FAKULTÄT FÜR !NFORMATIK
Faculty of Informatics

Diplomarbeitspräsentation

Real-time Rendering of Measured Materials

Masterstudium:
Visual Computing

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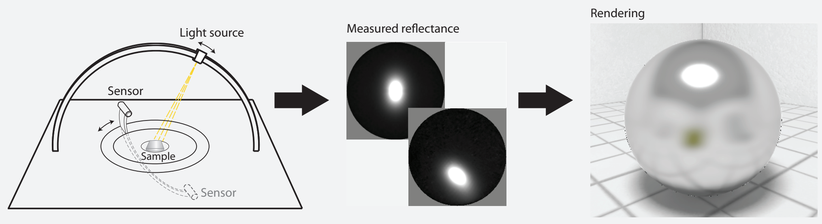
The problem / Motivation

I present an algorithm for the *real-time rendering* of *measured view-dependent materials*.

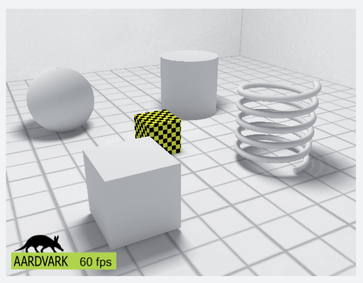
Main application: interactive walkthroughs of static scenes featuring view-dependent effects
→ high-quality presentation of architectural scenes / illumination solutions

Initial input: a light-mapped scene, illuminated by an external global illumination renderer
→ the algorithm dynamically computes a specular overlay as the view changes during walkthroughs

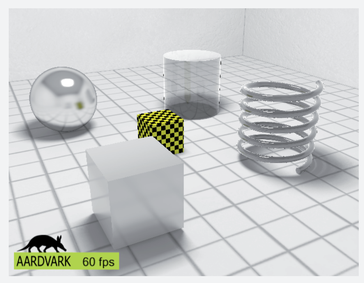
Major challenges / research questions:
→ how to represent measured material properties for fast evaluation?
→ how to compute the view-dependent illumination at each pixel, at 30-60 fps?



Measurement yields a realistic quantification of a material's reflectance behaviour



Only diffuse illumination (light map)



With specular overlay (thesis method)

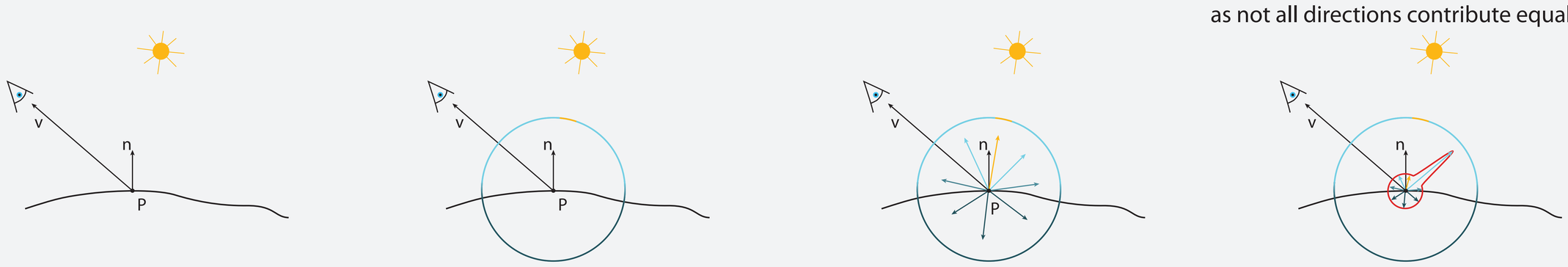
Methodology - approximating the view-dependent local illumination integral

1) A scene point **P** is shaded as seen from the viewing direction **v**

2) Incident light from all directions might get reflected into viewing direction **v**

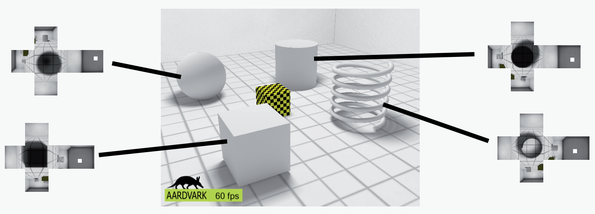
3) Thus, a *representation of the local incident light* is needed

4) Also, a *material representation* is needed that yields *sample weights for each direction*, as not all directions contribute equally

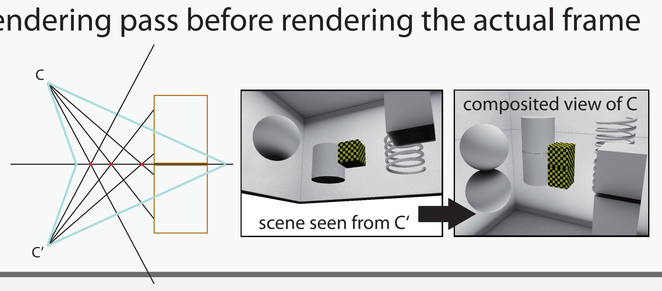


Representing the (approximative) distribution of incident light

For *curved* surfaces: reuse of one static cubic environment map per object



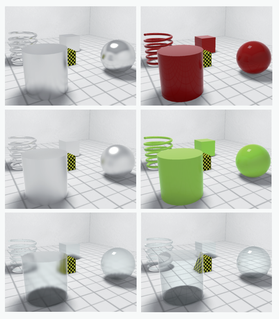
For *planar* surfaces: perform a planar reflection rendering pass before rendering the actual frame



Representing material properties

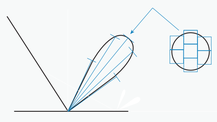
Fitting a model to measured data - **Contribution** - extension of a state-of-the-art reflectance model to allow transmission lobes

- isotropic / anistropic specularity
- Fresnel effects
- transmission



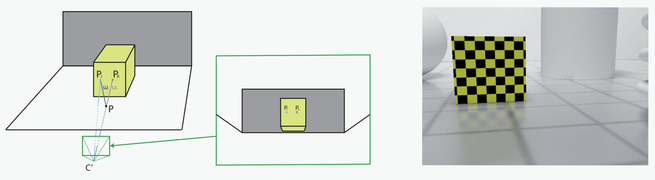
Performing the integration

Contribution - a deterministic uniform sampling scheme: Sample *only within the specular lobe* → biased, but fast!

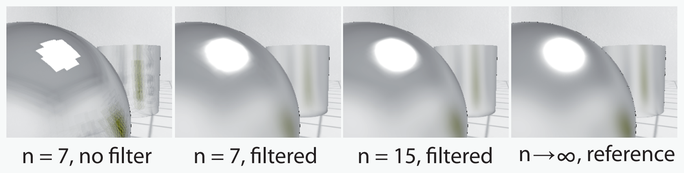


Strategic pattern ensures uniform lobe coverage:

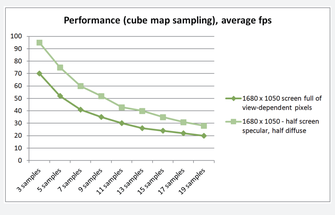
Contribution - mapping angular samples directly to sampling positions in planar mirror buffers

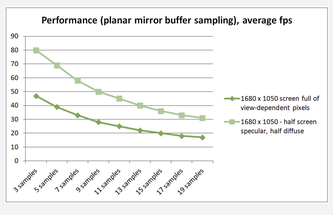


MIP-map filtering of the uniform samples to suppress aliasing - cheap alternative to taking more samples

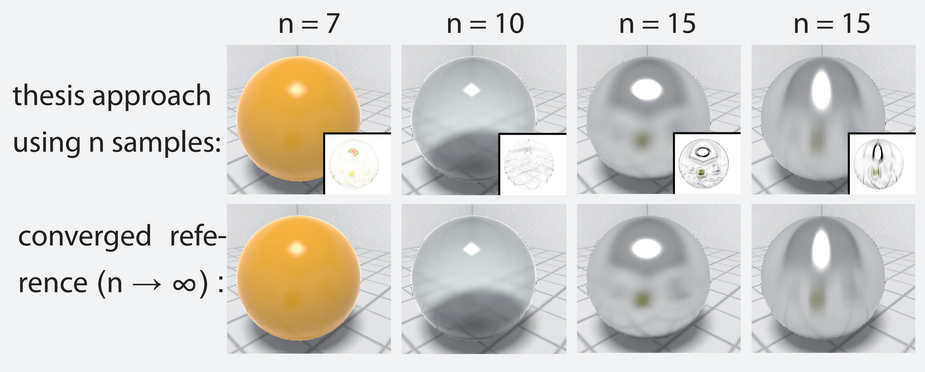


Results / Conclusions





The method achieves real-time frame rates on consumer hardware, even at high (1680 x 1050) resolution. More than 19 illumination samples were not needed for any of the test-datasets



Low sampling of wide lobes requires strong filtering to produce smooth results → high-frequency details are blurred out (floor tiling)

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