FAKULTÄT FÜR !NFORMATIK
Faculty of Informatics

Diplomarbeitspräsentation

Lens Flare Prediction based on Measurements with Real-Time Visualization

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Problem Statement / Motiviation

Lens flare is a visual phenomenon caused by interreflection of light within a lens system. This effect is often undesired, but it gives rendered images a realistic appearance. Common approaches in Computer Graphics rely on accurate models of (spherical) lens systems. Internal camera parameters however – especially the anti-reflection coatings – can often only be approximated.

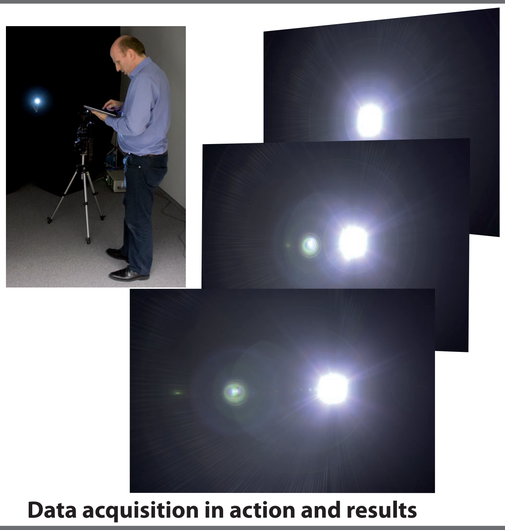
In this work, we analyze photos of lens flare to find parameterized descriptions suitable for physically plausible real-time visualization. The renderings can be used in light planning applications to avoid light positioning prone to inconvenient lens flare.

Disturbing lens flare in a broadcast

Data Acquisition

Lens flare depend on focal length, aperture and relative position to the light source (“constellation“). All possible constellations have been captured as input data.

A programmable panorama rotation head is used for image capture.



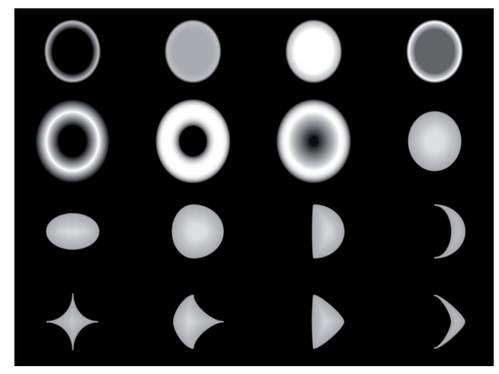
Data acquisition in action and results

Lens Flare Model

The lens flare model parameterizes the visual appearance of a lens flare.

An implementation on the GPU ensures efficient rendering.

Shape:	*Shade:*
center (x,y)	borderIntensity (b)
height (h)	innerIntensity (i)
left-side (l)	falloff (fl, fr)
right-side (r)	exponent (el, er)
curvature (l,r)	



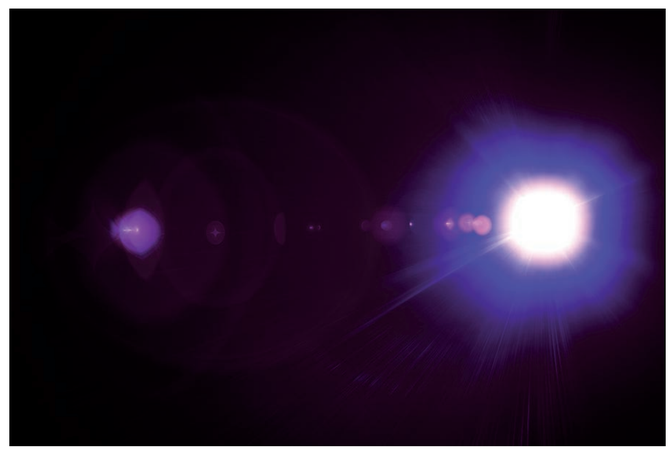
Model parameters and example shapes

Optimization

A user-driven initial step roughly maps the acquired photos to lens flare reconstruction parameters. The parameters are optimized to best fit the observations, using gradient descent.

To reduce the influence of background noise, the cost function considers edges in addition to intensity differences.

Lens flares‘ estimated parameters are used as starting values for the neighbouring photo. This semi-automatic optimization ensures efficient description of successive samples.



Optimization in progress (photography and rendering mixed)

Real-Time Visualization

For real-time rendering, we find a continuous representation of the discrete estimated lens flare using polynomial approximation. This leads to a strong compression of the captured data.

The resulting visualization allows for smooth transitions between the densely acquired smaples.

Dynamic ranges of lens flare and virtual scenes are aligned to composite renderings with other software as overlay.

Lighting Design

A lighting designer has to achieve certain design goals, while preventing camera to light constellations favoring lens flare. Using the continuous lens flare representation allows to explore various constellations.

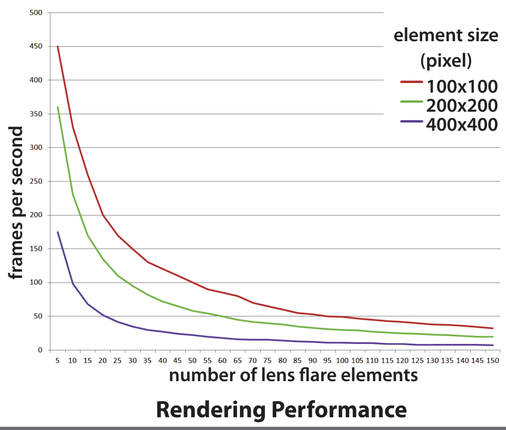
Additionally, a glare indicator has been derived from the continous representation. This allows quantitive evaluation and comparison of different constellation candidates.

Results, Conclusions, Outlook

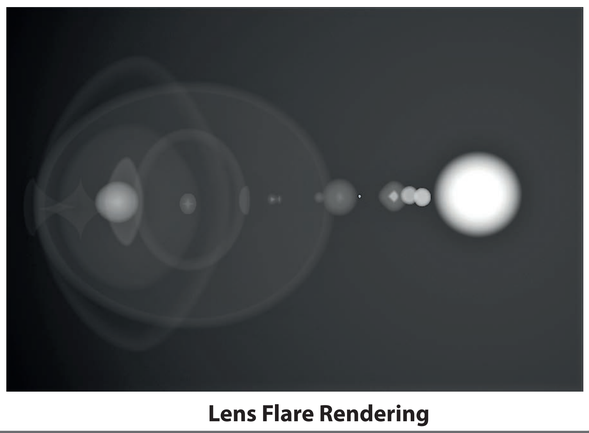
Our data driven workflow is able to generate physically plausible lens flare and does not rely on scarcely available lens system specifications. The acquisition prototype is camera independent and easy to use.

The rendering performance is real-time.

We intend to improve our technique to make it more robust and easier to use for lighting designers.



Rendering Performance



Lens Flare Rendering

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