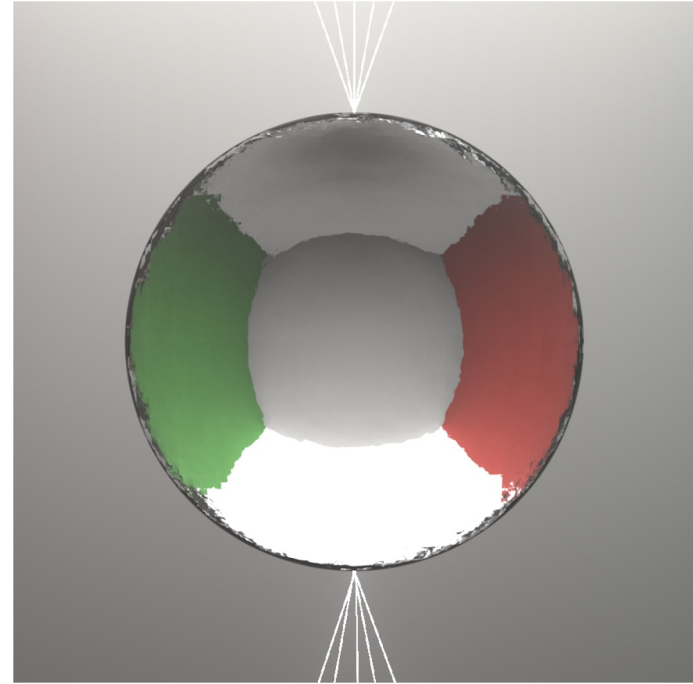
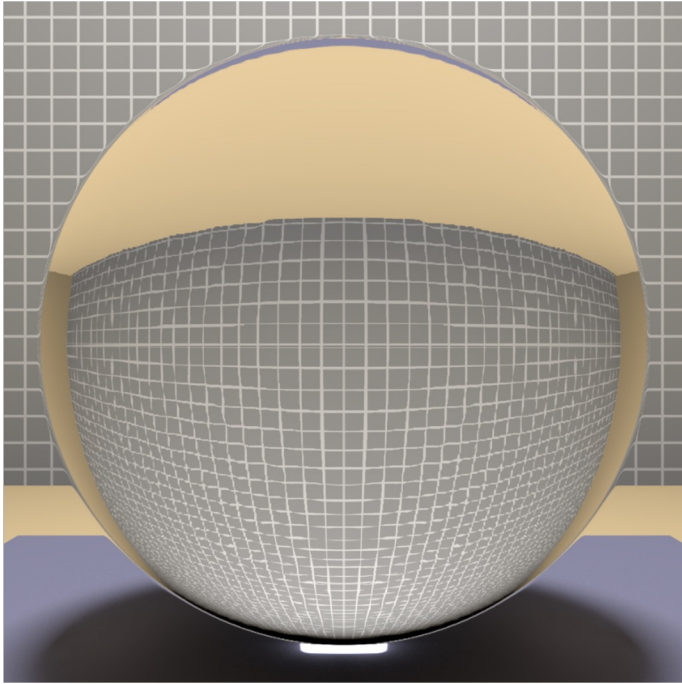


NONLINEAR DIFFERENTIABLE RAY TRACING RENDERING



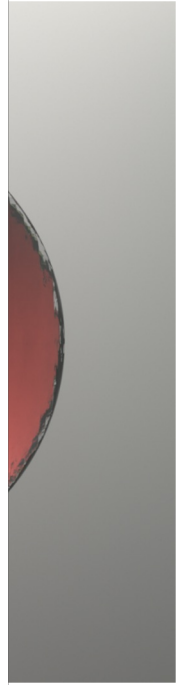
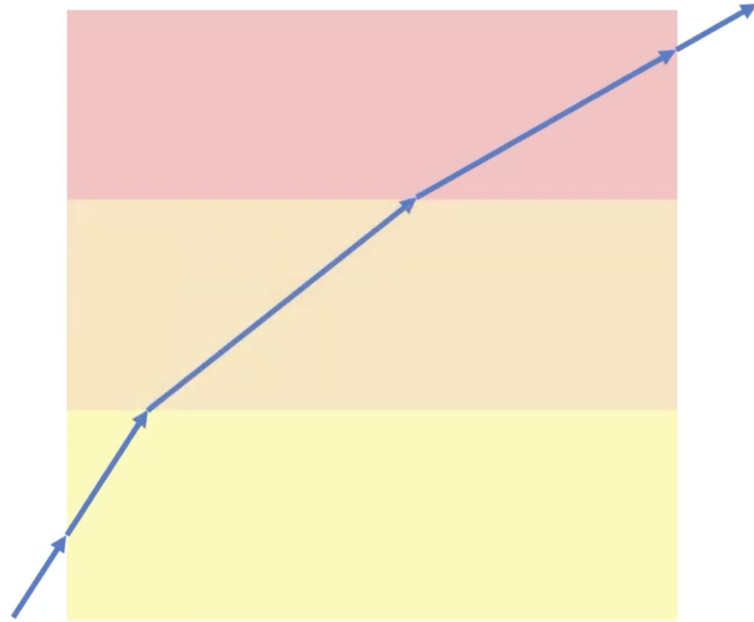
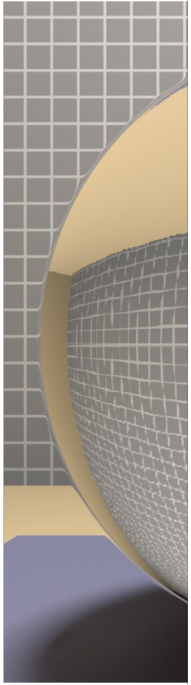
Jeong Uk Lee and Philipp Derr

NONLINEAR RAY TRACING

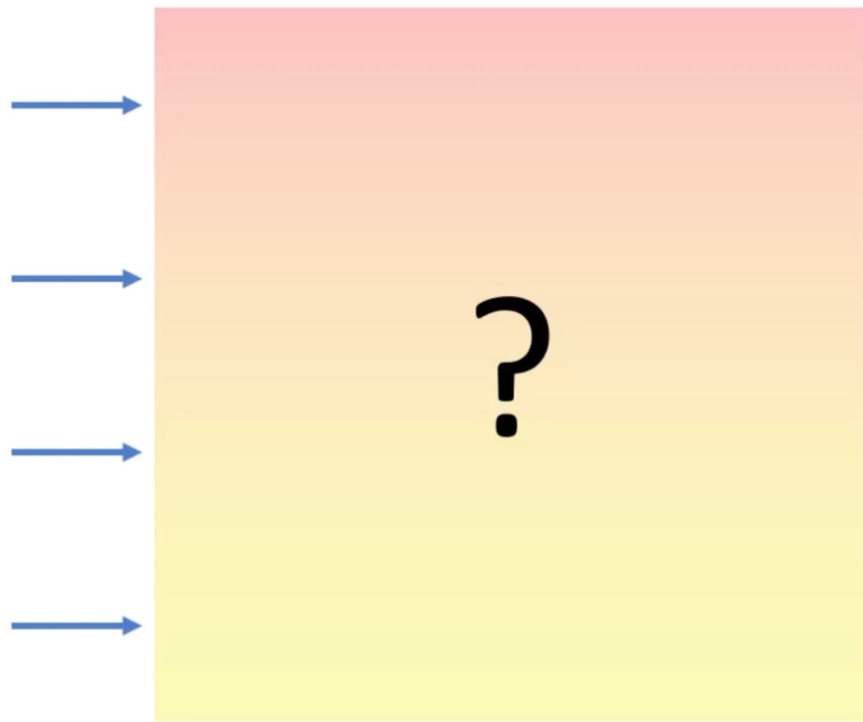


NONLINEAR RAY TRACING

Gradient Index



Inverse Rendering



Target Image

Problem

- Only available technique for Inverse Rendering for Nonlinear Raytracing is autodiff to calculate refractive gradient index
- autodiff uses huge amount of memory

Related Work General Idea

- **Adjoint Nonlinear Ray Tracing, Arjun Teh, Matthew O'Toole, Ioannis Gkioulekas SIGGRAPH 2022**
- Uses adjoint state method
- reduces memory usage
- still some limitations

Limitations

- **Initialization**

- requires a good initialization
- highly non-convex
- Exploring better initialization schemes

- **Sufficient measurements**

- unclear how many and what measurements are required
- for recovering recover the underlying refractive index field

Limitations

- **Scattering**

- only continuous refraction, no volumetric scattering
- can be combined with the refractive radiative transfer equation

- **Discretization bias**

- discrete numerical integration introduces bias
- Monte Carlo and randomization techniques could be introduced

Current Challenges

- trying to understand codebase of paper
- rendering some images
- many options to improve methode, but trying to focus on one solution

Sources

pictures are take from:

https://imaging.cs.cmu.edu/adjoint_nonlinear_tracing/