KAUST Google TUM

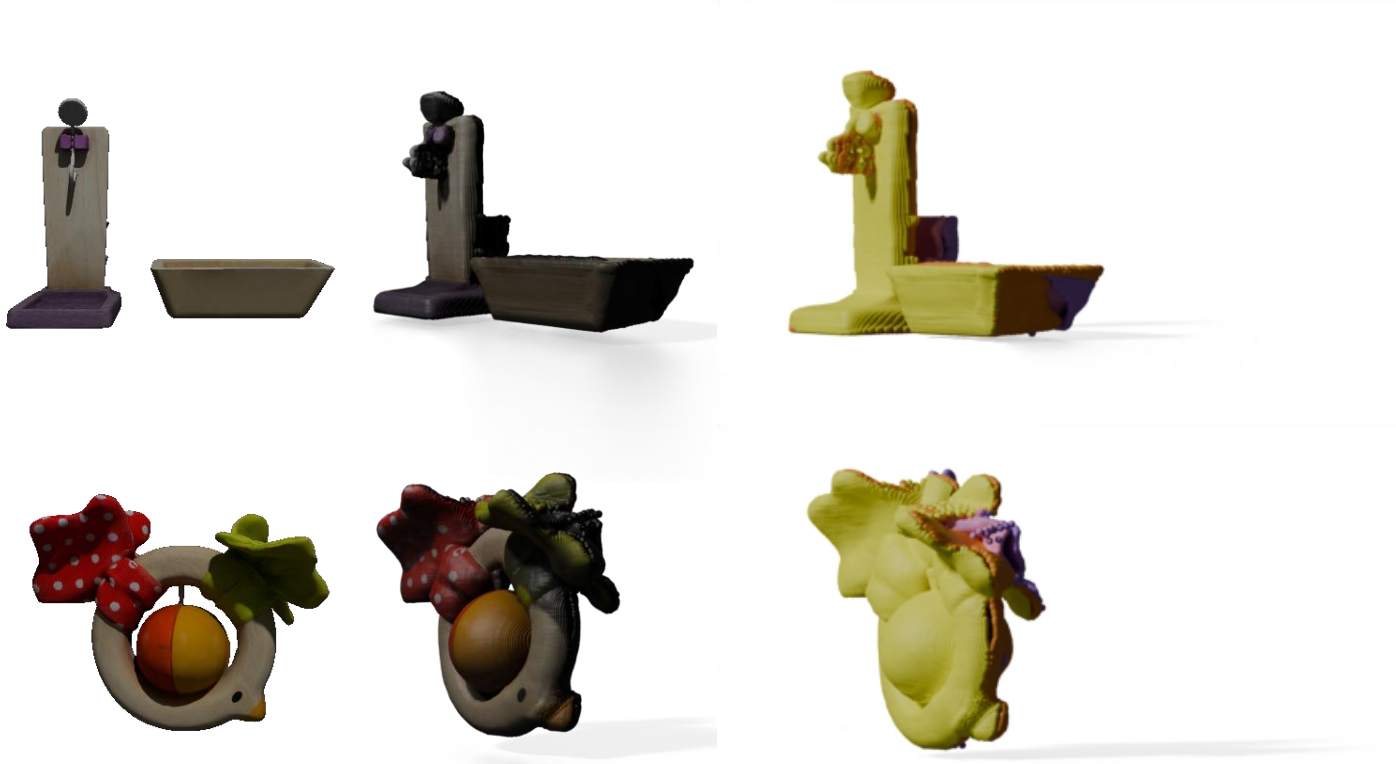
# LaRI

## Layered Ray Intersections for Single-view 3D Geometric Reasoning

**A single-feed-forward** method that models **unseen 3D geometry** using layered point maps, enabling **unified** geometric modeling for both **objects** and **scenes**.

LaRI leverages layered point maps to represent unseen geometry.

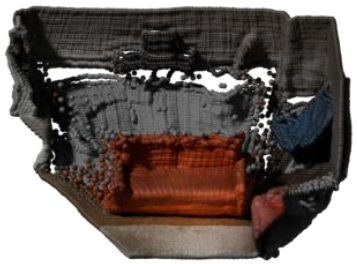
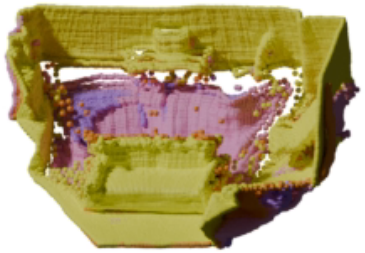
**Object-level data**



Input Predictions Predictions in Layers

LaRI leverages layered point maps to represent unseen geometry.

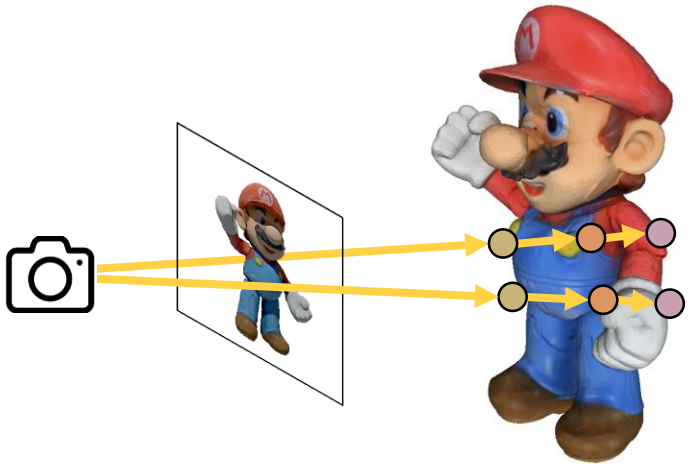
**Scene-level data**


Input Predictions Predictions in Layers

Each layer represents a single ray-surface intersection to “see through” the scene.

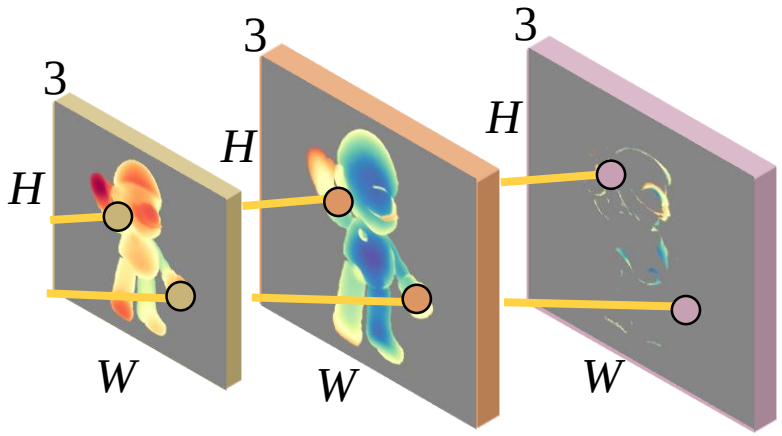
**The Ray-intersecting Process**



A single Image **I**

Ray-surface intersections

**Network Predictions**

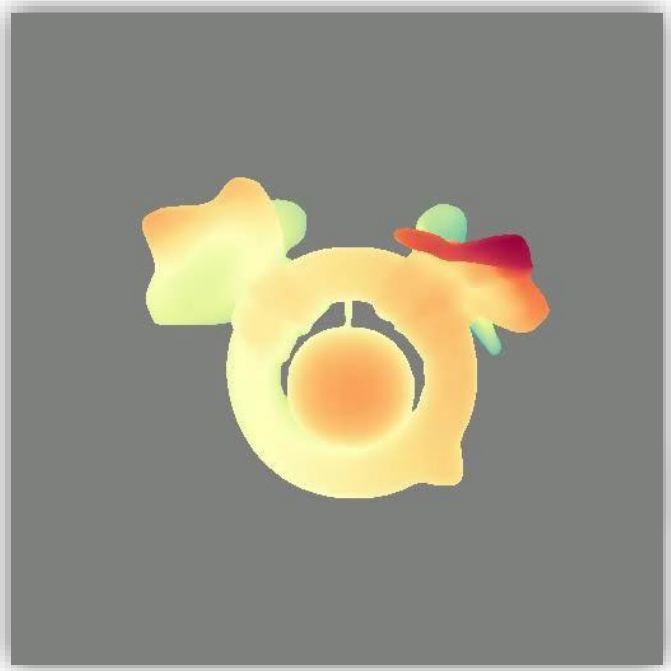



Layer 1: $\mathbf{V}_1$ Layer 2: $\mathbf{V}_2$ Layer 3: $\mathbf{V}_3$ ⋯ Layer: $L$

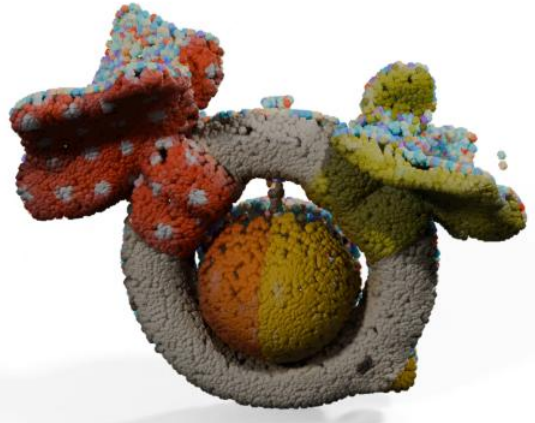
Ray intersections as point maps **V** $(H, W, L, 3)$

# Object-level Results

Input



Layered Depth Maps
(*z-axis* of the point map)

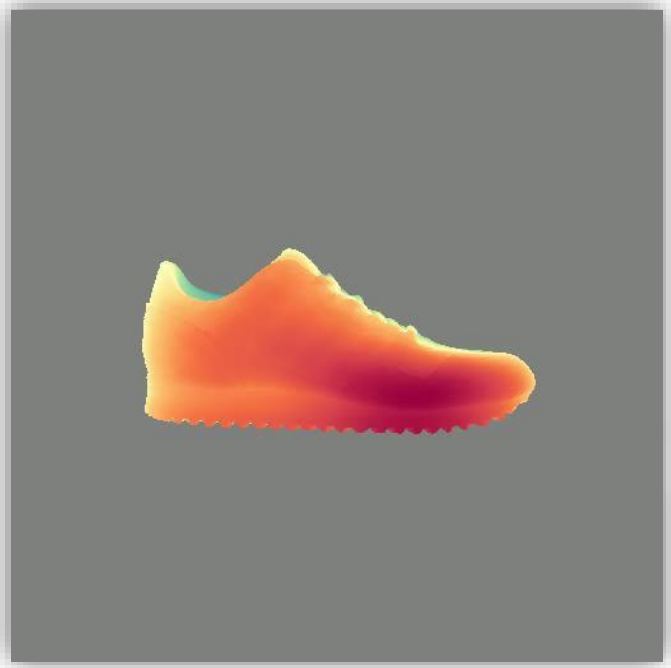


Point Cloud

* Each sample is subsampled to 20K points, unseen points are highlighted with *random* colors.

# Object-level Results

Input



Layered Depth Maps
(*z-axis* of the point map)

Point Cloud

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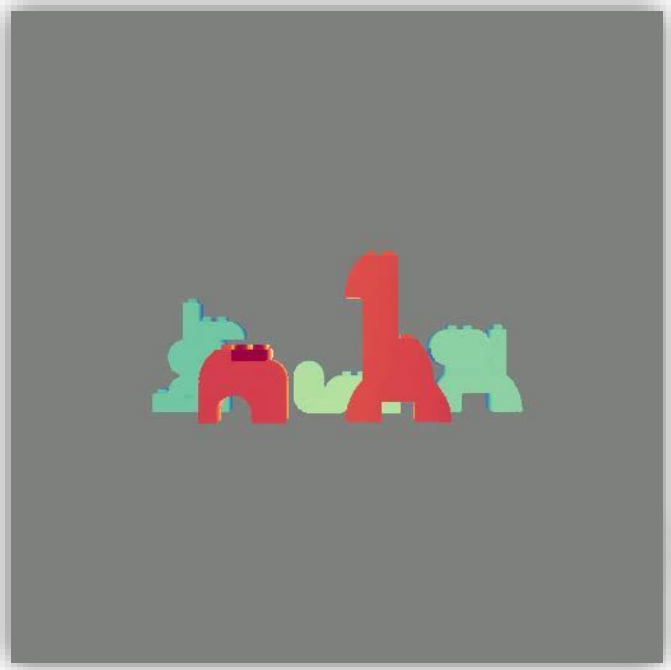
# Object-level Results

Input



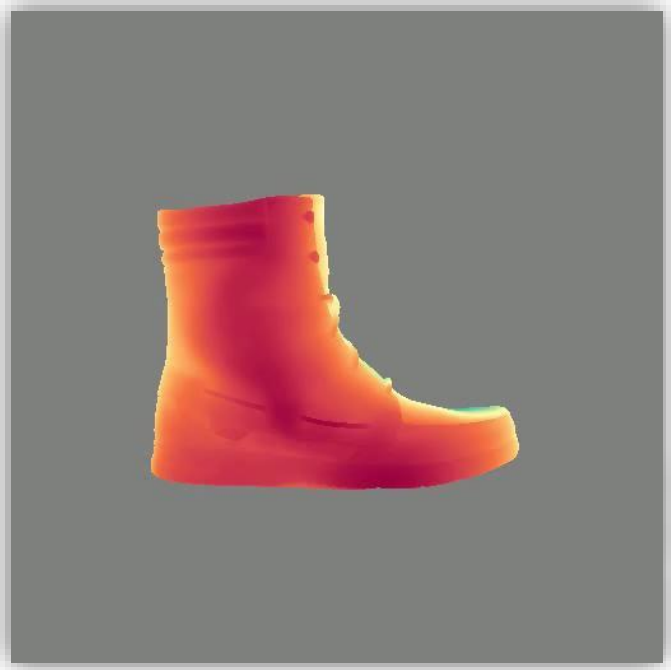
Layered Depth Maps
(*z-axis* of the point map)

Point Cloud

* Each sample is subsampled to 20K points, unseen points are highlighted with *random* colors.

# Object-level Results

Input



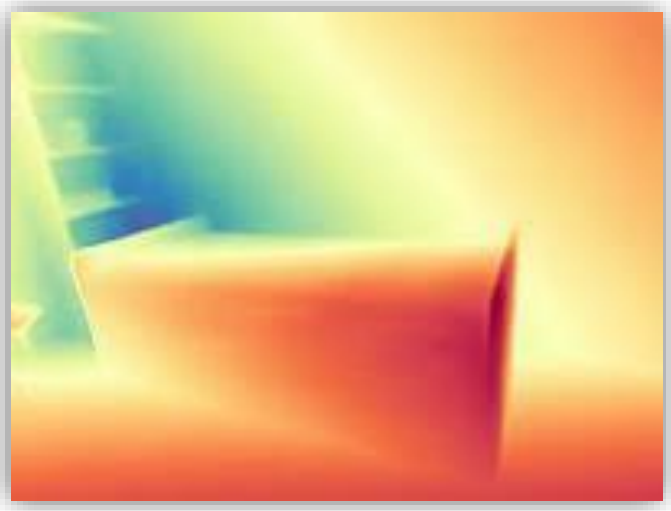
Layered Depth Maps
(*z-axis* of the point map)

Point Cloud

* Each sample is subsampled to 20K points, unseen points are highlighted with *random* colors.

# Scene-level Results

Input



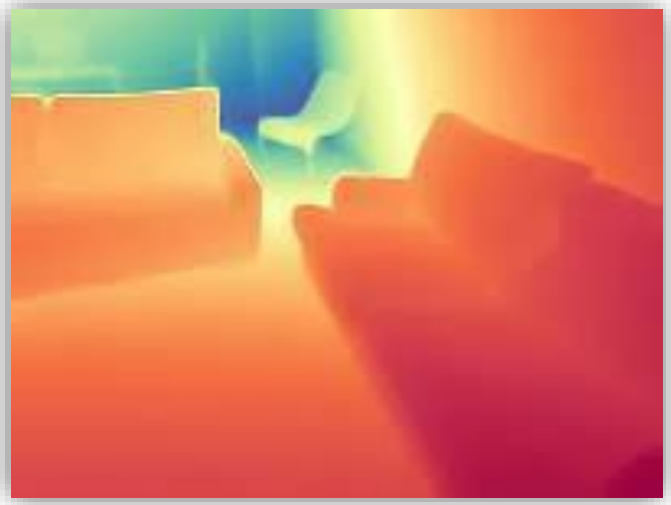
Layered Depth Maps
(*z-axis* of the point map)

Point Cloud

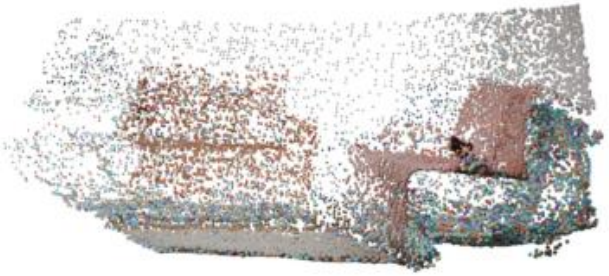
* Each sample is subsampled to 20K points, unseen points are highlighted with *random* colors.

# Scene-level Results

Input



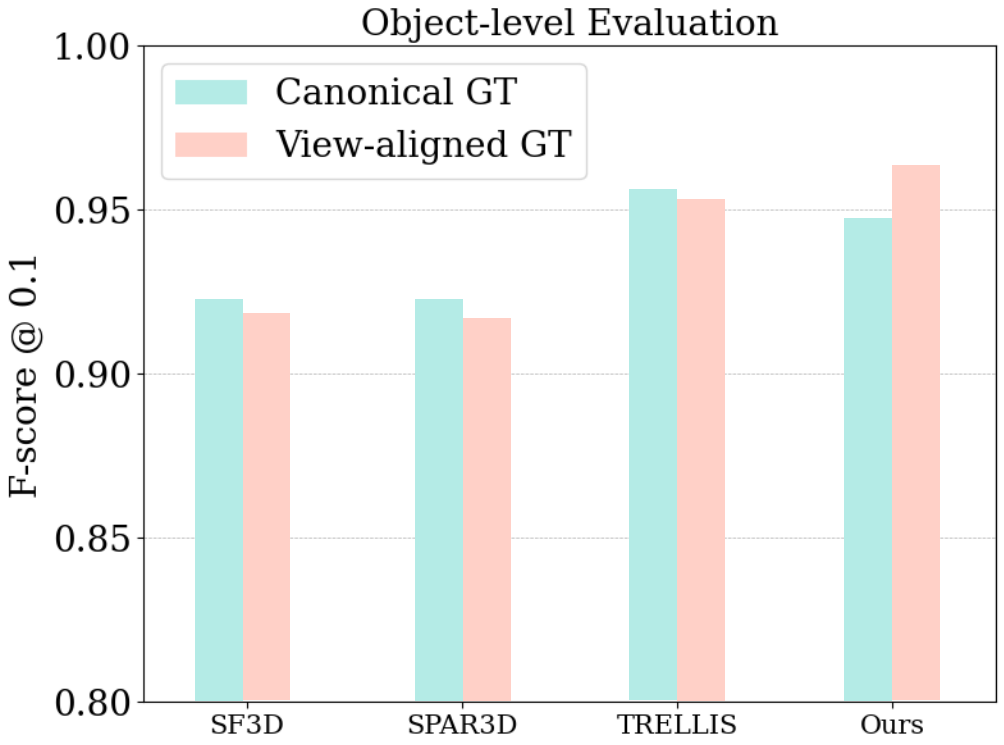
Layered Depth Maps
(*z-axis* of the point map)

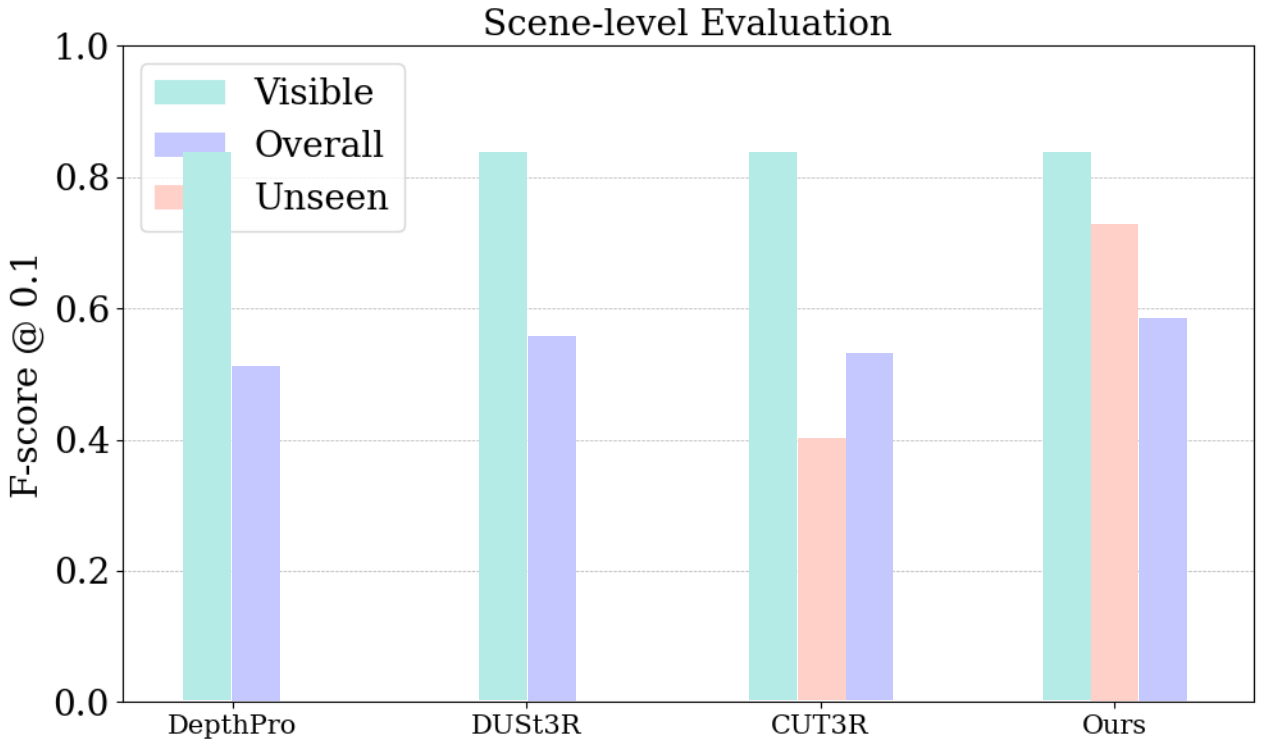


Point Cloud

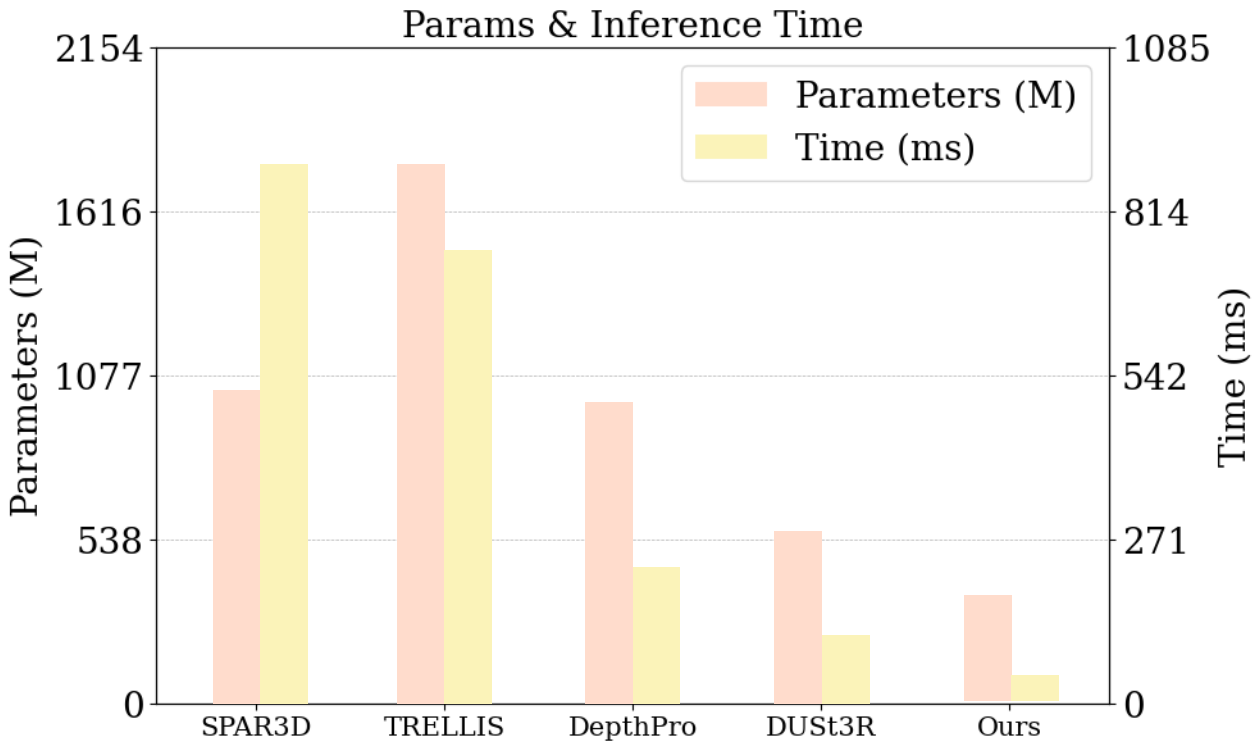
* Each sample is subsampled to 20K points, unseen points are highlighted with *random* colors.

# LaRI achieves comparable or better performance than exsiting methods with relatively limited training data.



LaRI used fewer parameters and is faster than competing methods.



# Thank you!

Find demos, code, and models at:

https://ruili3.github.io/lari

Stay tuned on Twitter:

https://x.com/leedaray