNR information is shown through the following dialogs:

SNR-RGB: shows the SNR for each R, G and B channel, so it is possible to evaluate which channel has the best signal-to-noise ratio and the coherence in its evolution. For example, neutrality adjustment processes (white balance) can induce more noise in some channels than others, due to the lack of signal.

SNR: shows the SNR along the luma.

RDEV: shows the dynamic range of the scene studied in terms of EV.

The statistics shown are:

Avg Dev: it is shown only for SNR-RGB and it shows the average deviation along each sample in relation to the difference between its channels.

Max and Min deviation: it is shown only for SNR-RGB and it indicates the maximum and minimum deviation along the channels and samples.

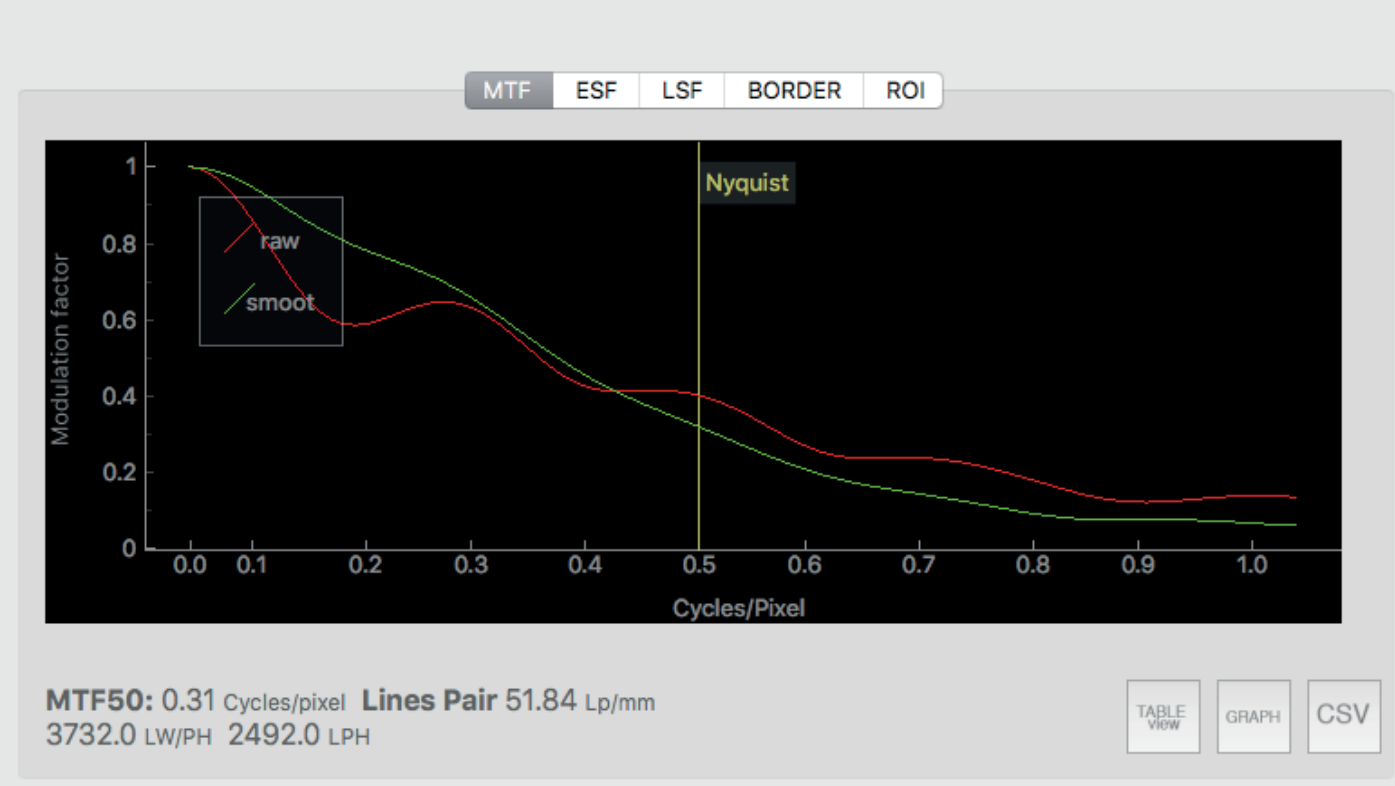
Average: it indicates the average SNR

Dev: indicates the standard deviation

Max and Min: the maximum and minimum SNR peaks.

Ejemplo del uso del patrón de reconocimiento GS Colorchecker Classic para detectar la escala de grises en exclusiva.

Acutance



The MTF (Modulation Transfer Function) tells us about the acutance, or ability to resolve the detail of a system regardless of its resolution in terms of pixels. Thus, an image may have many pixels, but may not have detail due to lens effect, shaking, depth of field, etc.

The MTF can not only be used to quantify in absolute terms the sharpness of a system, but it can also be used to evaluate other circumstances such as loss of detail due to trepidation or depth of field.

An RGB or grayscale image can be used to calculate the MTF, but it will always be studied in monochrome mode. To define the area to be studied, the ROI type pattern is used. If we study images that approach a large surface, and we define a very wide ROI, ImageQA may give an error, the same as if the edge is not well centered.

To calculate the MTF we need a “sloped edge” target

The dialogs show:

MTF: indicates the MTF characteristic curve in cycles/pixel

ESF: tells us about the "softness" of our edge, where it is also easy to highlight the work of focus improvement filters and the formation of "halos" during these processes.

LSF: Shows the sharpness of the edge.

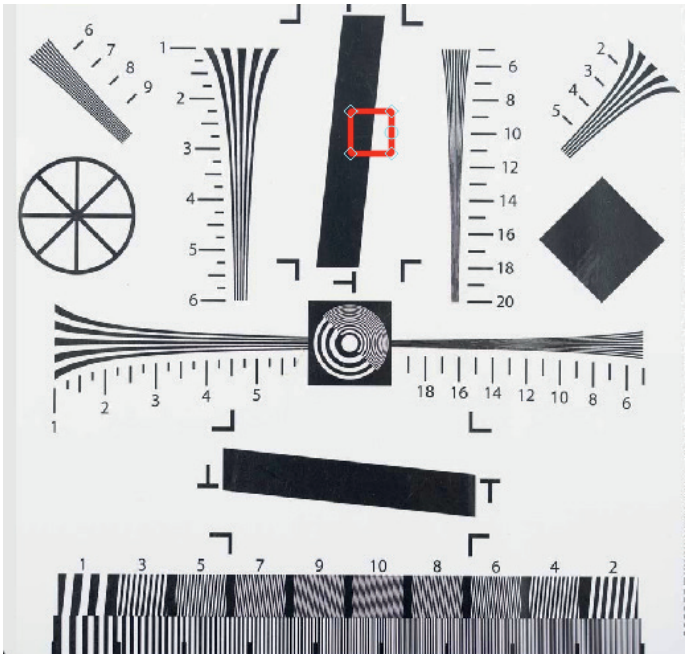
The MTF statistics are shown in the following metrics for the MTF50:

C/p or Cycles / pixel
Lp/mm or Line pair / millimeter
Lw/Ph or Lines Width / Picture Height
LPH or Lines Picture Height

Lp/mm, Lw/Ph and LPH metrics use the sensor data, such as its size and derived pixels, so they must be set in advance in the camera information panel.

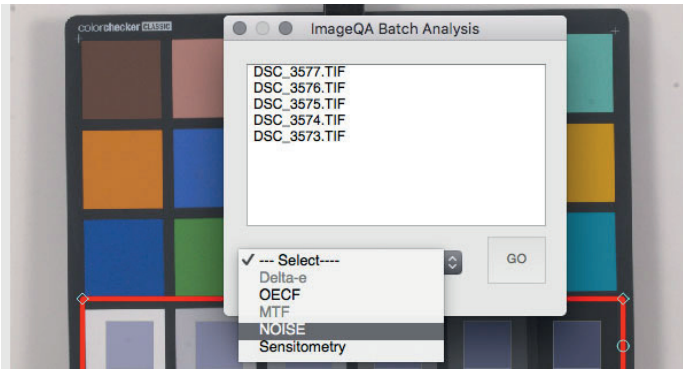
The camera information panel is only active with the Region Of Interest (ROI) pattern model that is used to determine the area where the MTF will be calculated. The camera information pane will ask for sensor size data in millimeters and in pixels, which will be used to calculate the pixel pitch used for metrics such as Lp/mm.

The camera information is partially extracted from the metadata and from the size of the image under test, so if our image is a clipping these data will be wrong and it will be necessary to adjust them manually.



ROI on a sloping edge. It can be drawn on both vertical and horizontal edges. An inclined edge is defined as one that has a 5º slope
ImageQA works with images that have a white or light gray background. Images with a dark gray can be misleading.

Batch



It is used to evaluate a set of images whose color management is disparate, for example with color profiles designed under different parameters or tools, or where different parameters have been introduced in the processing that affect color.

For batch processes, we must capture all the images with the same frame so that the pattern to be detected is in the same area. Then, the "Batch Analysis" button is activated and we select the test to be performed. The tests are filtered by the possibilities of each type of pattern.

OECF

Through this test, we can study differences in tonal reproduction for a set of images, for example, images taken with different exposure or images taken with different processing formulas where different curves are involved.

NOISE

Similarly we can evaluate the evolution of the noise through images taken with different ISO to discern which ISO setting is more efficient for our equipment. It can also be used to evaluate the noise resulting from different noise reduction filters.

SENSITOMETRY

It is used to extract a sensitometric curve, i.e. to relate exposure settings to the intensity taken by the resulting pixels. These curves can be made by keeping the aperture fixed and varying the speed, or vice versa, but we can also make them for light sources that have intensity regulation such as flashes or LED panels.

Another frequent use is to study the stability of flashes, so that several shots can be taken at the same power and see if they develop the same intensity or make a curve along all the "power" steps available in our equipment and verify the linearity of it.