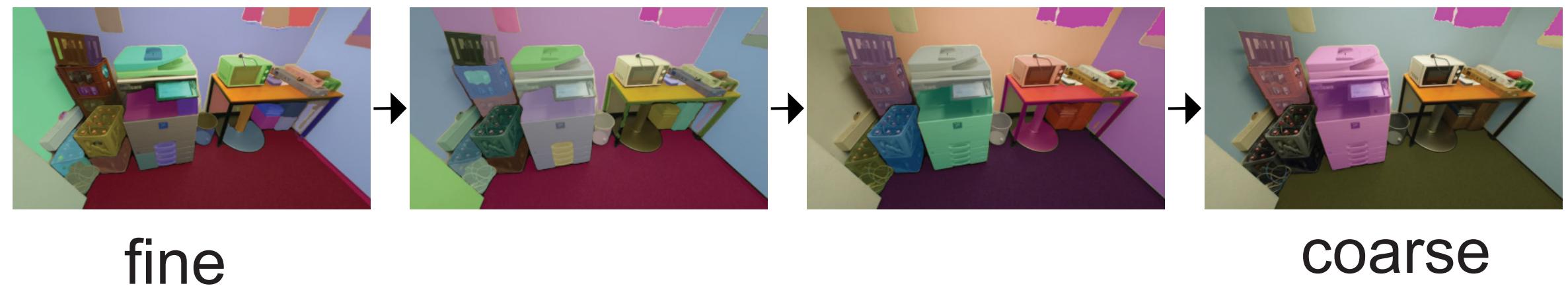


1. Motivation

3D objects and scenes are naturally organized in a multi-scale fashion



💡 Understanding & interacting with 3D scenes requires capturing hierarchical composition.

Existing methods...



...focus on flat semantics

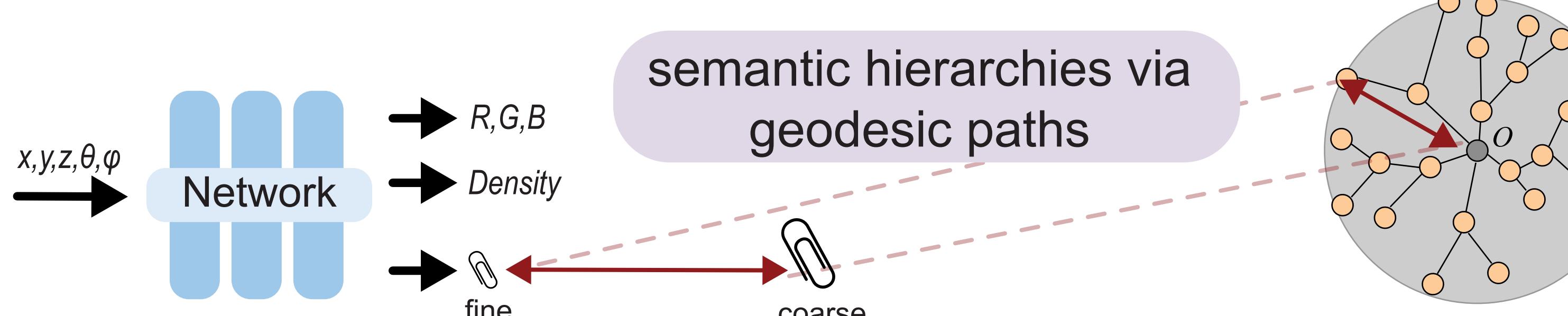
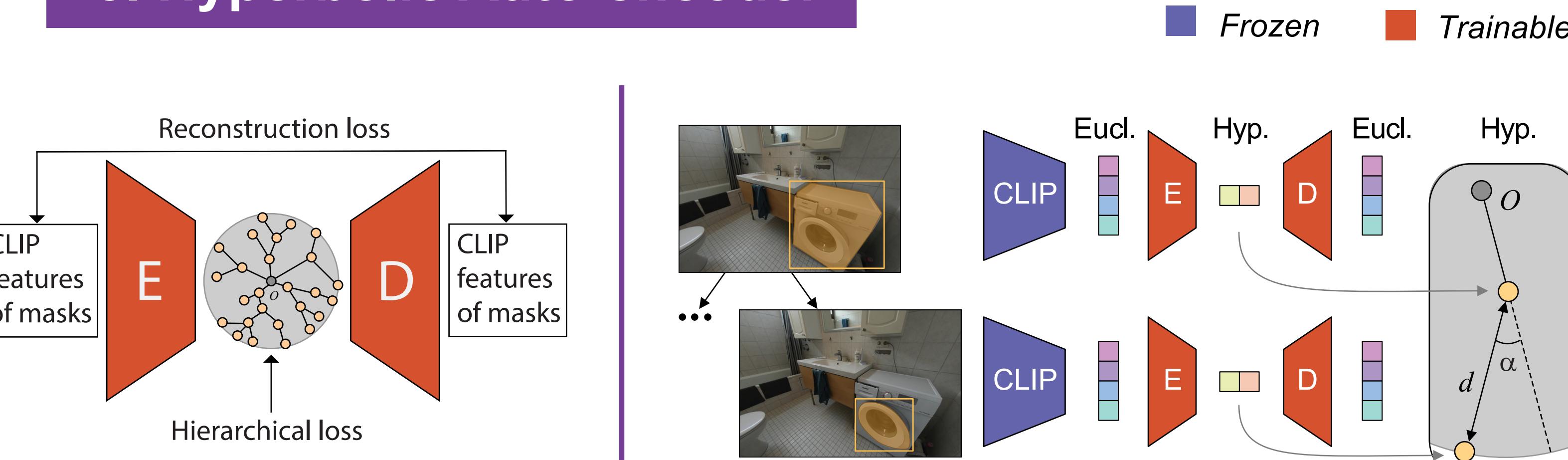


...require multiple rendering passes

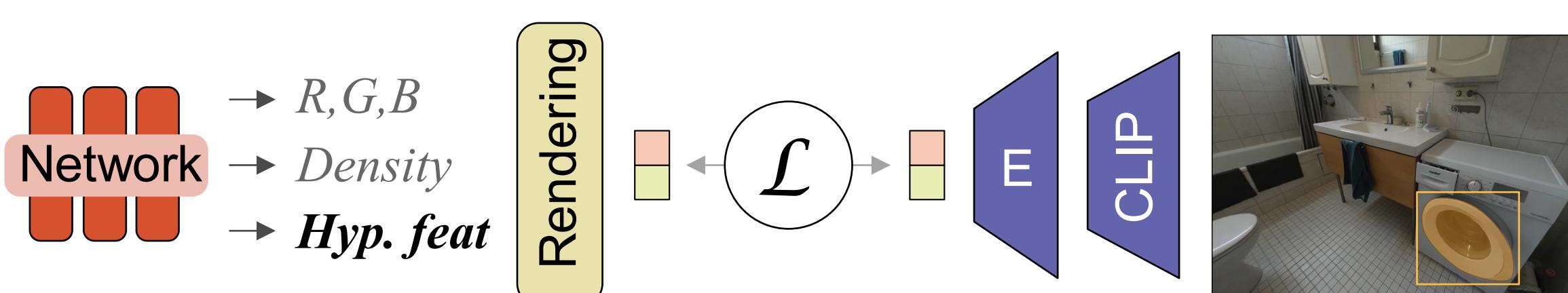


...rely on fixed discrete hierarchies

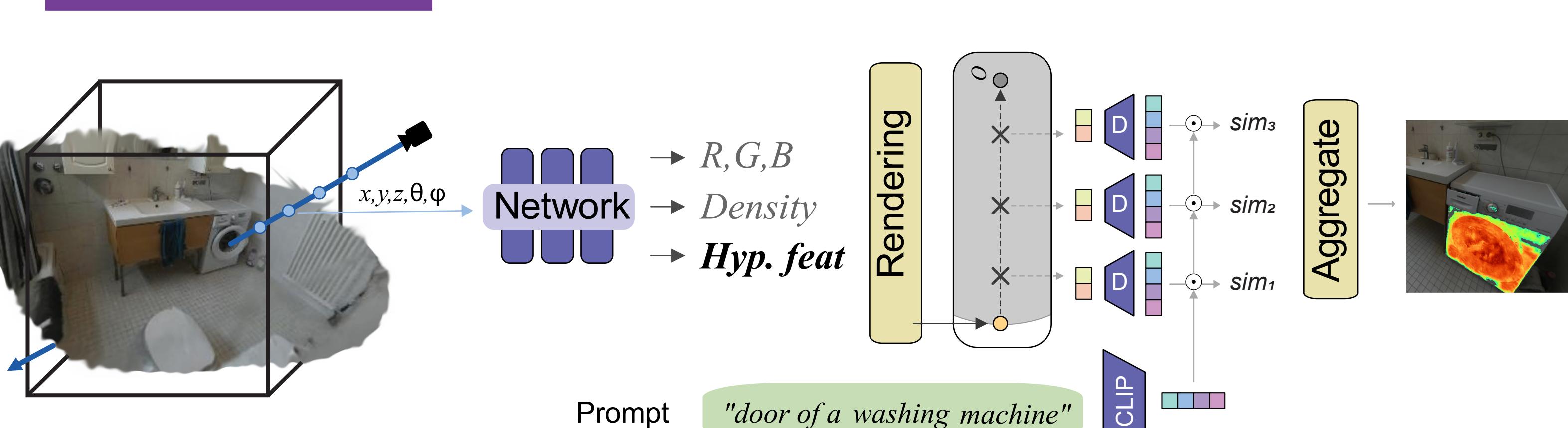
OpenHype represents scene hierarchies using hyperbolic geometry, enabling continuous hierarchical open-vocabulary 3D scene representations.

**3. Hyperbolic Auto-encoder**

💡 Hierarchical loss = Contrastive loss using the geodesic distance d and the exterior angle α as similarity measure

4. NeRF Training

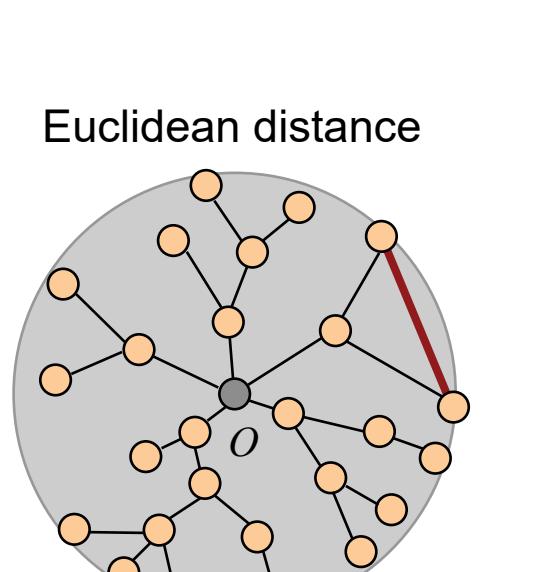
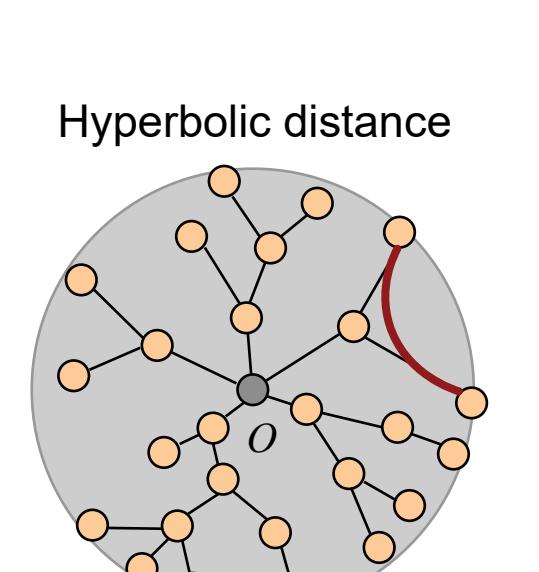
💡 Leaf nodes specify full semantic hierarchy via geodesic path to origin

5. Inference

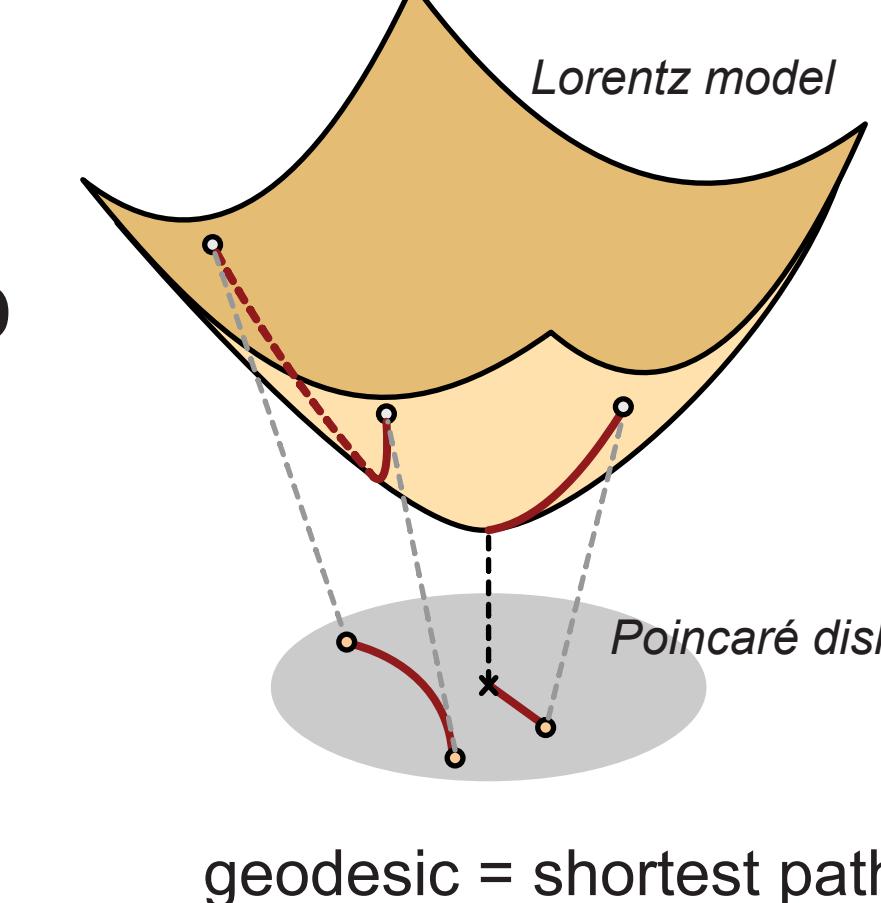
💡 Sampling along geodesic paths specified by each rendered feature yields vision-language features of different granularities

2. Hyperbolic Geometry

- Natural geometry for embedding hierarchies



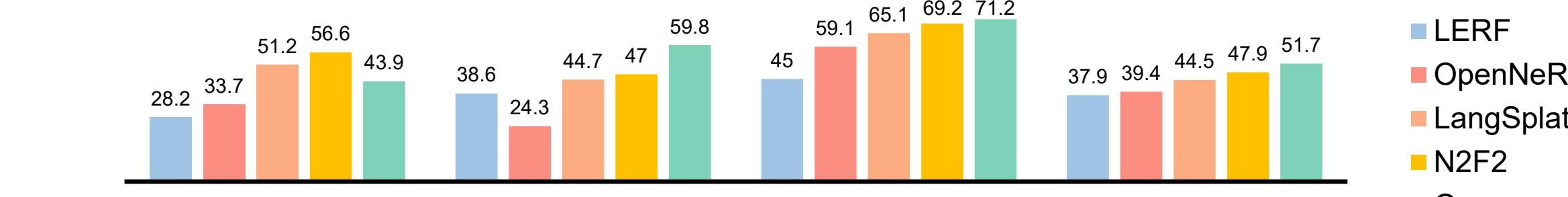
- “more space”
- Shortest distance between two points respects tree structure

**Project Page**

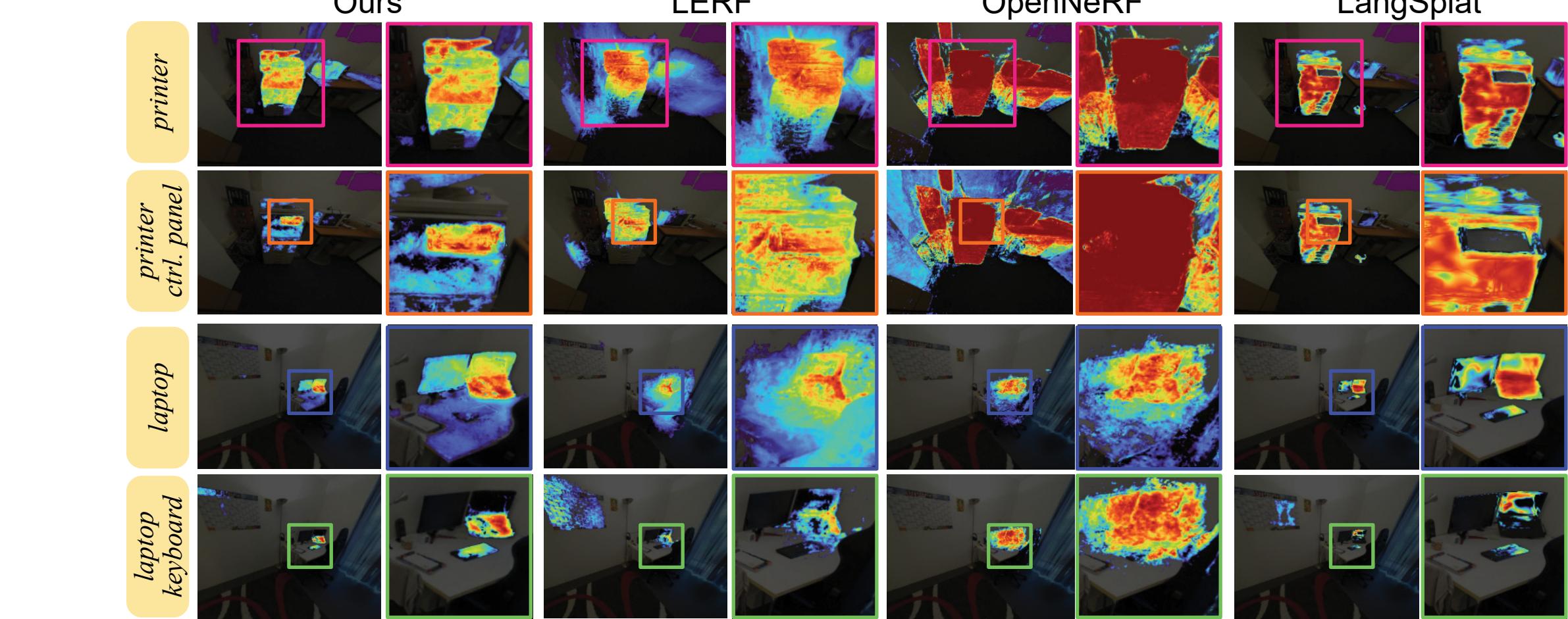
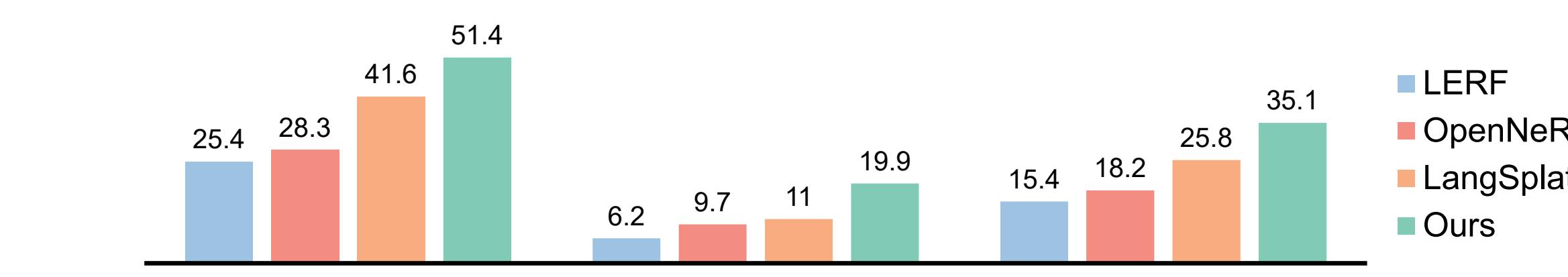
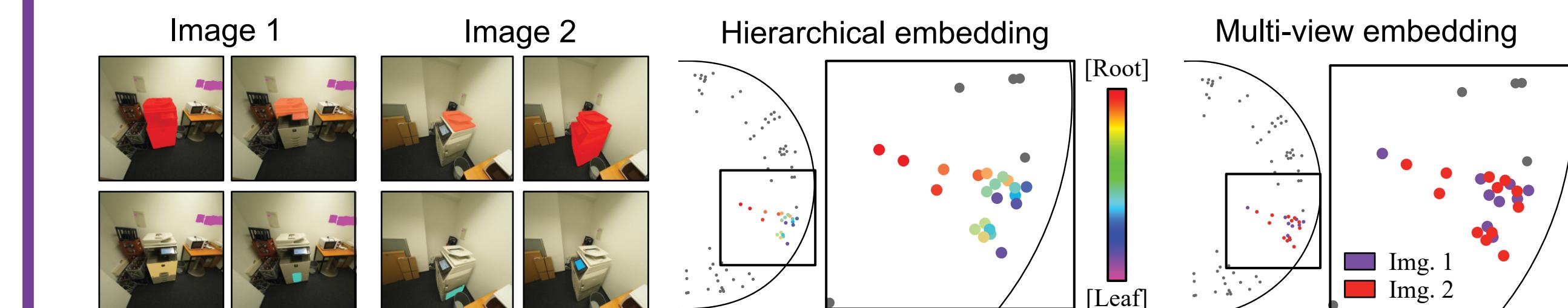
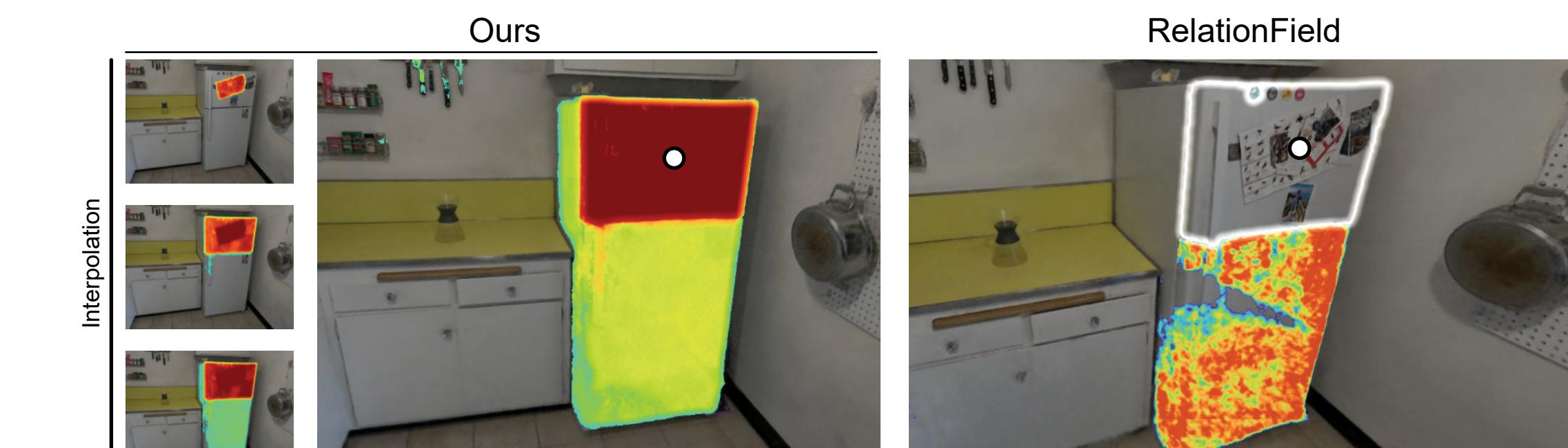
Paper and code are available:
lisaweijler.github.io/openhype-projectpage/

**6. Open-vocabulary Segmentation**

LERF dataset



Scannet++ subset

**7. Multi-view Consistency****8. Continuous Hierarchical Grouping****9. Summary**

- ✓ Natural multi-scale encoding via hyperbolic geometry
- ✓ Continuous hierarchical traversal using geodesic paths
- ✓ State-of-the-art segmentation accuracy and efficiency