Computational photography - programming exercise #3

Due: Jun 19, 2022

The purpose of this assignment is to implement direct global illumination separation in an image, along the line of the paper *Fast Separation of Direct and Global Components of a Scene using High Frequency Illumination*, by Nayer et al. `http://www.cs.columbia.edu/CAVE/projects/separation/`

Specifically you are given in the supplementary data a sequence of images where a stick was moved to create a shadow. You can model the shadow pixels as a global component only and the non-shadow pixels as direct+global. Therefore you get that

$$I_{global} = I_{min}, \quad I_{direct} + I_{global} = I_{max} \tag{1}$$

with

$$I_{min}(x, y, c) = \min_t I(x, y, c, t), \quad I_{max}(x, y, c) = \max_t I(x, y, c, t) \tag{2}$$

(As the shadow area in these stick images is very narrow it is fine to neglect the α component from the equation we presented in class.)

In the second part you are requested to capture your own stick images and show a direct/global separation. Note that many cameras apply gamma corrections on the radiance they measure so you should expect some inaccuracies, yet you can get some interesting decompositions. Nowadays some cell phone cameras allow access to RAW data, as well as scientific cameras. If you have access to cameras that provide RAW data you are likely to get better results. However, it is worthwhile trying with simple cameras as well.

Deliverables

Your solution should be a ZIP archive that includes the following:

- A Matlab functions with the formal `[Id,Ig]=seperateDirectGlobal(dirname)`, where `dirname` is the name of the directory from which you read all `*.jpg` images, and `Id,Ig` are the direct and global components you have separated.

- A written PDF named studentID1_studentID2.pdf (write your ID numbers instead of studentID1, studentID2) report with 1)the separated direct and global images and a discussion of the results. Which global components can you notice and how can you detect them? 2) Some sample input images you captured yourself, and the direct/ global results you achieved. Please discuss this result.

- Wrap all the matlab files, PDF and images into a single zip file name: studentID1_studentID2.zip (again use your IDs here)