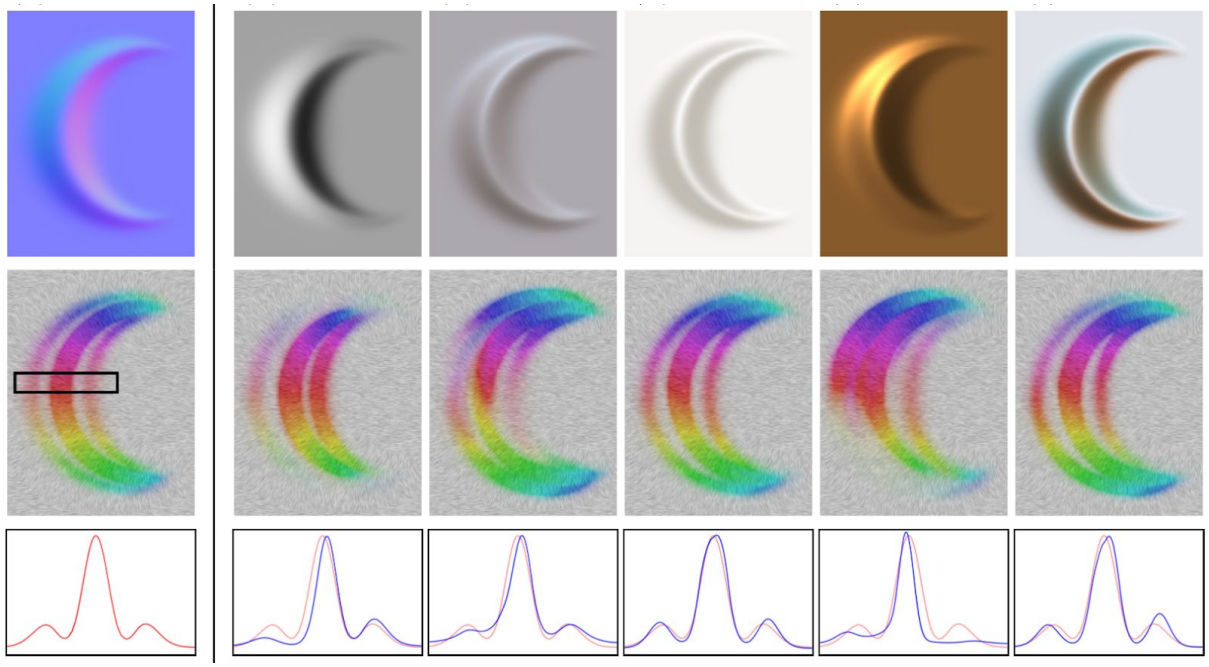
Analyzing correlations between shape/light/materials



Context

If we know quite precisely how light, shape and material interact together at a microscopic scale, the meso and macro-scopic patterns created in the images by such interaction are still unclear. In the above image, the simple (top-left) shape was rendered using different lighting and material properties. Even if the resulting images are very different, we still see approximately the same shape in all the renderings. Therefore, there exist invariant properties in these images that are correlated to the original shape, as we began to show in a previous paper (second and third row). These invariant properties are important, not only because they allow us to better understand the phenomenological links between shape, material and lights, but also because the human visual system is likely to use them to estimate the physical properties involved in an image.

Project

The goal of the project is to analyze a set of images with classic statistical tools, to better understand what are the image properties that are changing or not changing when physical input components are modified. For instance: what are the invariant properties in an image when rendered with the same object/material, but if the direction of the sun is modified? To that end, a robust methodology will have to be designed:

- Creation of a database of (controlled) images rendered with a physically-based renderer (such as mitsuba - http://www.mitsuba-renderer.org/index_old.html)

- Local analysis of each image using various statistical tools. Comparisons of the results with the input physical properties.
- Classification and design of simple models to test control these invariants.

This analysis will be useful to create new appearance models that will help to manipulate the physical properties in still images.

Bibliography

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Supervision

The project will take place in the Maverick team at Inria and be supervised by Joelle Thollot and Romain Vergne.