

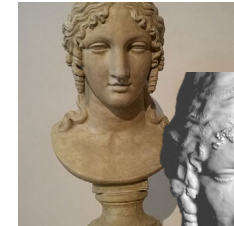
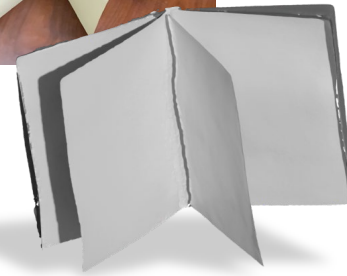
NeUDF: Learning Neural Unsigned Distance Fields with Volume Rendering

Yu-Tao Liu^{1,2} Li Wang^{1,2} Jie Yang¹ Weikai Chen³ Xiaoxu Meng³ Bo Yang³ Lin Gao^{1,2*}

¹Institute of Computing Technology

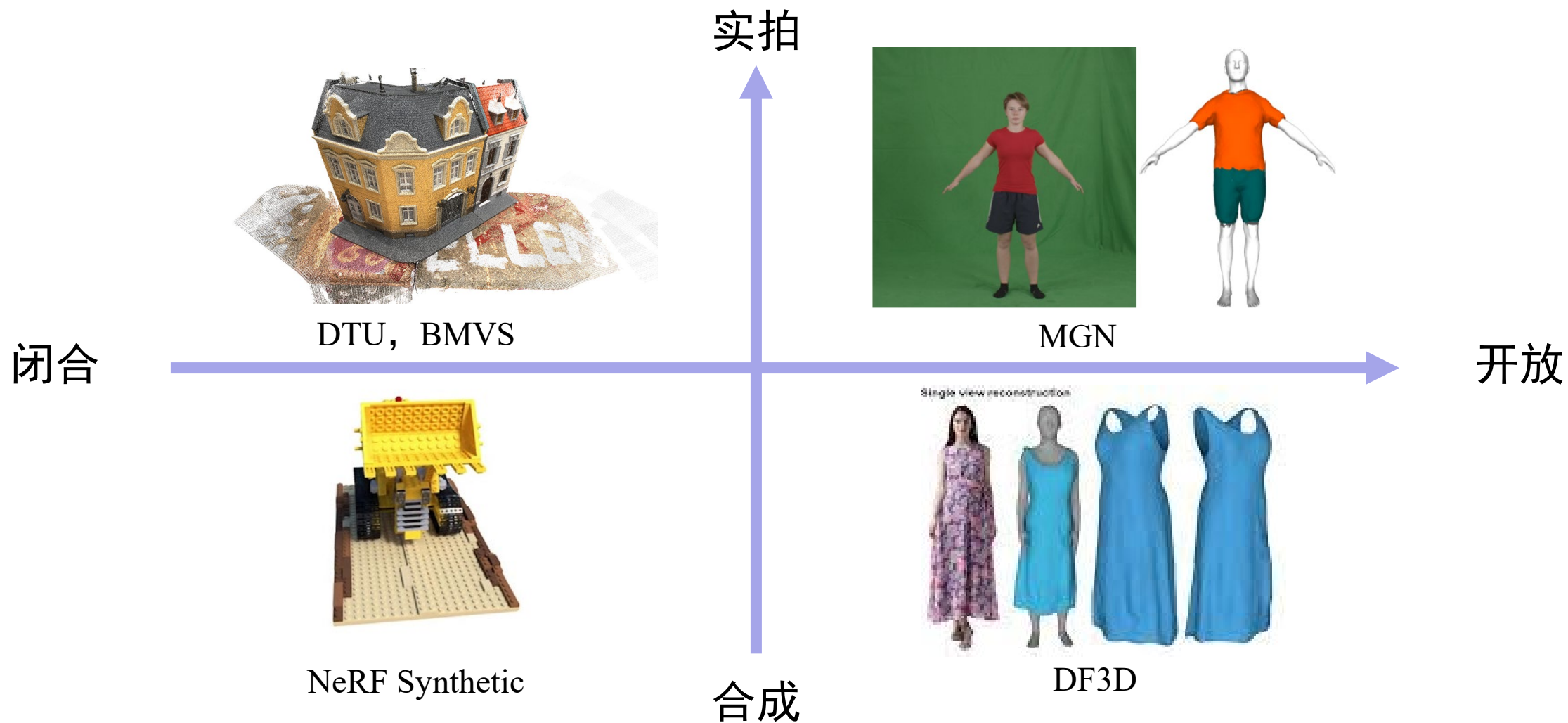
²University of Chinese Academy of Sciences

³Tencent Games



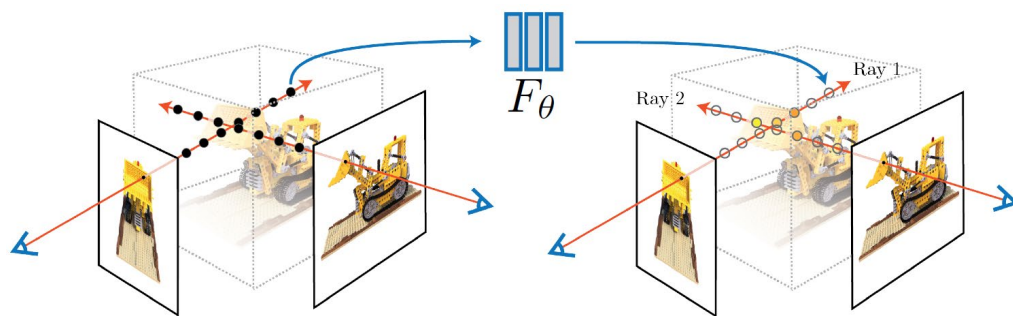
IEEE TRANSACTIONS ON
PATTERN ANALYSIS AND
MACHINE INTELLIGENCE

基于无符号距离场的任意拓扑曲面重建

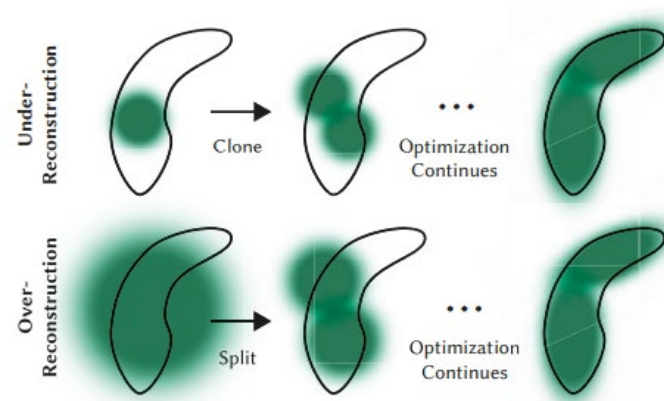


基于无符号距离场的任意拓扑曲面重建

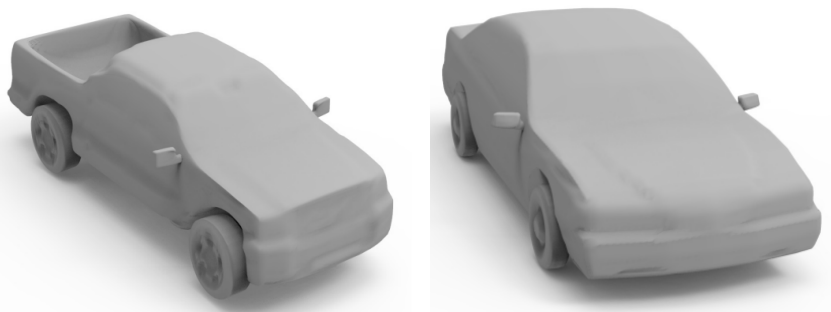
How to represent the complex surface



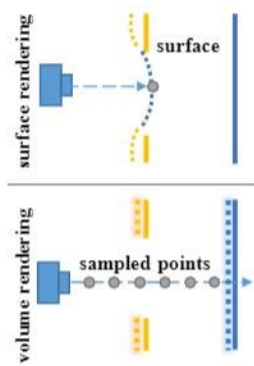
NeRF [Mildenhall et al. 2020]



Gaussian Splatting [Kerbl et al. 2023]



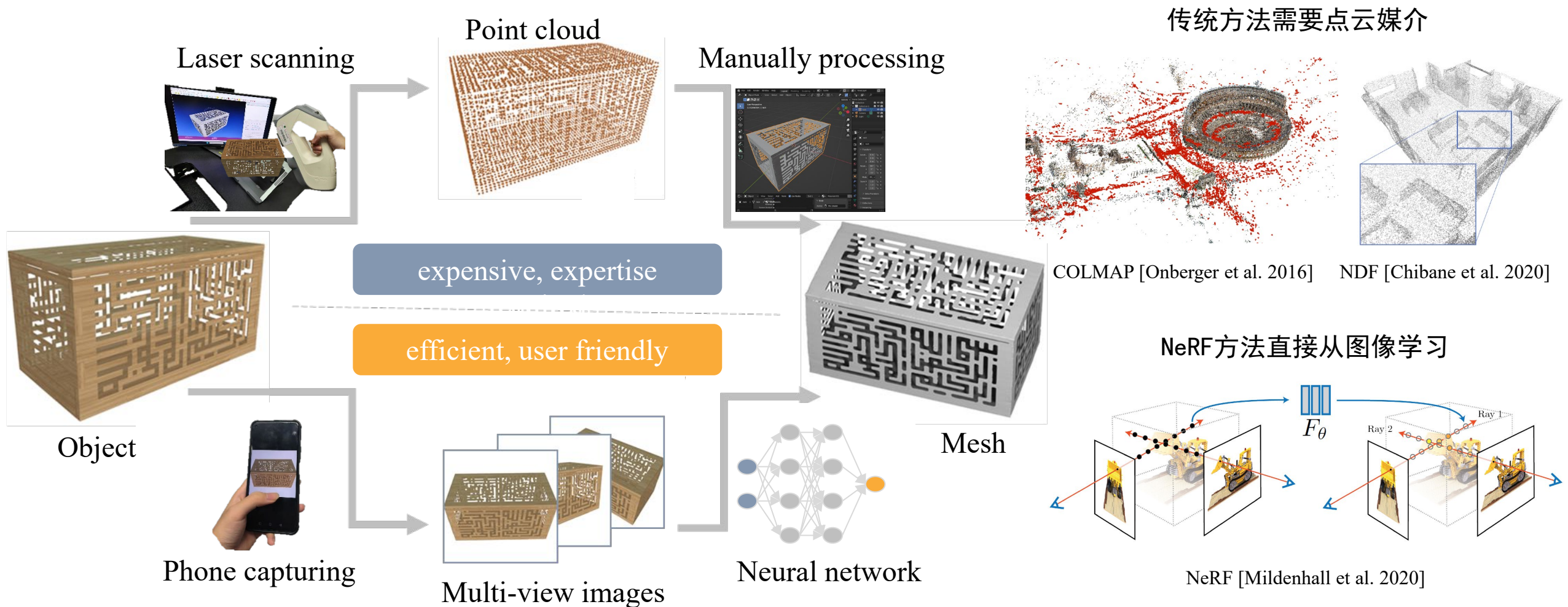
SDM-NET [Gao et al. 2019]



NeuS [Wang et al. 2021]

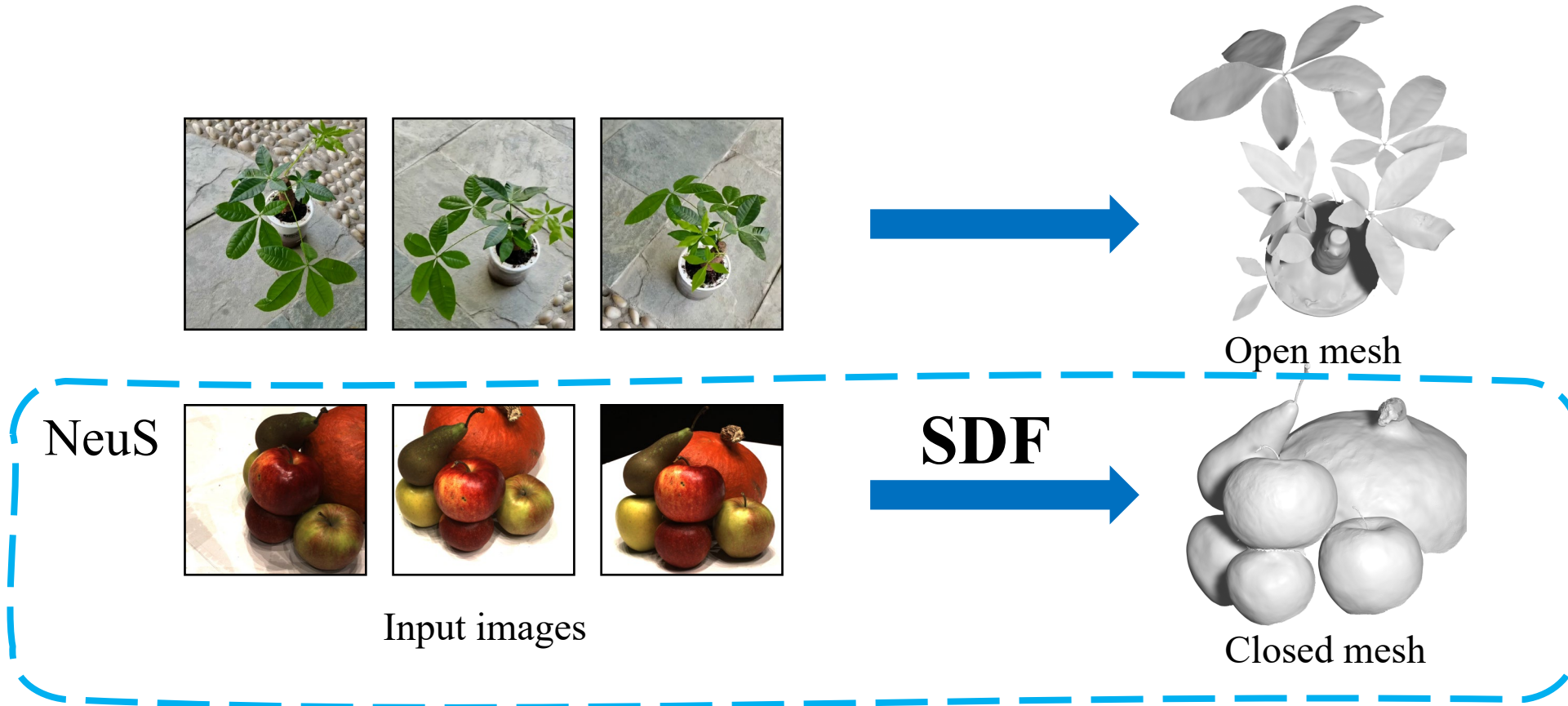
基于无符号距离场的任意拓扑曲面重建

- NeRF with UDF reconstruction for open surface reconstruction



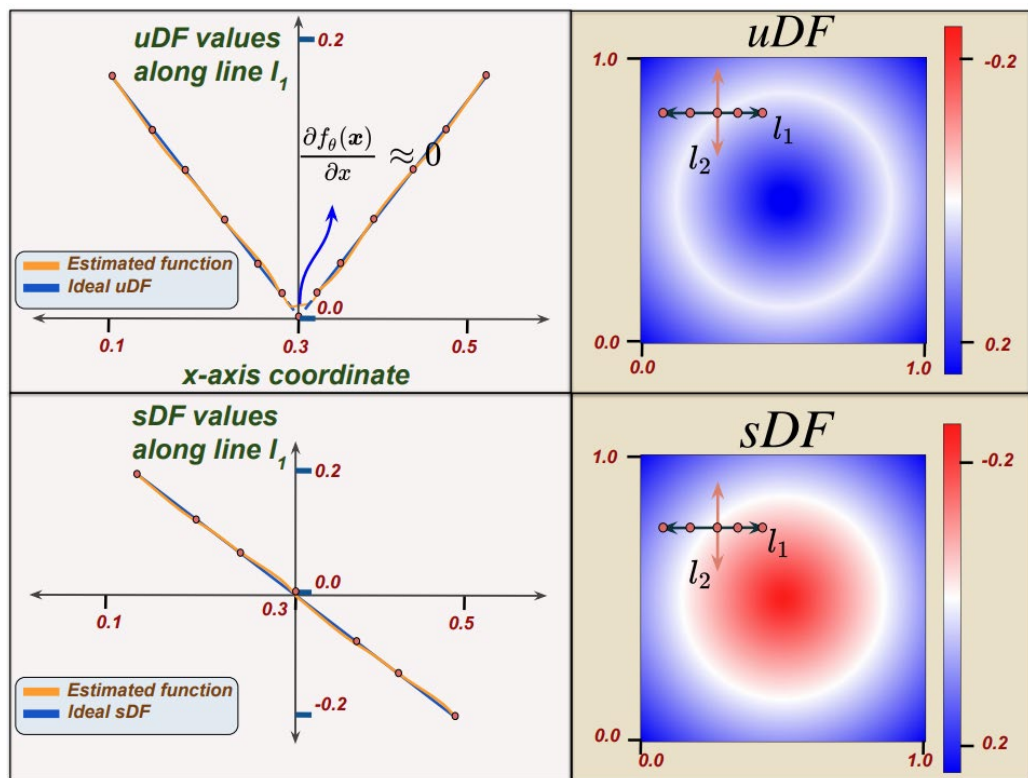
基于无符号距离场的任意拓扑曲面重建

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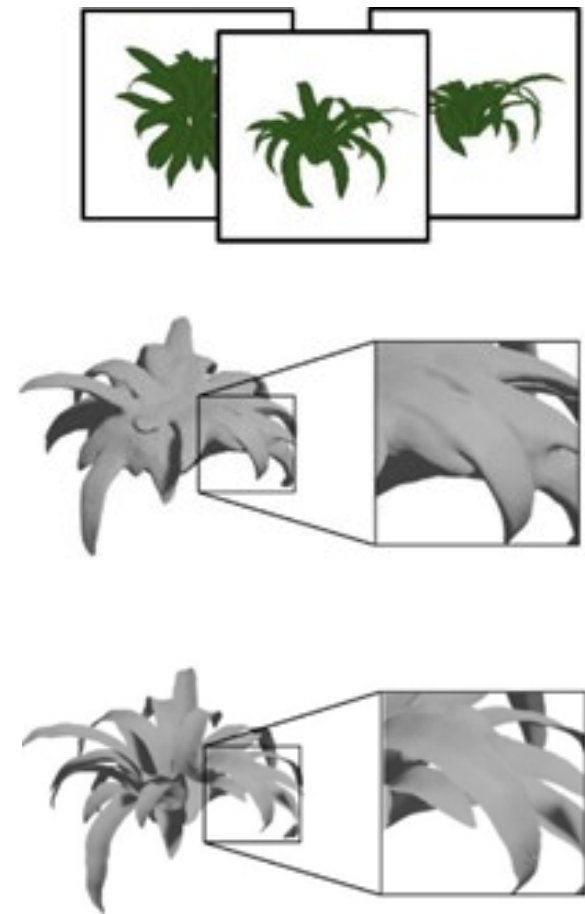
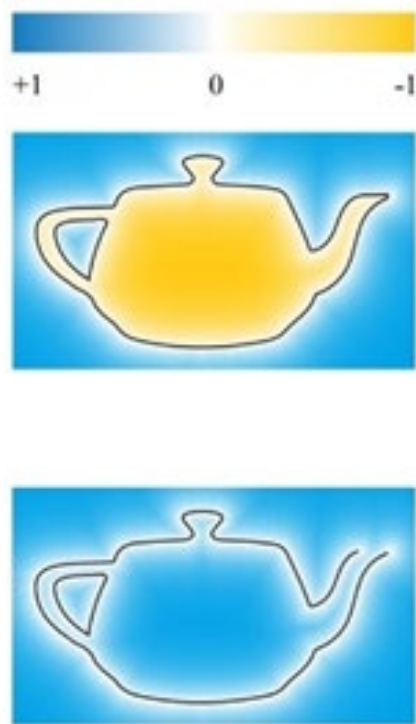
基于无符号距离场的任意拓扑曲面重建

■ Signed Distance v.s. Unsigned Distance



无符号
距离场

有符号
距离场



输入：多目图像
 输出：三角网格

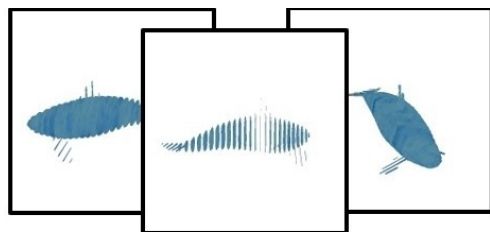
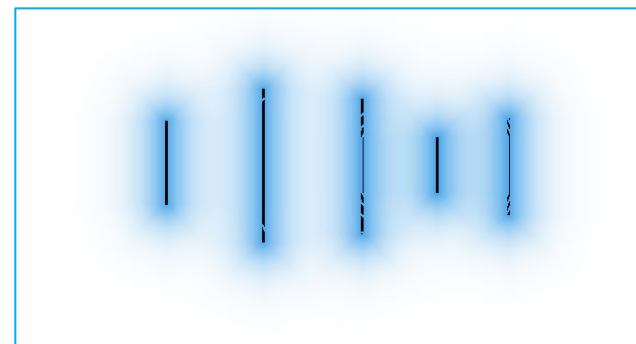
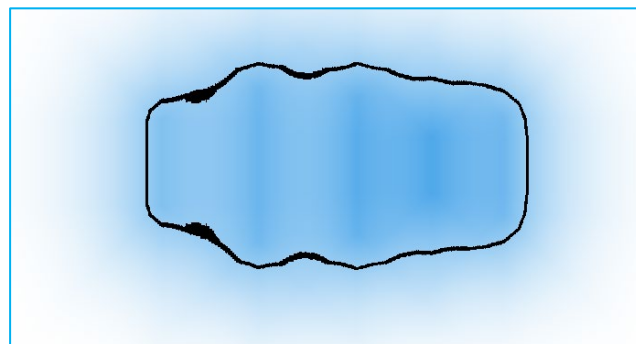
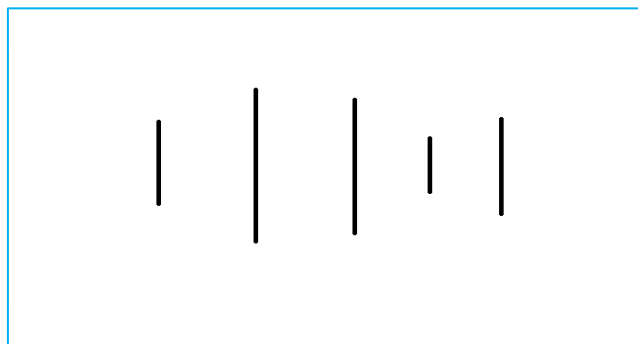
Venkatesh et al.

DUDE: Deep Unsigned Distance Embeddings for Hi-Fidelity Representation of Complex 3D Surfaces

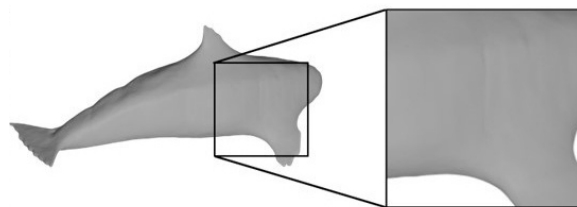
基于无符号距离场的任意拓扑曲面重建

■ SDF vs UDF

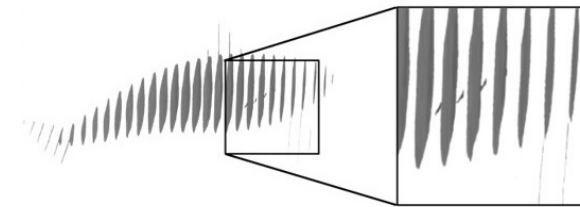
- ◆ SDF: Learn a criterion to divide the space, easily get stuck in local maximum
- ◆ UDF: Learn local minima, flexible in topology



GT



SDF



UDF

基于无符号距离场的任意拓扑曲面重建

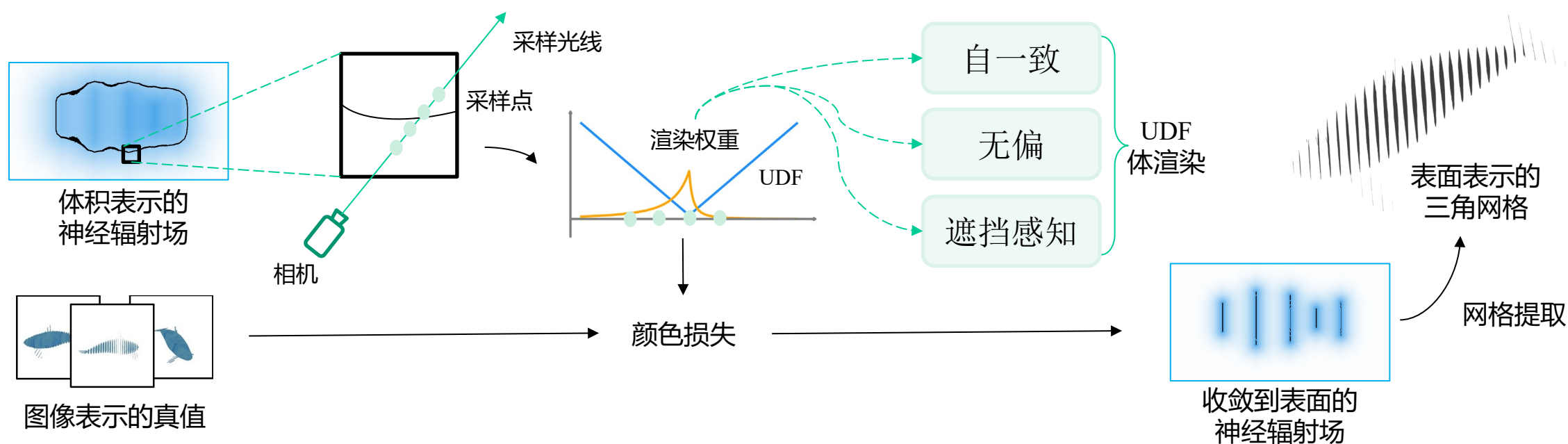
挑战

神经辐射场的体积表示



三角网格的表面表示

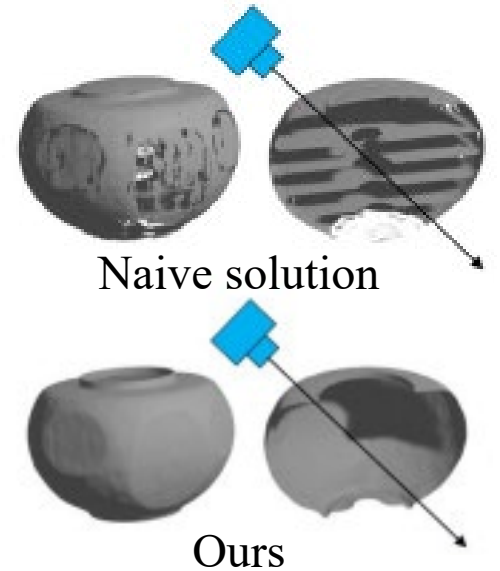
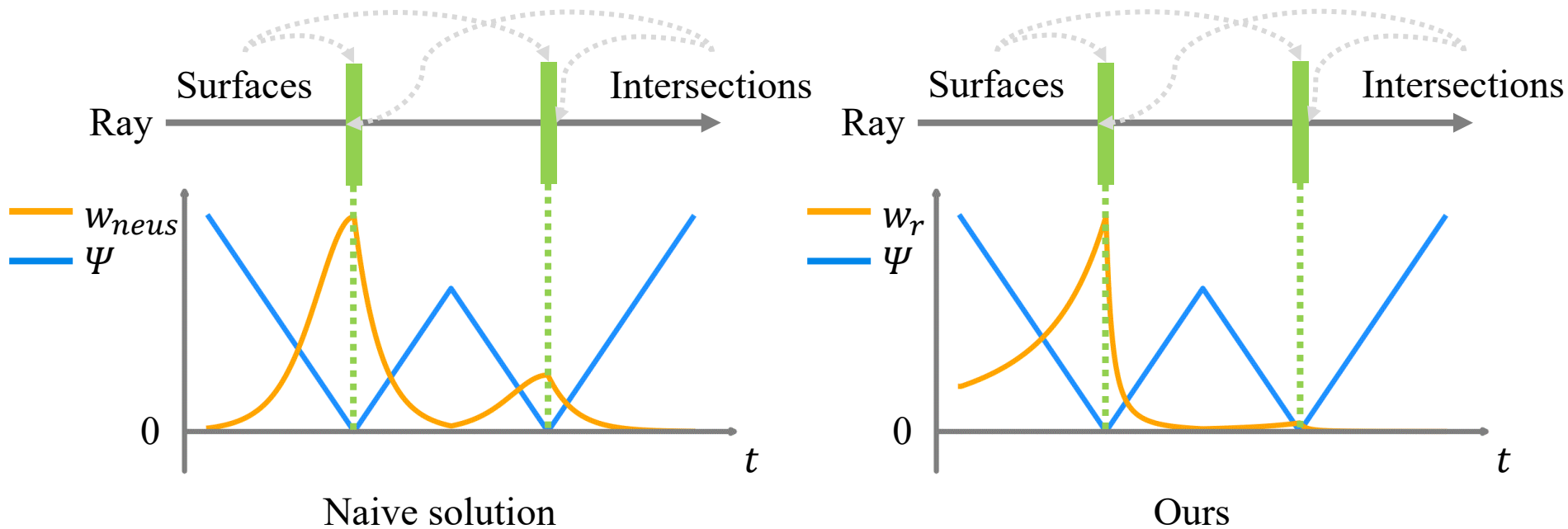
- 如何利用体渲染优化神经辐射场（体积表示），进而保证无符号距离场收敛到真实表面（表面表示）



基于无符号距离场的任意拓扑曲面重建

■ Comparison with a naive solution

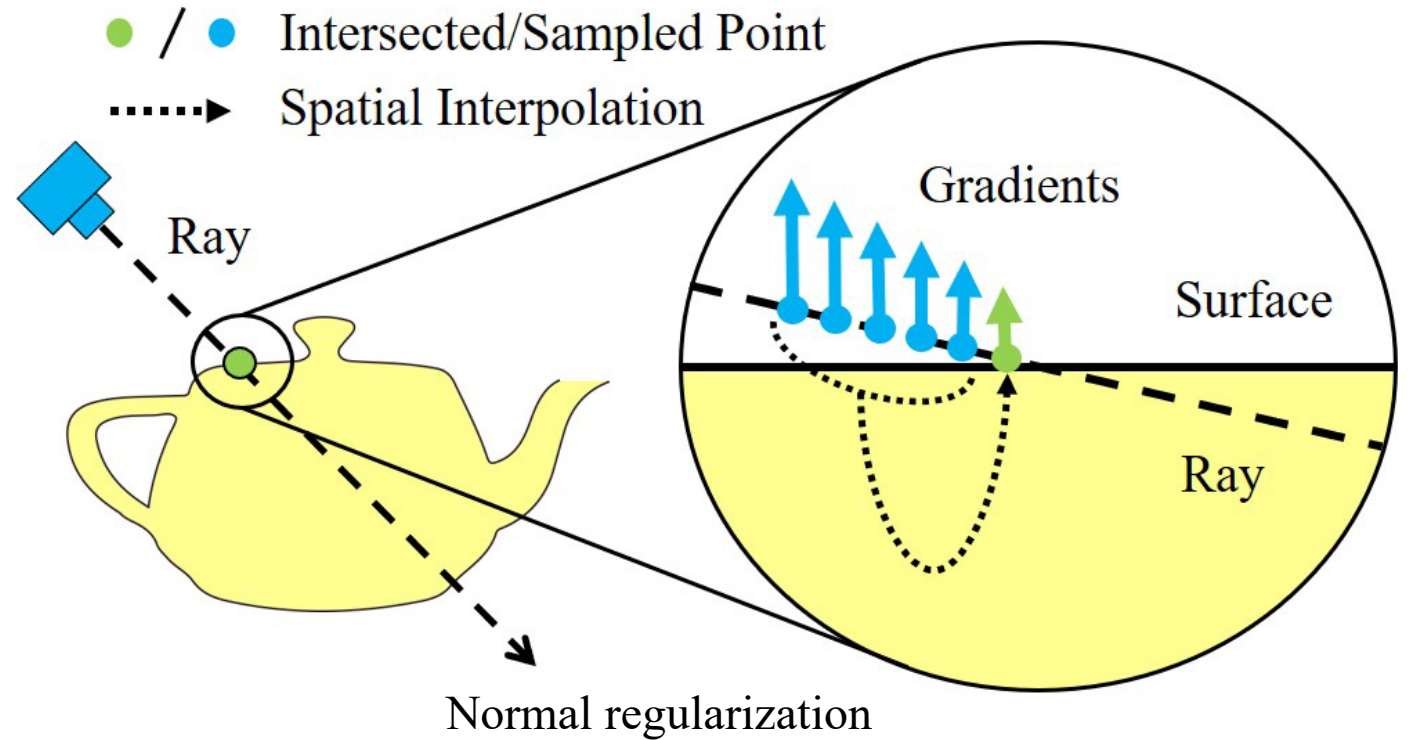
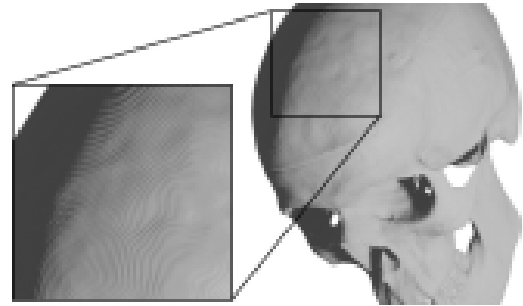
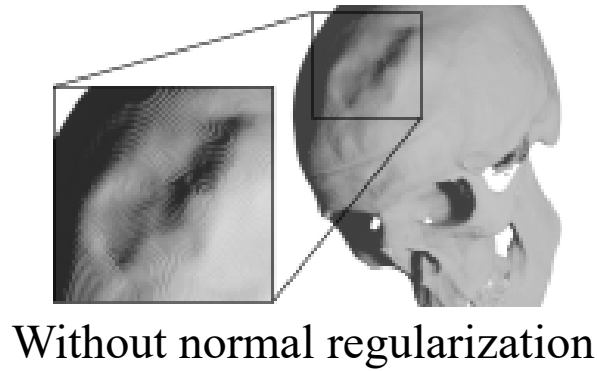
- ◆ A naive solution is to directly use the same weight structure of NeuS $w_{neus}(t)$
- ◆ The naive solution fails to distinguish multiple intersections or passing-by edges, leading to noise and poorly distinguished edges



基于无符号距离场的任意拓扑曲面重建

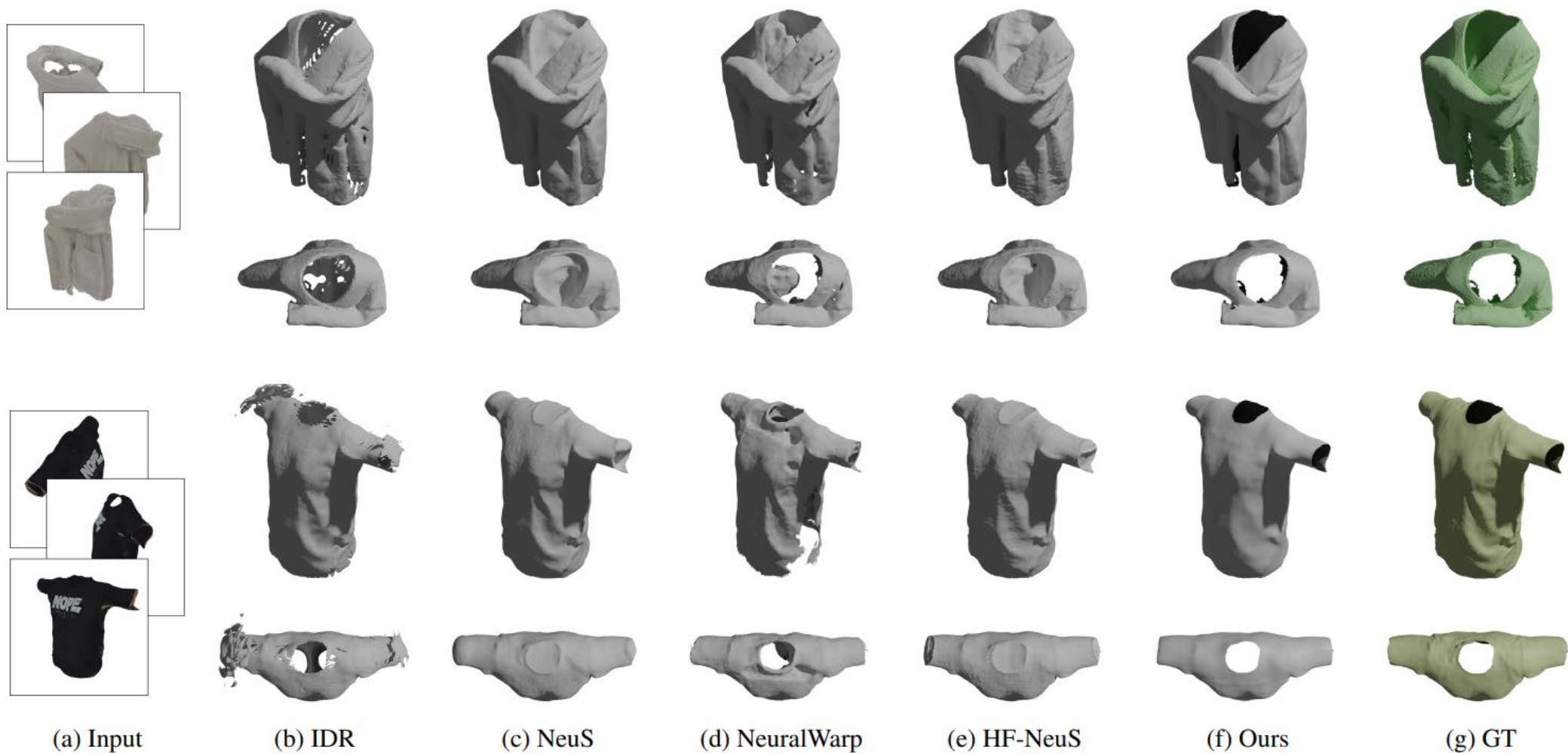
■ Sampling and regularization

- ◆ we leverage normal information in the surface neighborhood to enhance the normal consistency

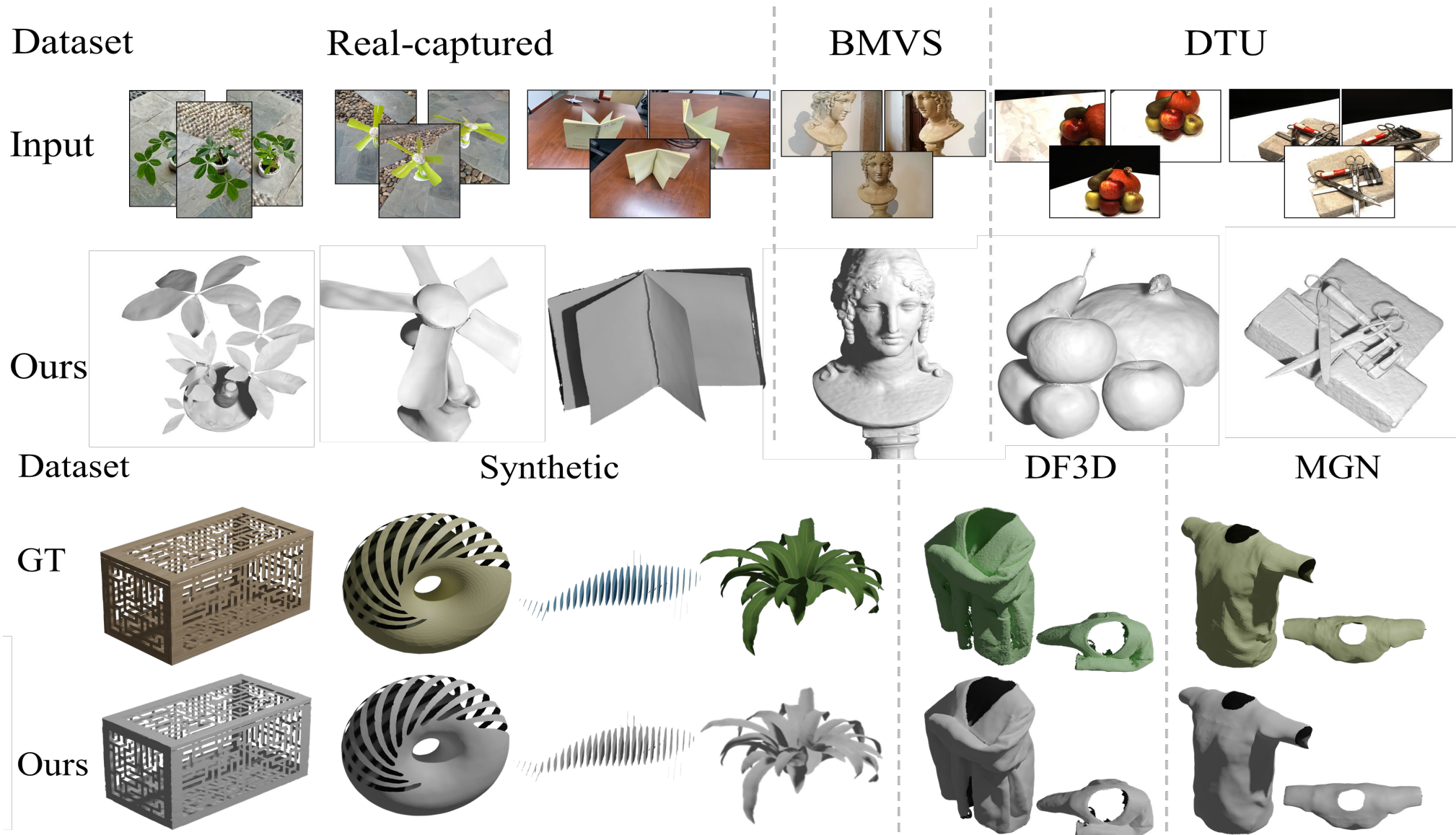


基于无符号距离场的任意拓扑曲面重建

■ 结果比较

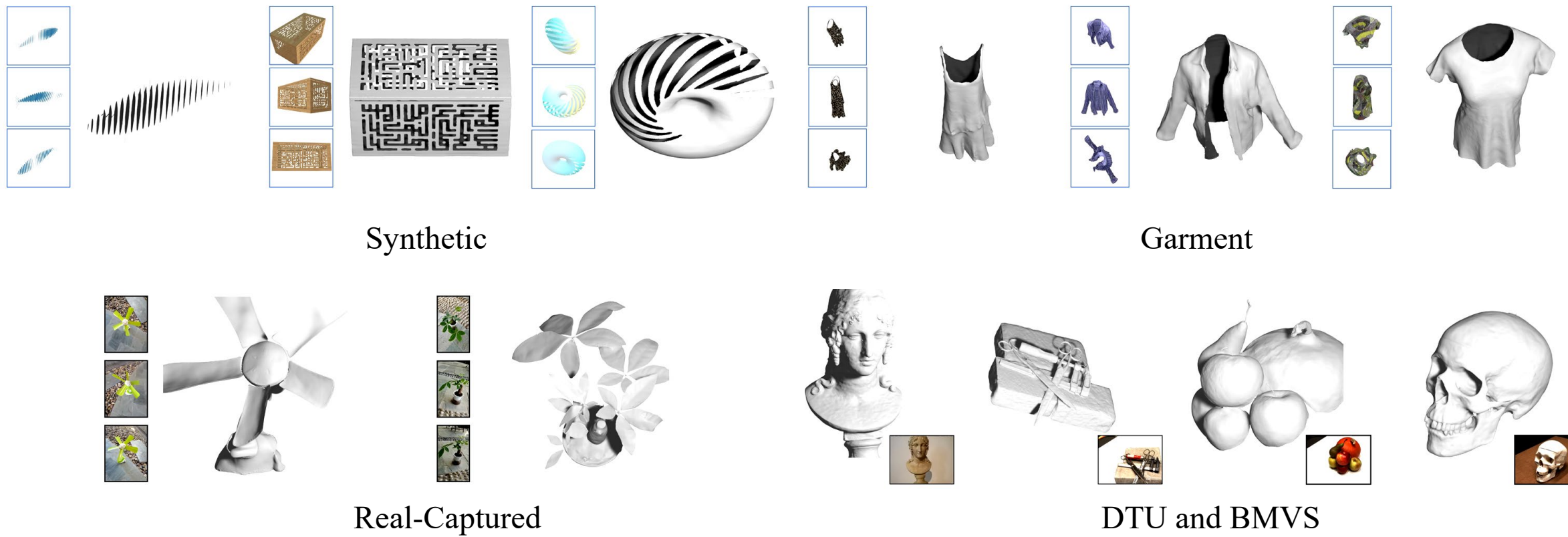


基于无符号距离场的任意拓扑曲面重建



基于无符号距离场的任意拓扑曲面重建

更多的结果



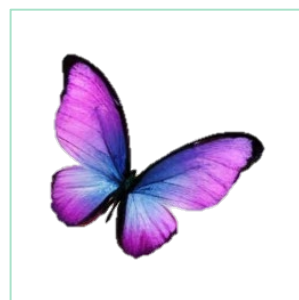
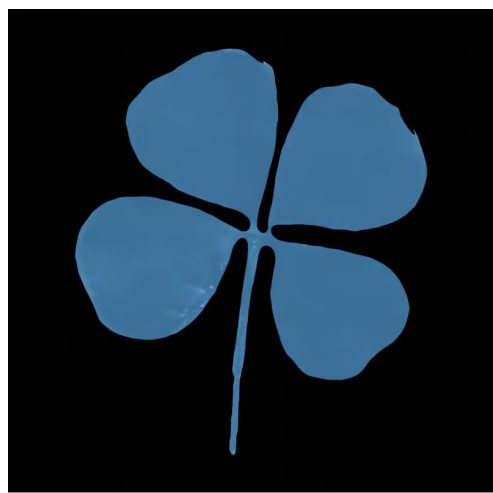
基于无符号距离场的任意拓扑曲面重建



SIGGRAPH 2024

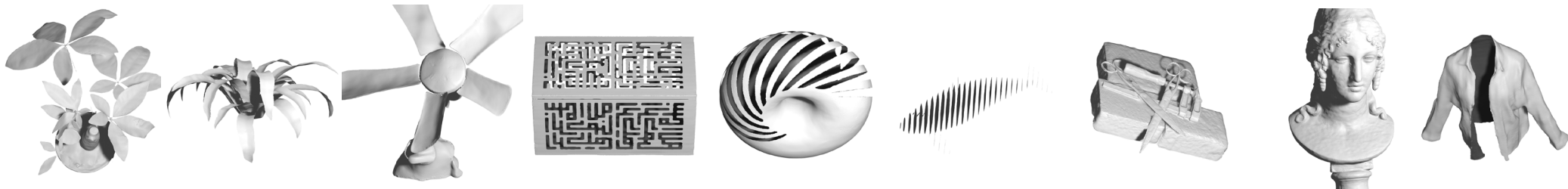
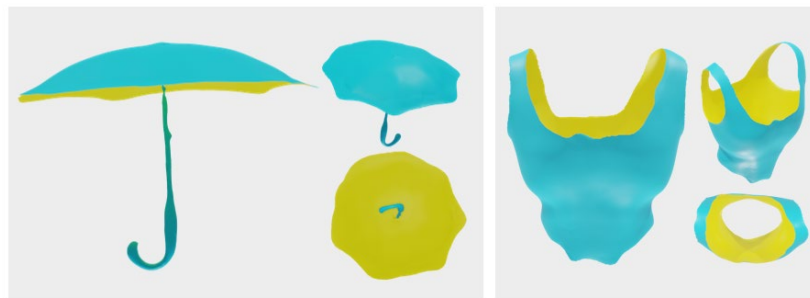
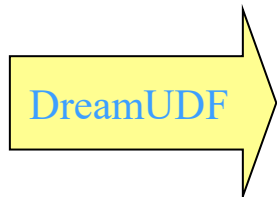
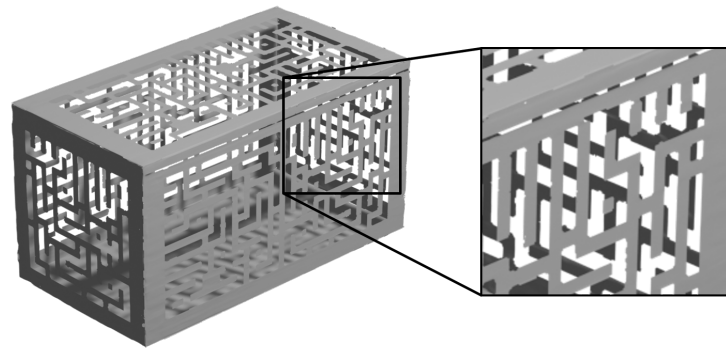
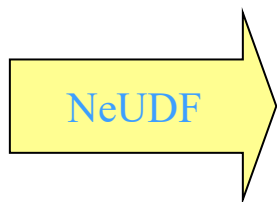
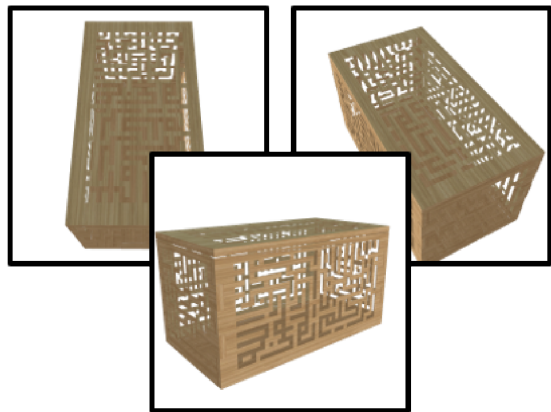
DENVER+ 28 JUL - 1 AUG

■ 生成复杂拓扑的开放曲面 DreamUDF



总结

■ 具有复杂拓扑的开曲面重建和生成



project page



code



video

