Sebastian SŁOMIŃSKI

Warsaw University of Technology, Lighting Technology Division

The correct image of illuminated object registration - problems arising from software capabilities and equipment limitations

Abstract. *Illumination of building is a very rapidly growing part of the lighting technology field. In fact, the only one method of static images recording of illuminated object at night, is digital photography. The correct registration of the object illuminated images, with correct white balance and true luminance distribution is technically complicated. In this paper the typical problems connected with photography of illuminated objects at night and methods for their reduction will be presented.*

Streszczenie. *Iluminacja obiektów jest bardzo dynamicznie rozwijającą się częścią szeroko rozumianej techniki świetlnej. W zasadzie jedyną metodą rejestracji statycznych obrazów, zawierającą iluminowany obiekt w porze nocnej, jest obecnie fotografia cyfrowa. Poprawne wykonanie zdjęcia iluminowanego obiektu, oddającego prawidłowy balans bieli oraz niezafałszowane poziomy luminancji na elewacji obiektu jest technicznie skomplikowane. W tekście przedstawione zostaną typowe problemy związane z fotografią nocną obiektów iluminowanych oraz metody ich ograniczania.* ***(Prawidłowa rejestracja obrazu obiektu iluminowanego - problemy wynikające z możliwości oprogramowania i ograniczeń sprzętu).***

Keywords: Lighting Technology, Illumination of building, photography
Słowa kluczowe: Technika świetlna, Iluminacja obiektów, fotografia

Introduction

Proper execution of the illuminated object picture at night or execution of a good photo with Illuminated street for example it not easy. Additionally, there is a possibility to make technically correct photography, which mislead the viewer – intentionally or not. Should also be noted, that modern graphics software used for the processing of images allows almost unlimited interference in the recorded image (the possibility of global and local parameters changes). It may be deliberately used to improve, or correct deficiencies or pictures, resulting from incorrect camera settings or technical limitations of equipment elimination. The problem arises, however, when the software layer, will be used to „improvement" of registered photo to conscious mislead the viewer.

Each registered pictures, used to evaluating of correctness of the lighting project or having to provide as close as possible to reality image of the object at night, should be supplemented with camera parameters, which was used during taking the picture and have an information, whether and how far-reaching changes have been made during picture post processing by software. Usually we cannot completely eliminate the initial electronic interference in registered picture, but we can these camera interventions significantly reduce, consciously using the hardware capabilities.

Digital Photography

The first point to consider, why digital camera manufacturers adding to the enrich the software of digital cameras in the "filters" and other allowances, which are designed to make captured image more attractive. This is related to the main area of digital cameras application. In most cases, they are not used for precise documentation of the ambient place, but to register image, will be pleasant for the person looking at it. In the landscape pictures, we want to see the lush greenery, saturated blue sky and bright colors of registered objects (clothes, animals and the other objects). Therefore, all the popular camera electronic, performs an initial intervention in the recorded image, to make it more attractive. The relationship that the cheaper and easier to use the camera has less potential to reduce this interferences. Worst possible performance for correct technical photography have devices, capable only record JPEG files, which are saved with a lossy compression, using only 8 bits per "pixel".

More expensive solutions, which are digital SLR's (and compact cameras without mirrors, with interchangeable lens), have the ability to capture images in files, which have a much better ability to register the details connected with color and brightness. RAW format is most popular. It's like a „digital negative", raw view recorded by camera matrix. This format have no loss compression and offers a much greater dynamic range than most other formats (12, 14 or 16 bits per pixel). It also stores a lot of additional information connected with the settings used during the image recording. This allows the correction of some very important parameters as post processing (white balance for example).

This is the most useful, when we have difficult lighting conditions, and we know, that we will want to modify photography later by computer software (using HDR or DRI techniques). Most difficult lighting conditions occur when we trying to photograph illuminated objects (particular objects illuminated by an architecture floodlighting method).

Dynamic range

The dynamic range describe - how many times the brightest (not white) area in the picture is brighter than the darkest shade (but not black). Making an object illuminated photograph, most areas containing a high luminance (luminaries area), are overexposed, while the dark areas are underexposed (the picture is not usually recorded in this part of any data or residual data are recorded). The human eye when „live" viewing the object at night, is able to capture accurately both strongly lit areas, and generally not illuminated also.

At this point the question arises whether being aware of the technical limitations of equipment (recording, displaying and printing), save images as it "sees" by the camera, or you try to "improve" the recorded image to be more similar to the human eye actually sees?

In this paper, all the considerations will be connected to the second variant.

HDR/DRI

To up close the recorded image to what human see, we should pay attention to two things:

1. save images in RAW format only (one or many),
2. make post processing of image (if necessary), using HDR/DRI technique,

HDR(High Dynamic Range), is a technique that prefer a image source recorder as RAW file - performance of the image in HDR technology from a single RAW file, or

multiple RAW files, using multiple exposures of the same scene. The second alternative gives a much higher processing capabilities of the material obviously. This possibility offers the technique contained in many modern cameras, named as bracketing. Bracketing - a series of shots of the same scene at a fixed aperture and exposure changed with a predetermined pitch.

Fig.1. Staszic Palace in Warsaw floodlighting (without cropping and post processing)

How difficult is to implement a "good" pictures, shown in Figure 1 (the same object example) – all photographs was made with automatic mode and saved in JPEG files. Recorded images have white balance differences, and for each of them acceptance of illuminated building is different. To get an attractive visual effect (brighten underexposed areas and reduce out of dynamic range fragments) we can make a few photos with different exposure (most 3 – fig. 2). As a result, the appropriate use of information stored on each of them we can get a picture similar to the image visible by the human eye. To properly set the white balance at the capture time, we have to use white pattern.

Image processing allowed us to obtain the final graphics, containing the extended information associated with registered objects. Figure 3 shows the deliberately "exaggerated" resulting image to show the technology possibilities.

a) 

b) 

c) 

Fig.2. Orthodox church in Wola in Warsaw floodlighting, registered at three different exposure times in RAW files.

The question that arises while watching the final image relates to the fact how much the resulting image (fig. 3), if different than basic RAW picture (fig. 2b), registered by digital camera, which contains a smaller percentage of overexposure and underexposure than 2a and 2c images.

Fig.3. HDR result, obtained by combining 2a, 2b and 2c images.

Summary

For the final result is not in doubt, is there still a photo, or just graphics without connection to reality, belongs to each image (modified or not), include:

1. detailed table containing the parameters was performed at the photograph and description of equipment used (fig. 4),
2. differential image showing how the final version differs from the primary source file (fig. 5),
3. table containing the list of eventual post processing modifications made after shooting (table 1),

A differential should be generated as the difference between original image and the image after modifications. It can be presented in the positive or negative form (decision should be dictated by the readability of the final image). In our case, if the images: before modifications and final image not do not contain any differences, a differential

picture (fig. 5) would be white. It should be noted that in order to correctly generate a differential, both images should have the same resolution. Therefore, scaling picture should be the last step in the preparation of photographs for publication.

Parameter	Value
Camera body	Canon EOS 50D
Lens	Sigma 17 – 70
Focal	17mm
ISO	100
Shutter	f/2.8
Exposure	1/500
File format	JPEG/ RAW/ …
Change of exposure as post processing	± EV
Photograph interference ?	Y/ N
HDR / DRI	Y/ N

Fig.4. The parameters at which the photograph was performed

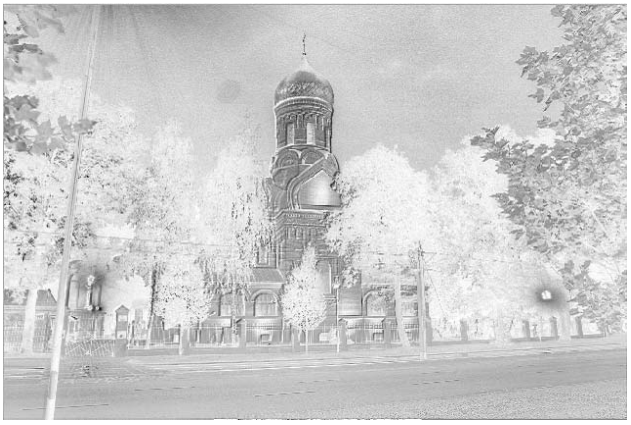

Fig.5. Differential picture

The above information set allows for an unambiguous statement, how changes have been made and give ability to fully restore the conditions under which the image was recorded.

Allowing replicate conditions also facilitates knowledge of parameters such as:
- longitude and latitude,
- date of the photo,
- hours of the photo.

All these parameters can be obtained already after a photograph, using the "EXIF" data, recorded by every modern digital cameras.

Table 1. A list of modification by specialized software

Canon EOS 50D - Sigma 17-70 f/2.8@ 17mm f/5.6 Iso: 100
7 exposures (-3,-2,-1,0,1,2,3)
HDR photograpy i tonal correction using Photomatix Pro
Post Processing and color corrections in Photoshop software
Detail emphasis by Nik Software Sharpener Pro
Sharp edges using Topaz InFocus
Zone of saturation and contrast correction

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***Author**: Dr. Eng. Sebastian Słomiński, Warsaw University of Technology, Lighting Technology Division, E-mail: sebastian.slominski@ien.pw.edu.pl;*