"Challenges and Opportunities in Differentiable Rendering at Scale"

Abstract:

Computing the gradients of computer graphics models has become increasingly crucial for computer vision and machine learning in solving inverse problems, inference, or synthesizing images. When differentiating a light simulator/renderer, several challenges arise. Firstly, object boundaries and occlusion introduce discontinuities. Naive automatic differentiation would fail to account for the resulting Dirac delta signals from the differentiation of discontinuities, leading to incorrect results. Secondly, light transport simulation and its differentiation require solving a high-dimensional integral using stochastic estimators. Naive estimators of derivatives may exhibit high variance and cause divergence in gradient-based optimization. In this talk, I will discuss our recent work on new numerical methods and programming languages for addressing these challenges.