intelligent
image
enhancement
www.colour-science.com - Switzerland

ImageAdaptor™
UPLOAD · EDIT · ENHANCE · READY FOR PRINT

Q-Enhancer

from Colour-Science AG in Switzerland

Introduction

Q-Enhancer is a fully automatic solution for image enhancement and output device profiling built for high volume digital production environments.

The Q-Enhancer system helps to achieve standadized quality for digital printing which is independent of the output unit.

Features

Automated unattended image processing.

Image Enhancement including:

Projects

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Adaptive Brightness and Contrast Enhancement (ABE)

The adaptive Brightness and Contrast enhancement stage uses SVM (Support Vector Machine) object recognition technology to classify the images and so determine the optimum settings for white- and black-point level and for the gamma correction.

The underlying SVM classification models have been trained with a large sample image set. The special class dependent corrections are automatically extracted out of this image database, but they can also be manually adapted if this is needed.

The advantage of this technology is that difficult scenes like snow-, night-, portrait, flash-, and other images are detected and so the optimal corrections can be made.

Examples

White point:
Skin tone −35% correction

Black point:
Pure black +0% correction

Gamma:
Center weight 70%
= −15% correction

White point:
White −0% correction

Black point:
Pure black +0% correction

Gamma:
Snow = +25% correction

Q-Enhancer comes already with well determined black/white point and gamma models. It is possible to adapt the behaviour of the ABE enhancement for special applications.

Adaptive Colour Enhancement (ACE)

The adaptive color enhancement can remove linear and nonlinear casts. Nonlinear means that the color cast in the shadows can be different then the cast in the highlights.

ACE is in fact using the same classification engine as ABE to differentiate a normal color cast situation (where the black and white point have a neutral color balance) from special cast situations like artificial light, portrait with skin tone white point, colored black point (for example in the green trees)...

Examples

Exampels of uncorrected digital camera images which require special colour corrections:

White point:
Artificial light (yellow)

Black point:
Pure black +0% correction

Problem:
The white point is strongly coloured. ACE detects this as an artificial light scene. ACE should not correct this colour cast in the white point.

White point:
Blue sky

Black point:
Brown bushes

Problem:
This image has nearly no neutral tones. Even the black point and the white point are strongly coloured. ACE has to detect the white point as sky and the black point as brown bushes.

White point:
Skin tone (flashed)

Black point:
Brown artificial light

Problem:
This image is difficult to correct as it is a mixed light situation with artificial light and flash. The forehead is the brightest point and has to be recognized as a skin tone white point.

Shadow and Highlight Enhancement (SHE)

The SHE enhancement is one of the most important image enhancement steps. The enhancement results are obvious especially in the shadow areas where much more detail will be shown.

SHE also acts on the highlights which are near saturation. A good example are flash portrait images shot at night. Here SHE tries to bring back some skin details in the overexposed "flash head".

Original image

SHE enhanced image

Examples

Digital camera image

SHE enhancement on

Memory Colour Enhancement (MCE)

The MCE Memory Colour Enhancement is a local colour enhancement of key colours which have to be plesant for the human eye.

These are colors of skin, sky, vegetation and others. For these colors we have memorised a pleasant reference colour in our mind. Because of this we call them memory colors.

Skin tones should for example be rather warm tones, vegetation should show a nice saturated green and especially not be to bluish. The sky should be more bluish than grey. For these colours we define attractive Memory Colour Points which pull non pleasant colours closer to more pleasant colours.

We also define repulsive Memory Color Points which tend to push of unpleasant colors like magenta colour casts towards more pleasant colors.

Examples

Memory Color example:

In this example the vegetation colour changes from a dark bluish green to a warmer more pleasant green.

The shadows enhancement increases the brightness of the dark vegetation scenes.

Memory Colour Enhancement

The combined power of SHE and MCE

Details in the shadow area are accentuated.
Highlights are reduced to restore skin details.
Skin colour is enhanced locally.

Examples

This is the original digital camera image.
The foreground is overexposed by the small camera flash and the background is nearly black.

SHE will lighten up the shadows to bring out the details of the book shelves. The overexposed "flash head" is made slightly darker to bring back the skinn details.

MCE detects skin colour in this image.
The MCE Memory Colour Enhancement will now drag the detected skin colour to a more pleasent colour.

Local Sharpness Enhancement (LSE)

The LSE algorithm is performing variable sharpening of the image depending on object recognition algorithms. It is so possible to locally sharpen vegetation and edges and even smoothen objects like sky or faces.

This algorithm will achieve specially good results on images coming from cameras with noisy CCD's and low resolution images from camera equipped cell phones.

Examples

This is the original digital camera image.

Detail：

The traditional sharpening will also increase the grain in the sky. This grain is normally due to camera noise.

Detail：

The LSE sharpened image shows the same sharpening effects like a traditional sharpening on some important parts (vegetation, edges..) while reducing substantiallly the noise in the sky.

Detail：

Red Eye Removal (RER)

Due to always smaller cameras the flash moves always closer to the objective. A result of this miniaturization are the red flas eyes. The RER algorithm detects and removes "Red Eyes" fully automatic.

Examples

Original digital camera image

Q-Enhancer processed image

Local Noise Reduction (LNR)

The LNR algorithm is performing a special noise reduction on some parts of the image. This algorithm mainly reduces thermal noise in the spatial domain.

This filter is specially useful to get rid of heavy noise which could for example be an obstacle for a good shadow enhancement. The filter may also be used to reduce quantization noise due to high compression.

The big difference to a standard noise reduction filter is edge preserving and that it only acts on selected parts of the image and does not simply make the whole image unsharp.

PROJECTS

Local Jpeg Artefact Removal (LAR)

The LAR algorithm removes DCT (Discrete Cosine Transform) quantization noise which is generated with the Jpeg compression. This algorithm is very useful if small images coming from MMS (Multimedia Messaging System) should be printed in good quality.

The resolution for MMS cell phones is today about 480x640 pixels and the images are normally compressed to about 40 kb compared to about 1 Mb for a image from a digital camera.

Examples

Original image (zoomed) showing strong jpeg artefacts

Image (zoomed) after jpeg artifact removal

Edge Preserving Upsampling (EPU)

Another major problem when trying to print small images is the fact that conventional resizing algorithms like bicubic show bad results if you have to upsample small images.