Bo Zhu, Li-jun Xie, Guang-hua Song, Yao Zheng
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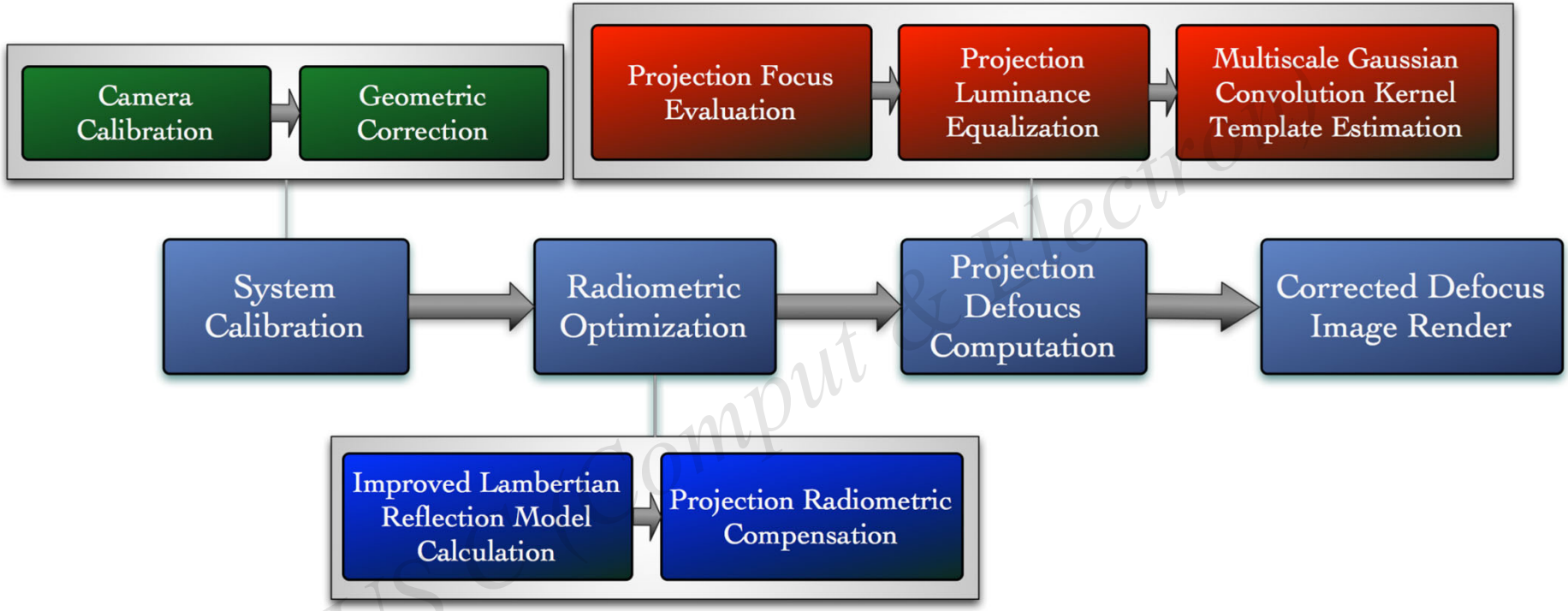
An efficient projection defocus algorithm based on multi-scale convolution kernel templates

基于多尺度卷积核模板的投影图像模糊消除方法

Key words: Projection focal, Sobel-Tenengrad evaluation function, Projector defocus, Multi-scale convolution kernels

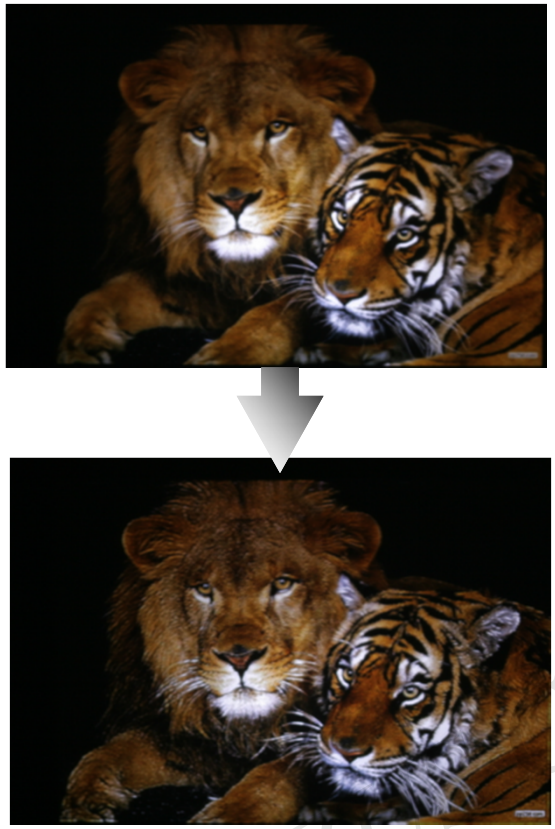
关键词：投影焦距；Sobel-Tenengrad评价函数；投影模糊消除；多尺度卷积核

Method



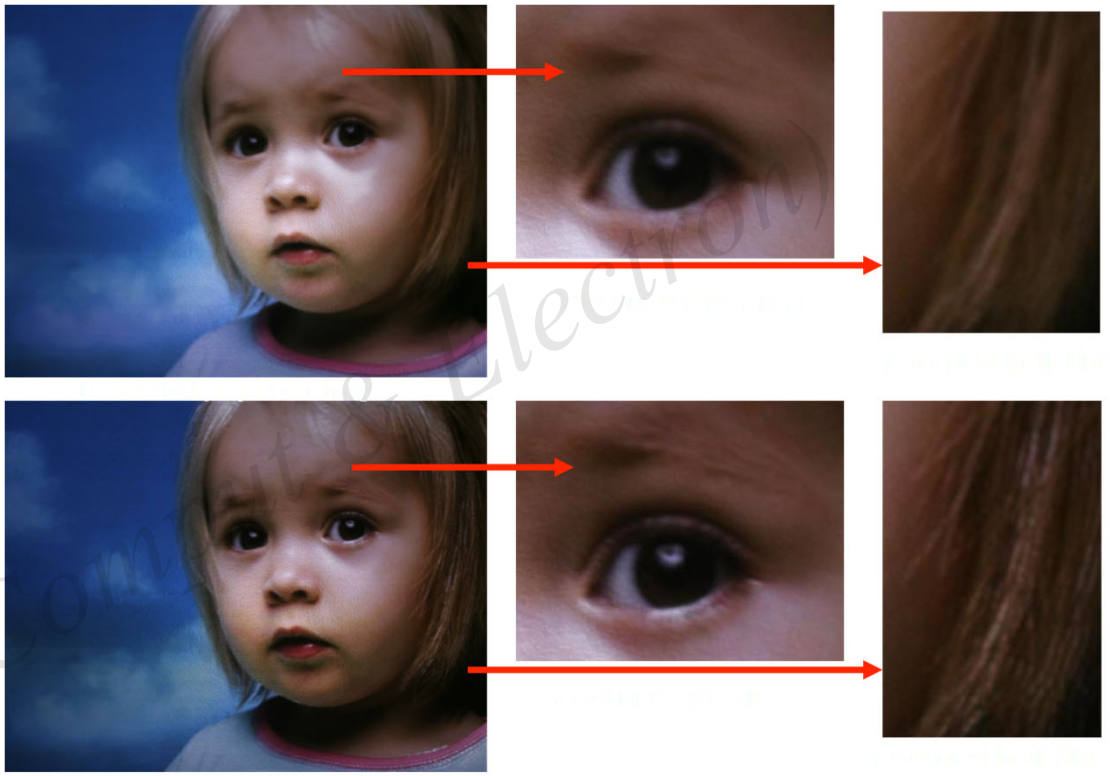
The algorithm runs on a self- designed smart projection system. Based on geometric calibration and radiometric compensation optimization for projection images, the main projection defocus correction algorithm applies a novel modified ST focus evaluation function to calculate the degree of sharpness for intensity equalization, and constructs multi-scale defocus convolution kernels to remap and render the defocus projection images.

Results



Experiment 1

In local area analyses about corrected projection image (bottom row), details of the hair of the lion and the beard of the tiger can be observed, and the sharpness and color of the whole picture are similar to the original image (top row)



Experiment 2

The magnification of various regions of the captured experimental images shows that the detailed textures in the eye and hair regions (top row) of the image are difficult to distinguish. From the captured defocused projection image, an observer can detect clear textures in the eyebrows and eyelashes, and the hair shows many more smooth lines (bottom row)

Contributions

- **The algorithm does not require multiple projectors or auxiliary optical calculation equipment to construct a complex defocus projection system, which makes the projection defocus system much simpler.**
- **This method provides a novel focus evaluation function to obtain a defocus estimation kernel template, in preference to applying the optimization iteration method, which requires considerable computational time for the multiple iteration steps necessary to ensure accurate defocus results. This improvement is very important to satisfy the need for projection defocus in real time.**
- **The significant defocus accuracy from applying this multi-scale convolution defocus computation and added radiometric optimization algorithm can effectively eliminate projection blur and enhance the defocus projection effect to adapt to environmental textures and satisfy the observer's visual criterion.**