

ICT22-028 - Toward Optimal Path Guiding for Photorealistic Rendering

Abstract

Photorealistic rendering, which is essential for many applications, involves evaluating complicated integrals. These integrals are predominantly approximated with a Monte Carlo method called path tracing. Unfortunately, this method generally requires many samples and therefore long computation times for noiseless images. Recently, so-called path-guiding techniques have been introduced, which gather knowledge about the integrands to facilitate sampling. In this project, we seek to identify and exploit untapped potential in path guiding to provide significant improvements in this active line of research. The two principal problems in path guiding are i) representing gathered knowledge and ii) sampling using that representation. We strive toward the ideal of optimal path guiding (considering practical constraints), which leads us to our main research questions: Q1. How can we represent path-guiding knowledge optimally? Q2. How can we sample optimally using that representation? We pursue two novel key ideas for possible answers: For Q1, we cast the problem of representing knowledge as a mathematical optimization problem, enabling us to exploit the knowledge and methods from the field of optimization. For Q2, we introduce “scalable product importance sampling”: adapting sampling accuracy as required to economize on resources. We see great potential for synergies between the two ideas and for them to open up new lines of investigation, thereby inspiring many follow-up works.

Scientific disciplines:

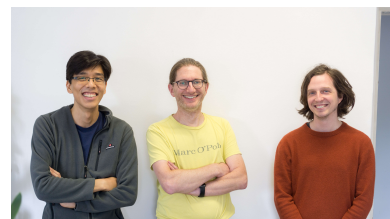
Computer graphics (100%)

Keywords:

photorealistic rendering, global illumination, physically based rendering, Monte Carlo rendering, importance sampling, path guiding

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Further links to the persons involved and to the project can be found under

<https://www.gmbh.wwtf.at/funding/programmes/ict/ICT22-028/>