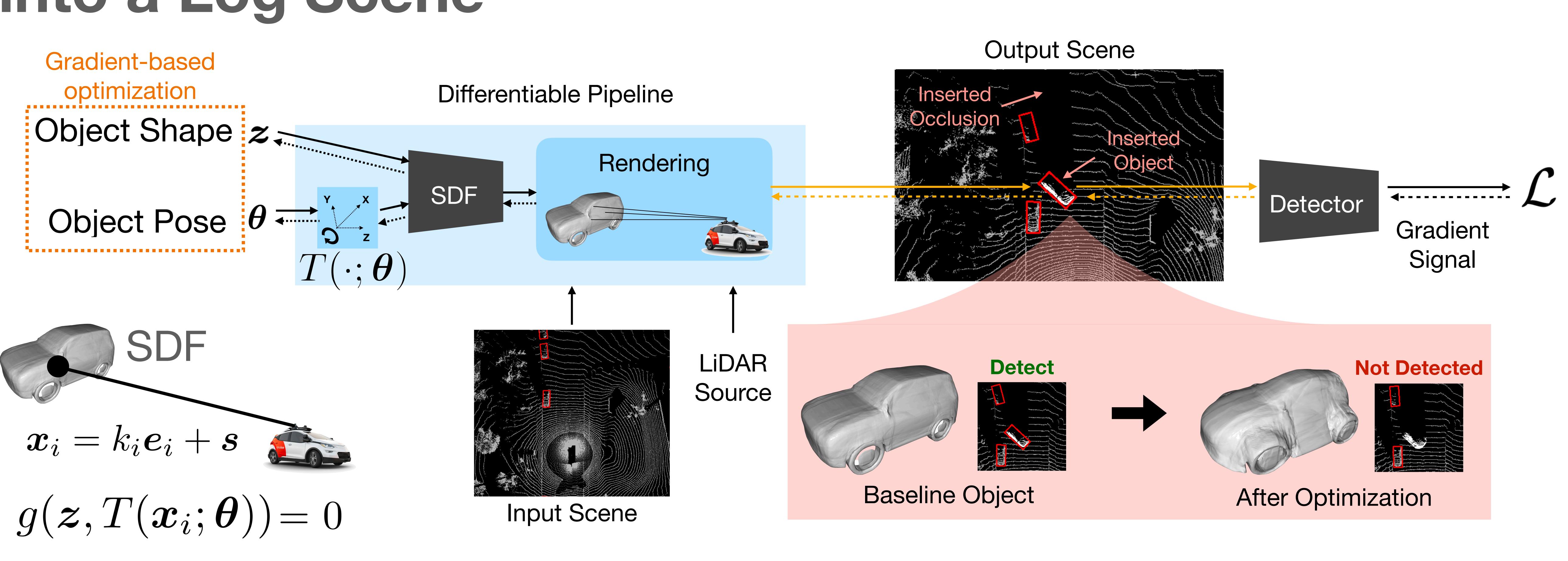
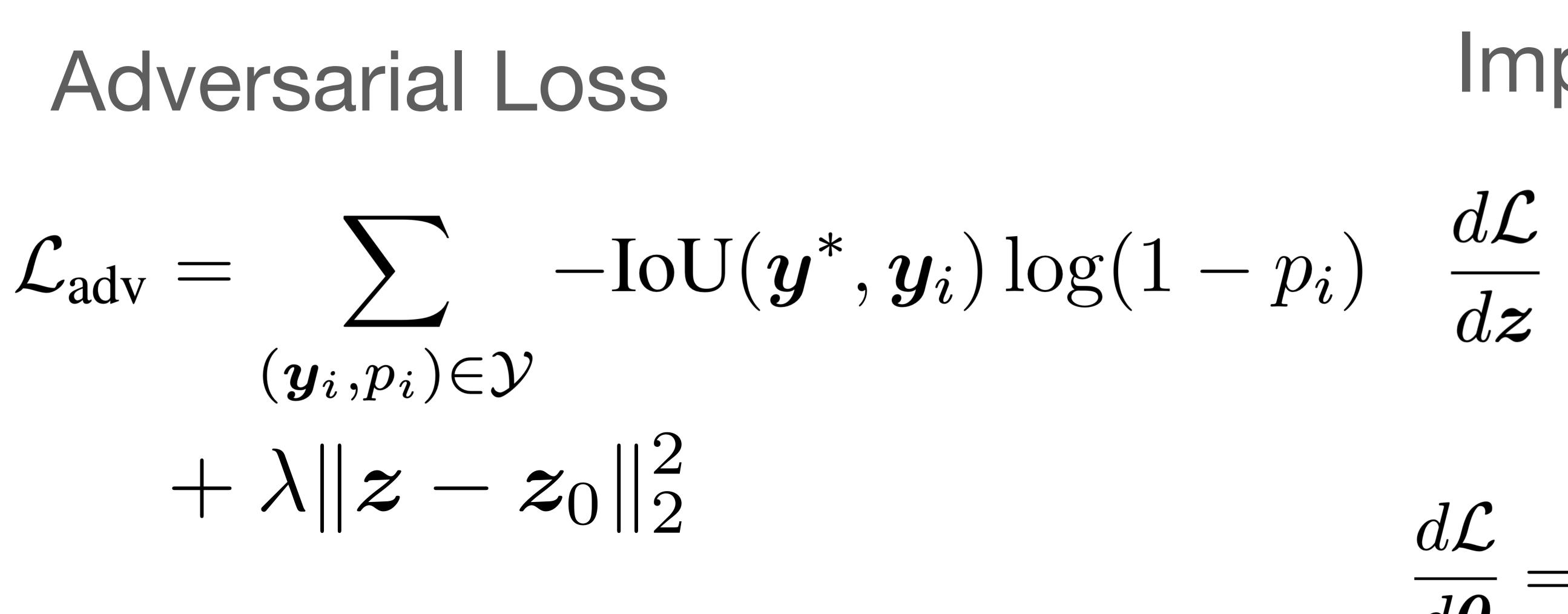
Cruise SHIFT3D: Synthesizing Hard Inputs for Tricking 3D Detectors Hongge Chen, Zhao Chen, Gregory P. Meyer, Dennis Park, Carl Vondrick, Ashish Shrivastava, and Yuning Chai

Motivation

- **o** 3D detectors can fail on rare or **unknown unknowns** on the road.
- o Instead of response reactively, we want to detect failures in a proactively.
- and learn from them.
- o Two requirements for the synthesized hard examples. o Challenging/Adversarial: Revealing failures. o Realism/Natural: changes easily recognizable and semantically meaningful.
- o SHIFT3D generates challenging object shapes and poses, and render them into log scenes.

A Differentiable Pipeline to Render SDF Objects into a Log Scene





Cruise LLC

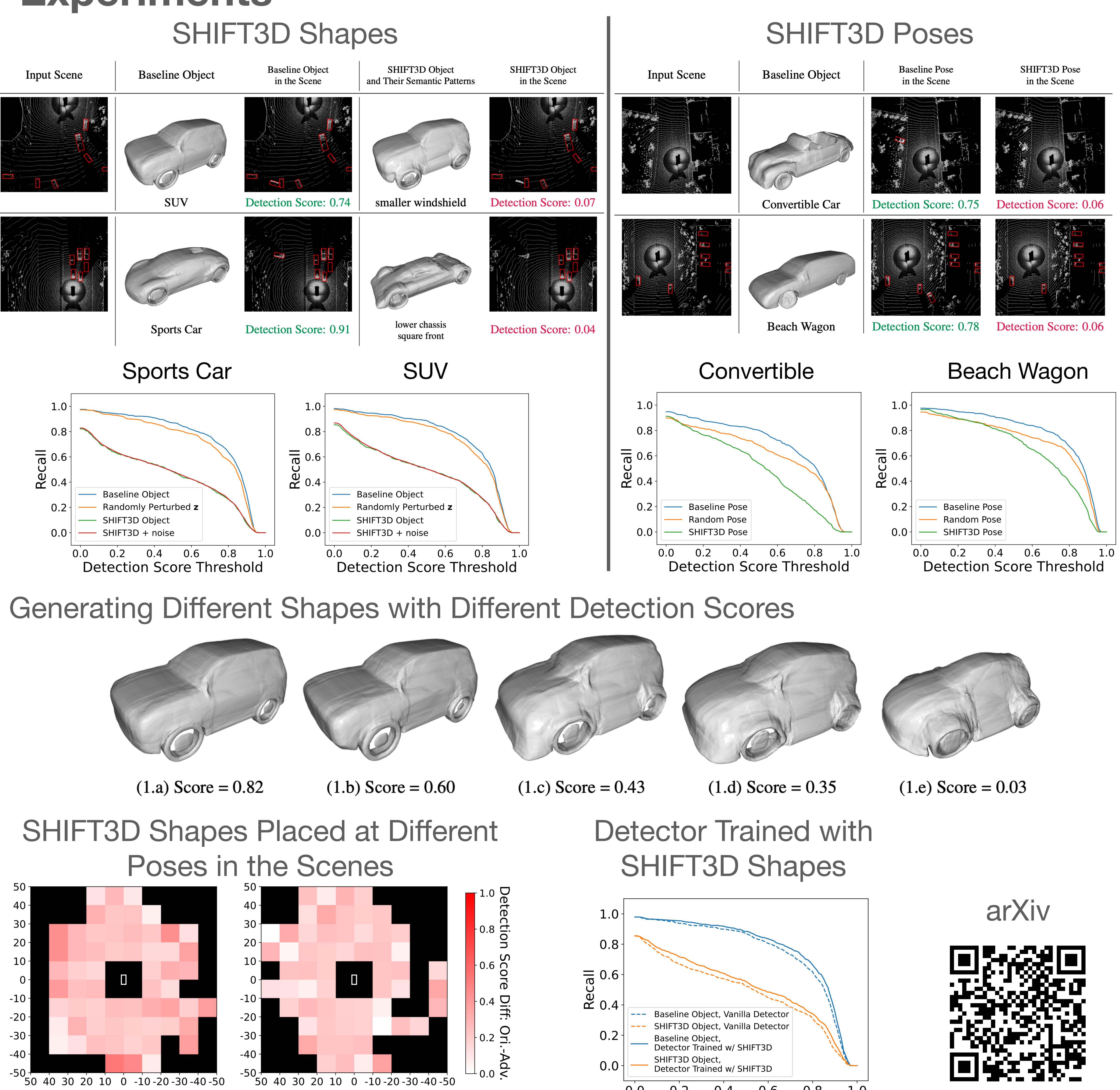
• We want to synthesize hard examples for LiDAR data to discover unknown unknowns

Implicit Differentiation

$$= -\sum_{\text{points on the object}} \left(\boldsymbol{e}_i \cdot \frac{d\mathcal{L}}{d\boldsymbol{x}_i} \right) \left(\boldsymbol{e}_i \cdot \frac{\partial g(\boldsymbol{z}, \cdot)}{\partial \boldsymbol{x}_i} \right)^{-1} \frac{\partial g(\cdot, \boldsymbol{x}_i)}{\partial \boldsymbol{z}}$$

10 ∂x_i $a \boldsymbol{\theta}$ $O \boldsymbol{x}_i$ $d\boldsymbol{x}_{i}$ $\mathcal{U}\mathcal{D}$

Experiments



0.6

Detection Score Threshold

0.8 1.0

