Deep Point Cloud Reconstruction

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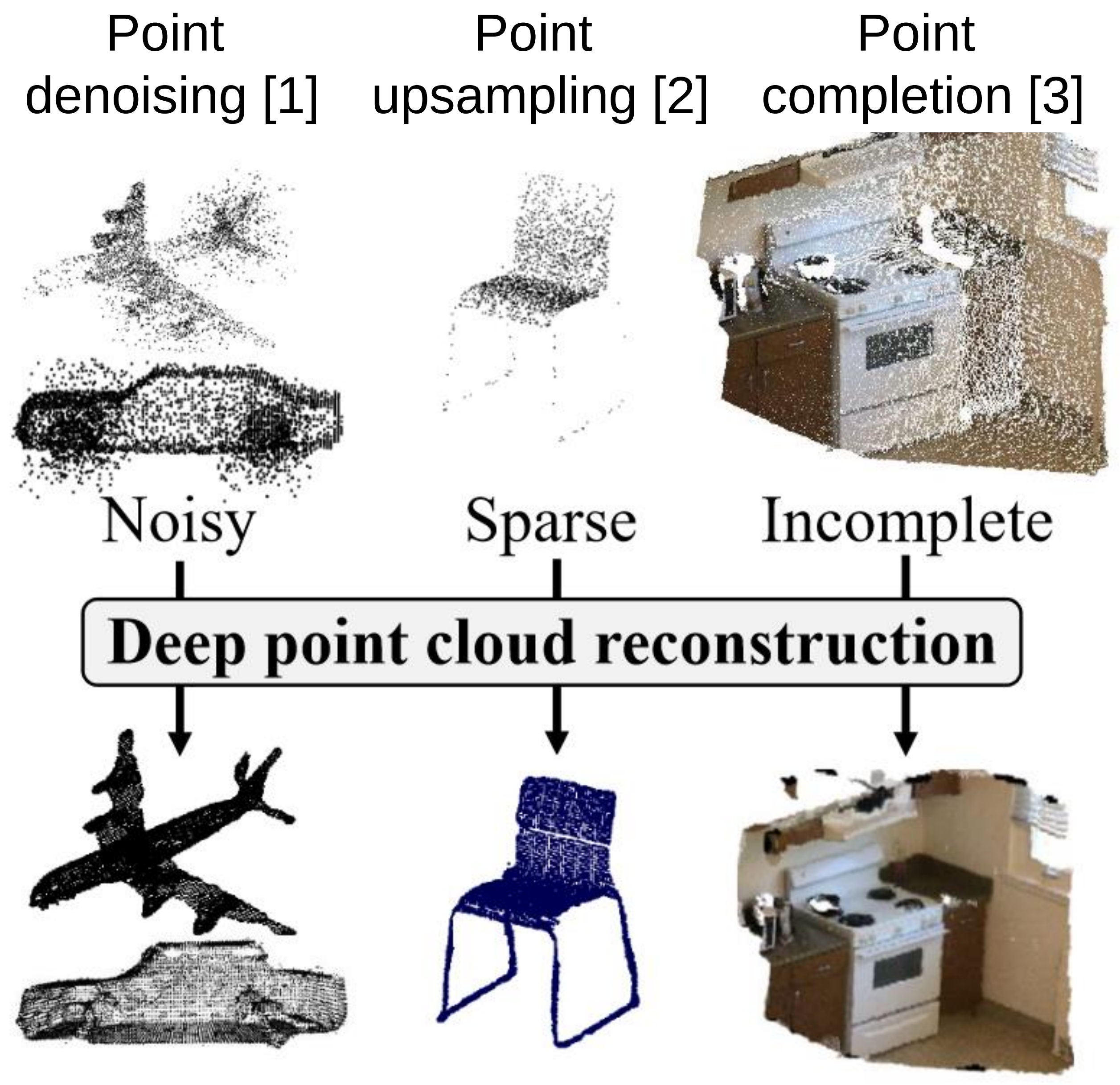
(* equal contribution)
1 KAIST
2 POSTECH

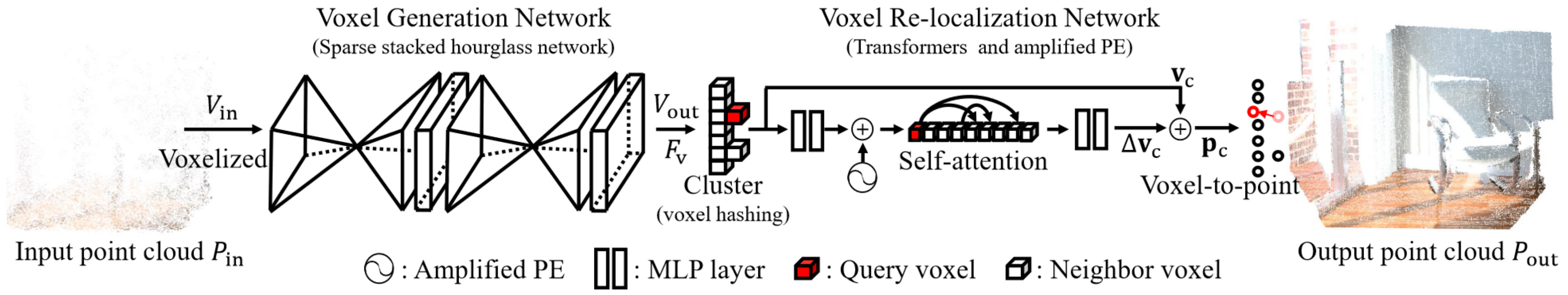
Task Definition



This paper introduce a new task, **Point Cloud Reconstruction**, which **jointly** solves the shortcomings in 3D point clouds.

References
[1] Luo et al., "Score-based point cloud denoising." CVPR. 2021.
[2] Li et al., "Point cloud upsampling via disentangled refinement.“, CVPR 2021.
[3] Peng et al., "Snowflakenet: Point cloud completion by snowflake point deconvolution with skip-transformer." ICCV 2021.
[4] Choy et al., "4d spatio-temporal convnets: Minkowski convolutional neural networks." CVPR 2019
[5] Vaswani et al., "Attention is all you need." Neurips 2017

Two-stage Method



- **1st stage**: raw **point** → dense **voxel**

Why voxel?
- Task coherency with sparse conv layer [4].
  e.g., voxel pruning layer → denoising task
  voxel generation layer → upsampling task

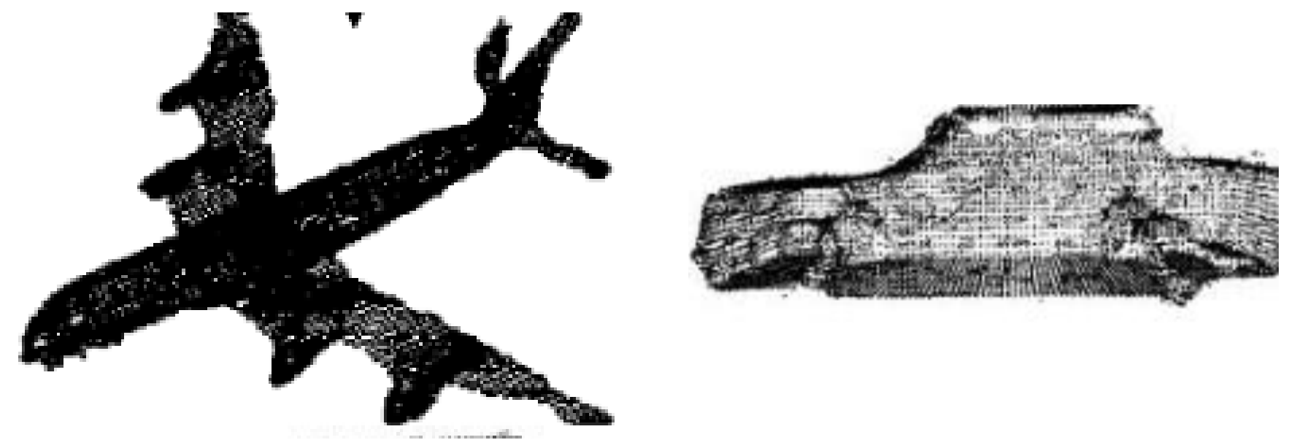
- **2nd stage**: discrete **voxel** → soft **point**

Using transformer [5]
we re-locate 3D voxels closer to the 3D surface
by looking at voxels' neighbors.

Generalization Check

Train set → Test set

Train set
Synthetic, object-scale
high-quality GT
ShapeNet dataset



Test set
Real/synthetic, room-scale
noisy RGBD sensors

ICL-NUIM dataset
ScanNet dataset

Reconstruction Results

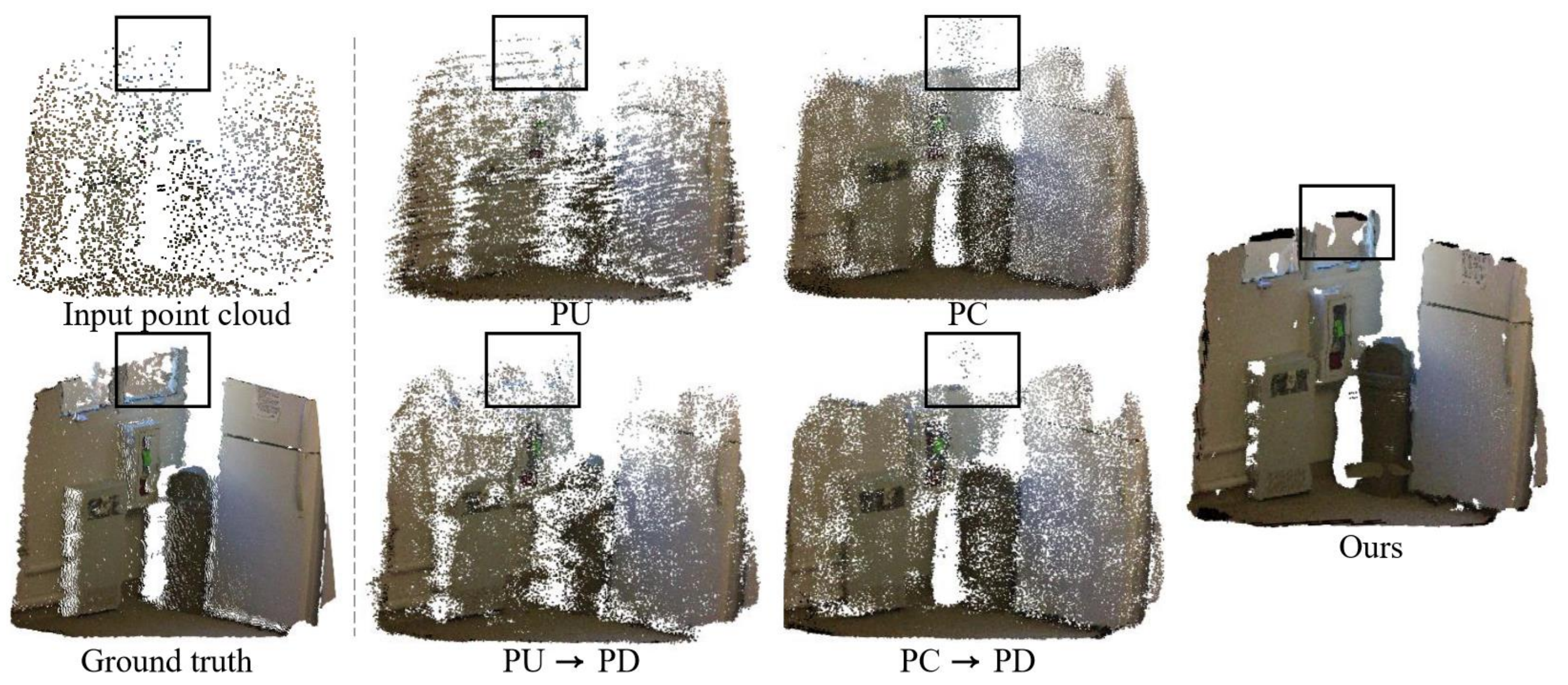


Fig. Qualitative comparison with PC[3], PU[2]. PD[1]

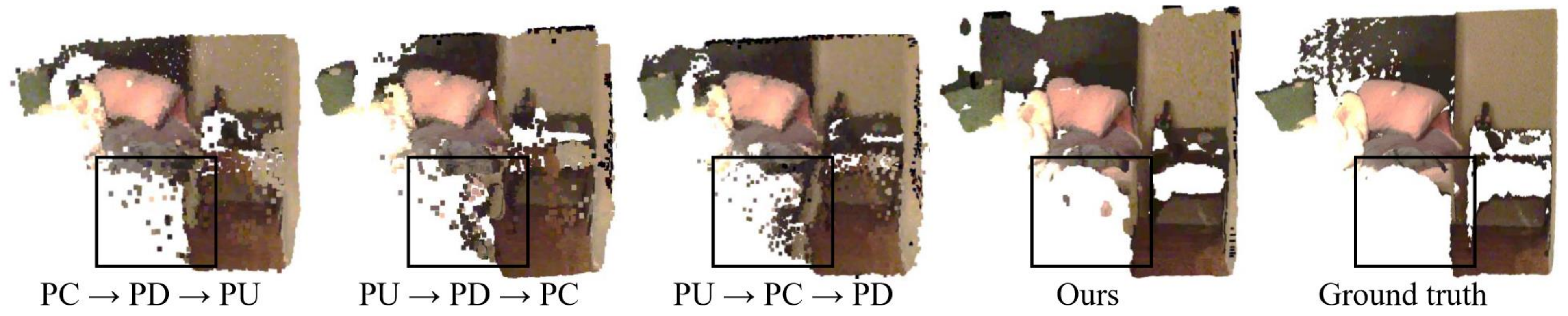
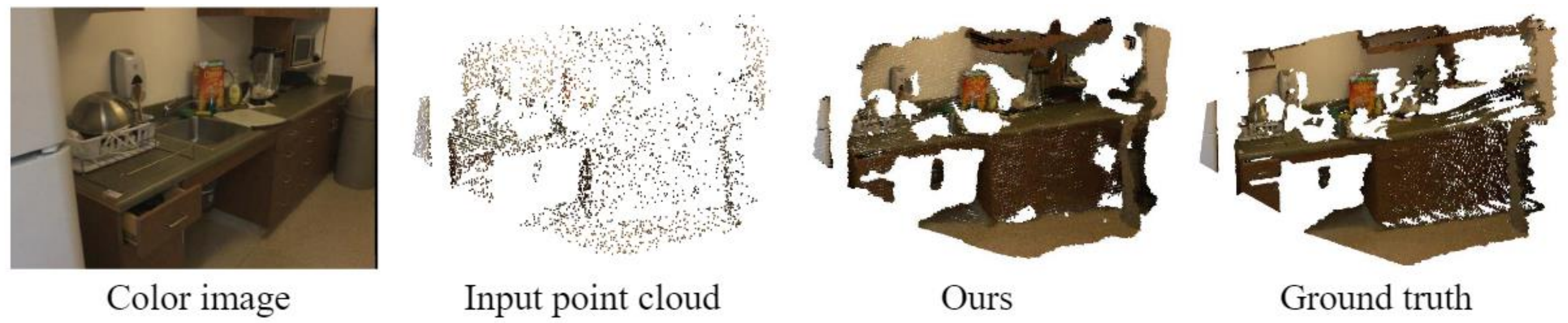


Fig. Comparison with combined previous studies.

Limitation



- Heavy dependency on given raw input points.
- Process of multi-view / larger-scale point sets.