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Learning 3D Shape Completion under Weak Supervision

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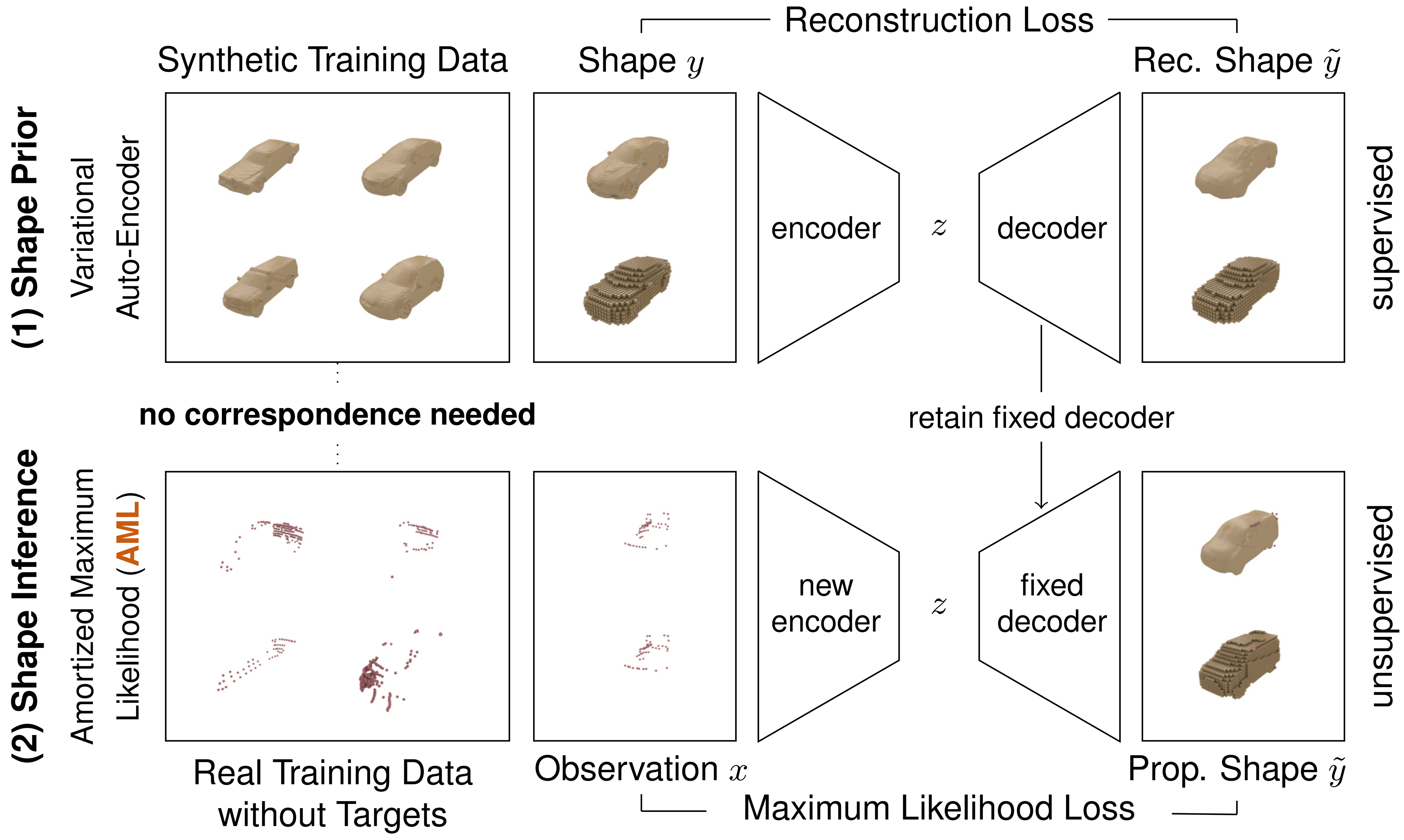
Problem

Learning **3D shape completion** of sparse and noisy point clouds **without ground truth**.

Contributions

- Learning-based, but weakly-supervised, amortized maximum likelihood (**AML**) approach.
- Synthetic and real benchmarks.

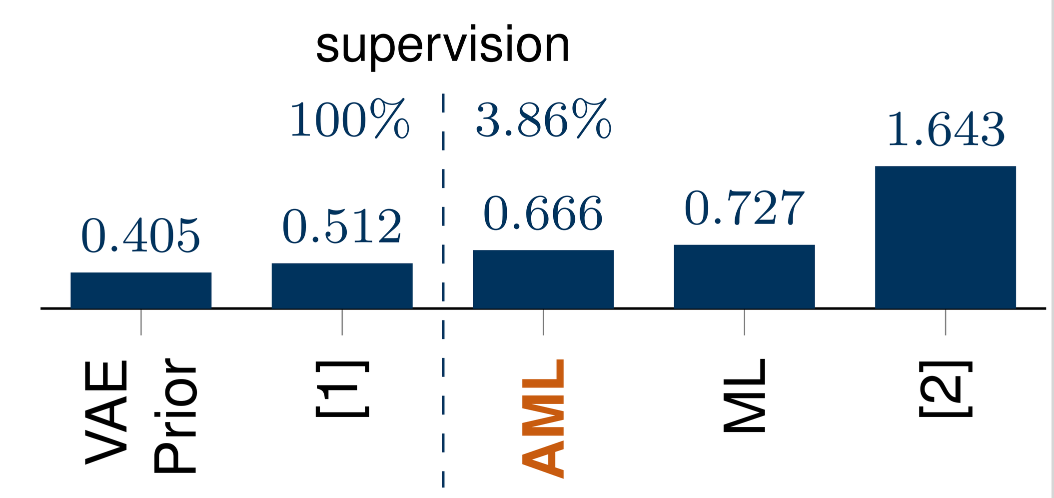
Method



Quantitative Results

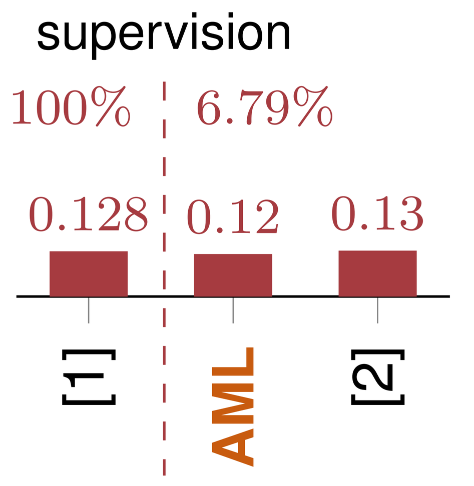
ShapeNet

Accuracy and Completeness [vx] ↓



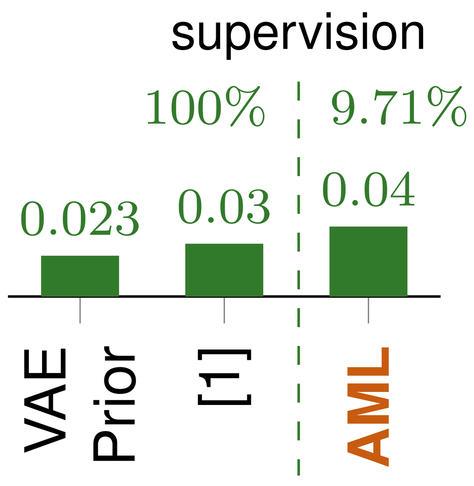
KITTI

Completeness [m] ↓

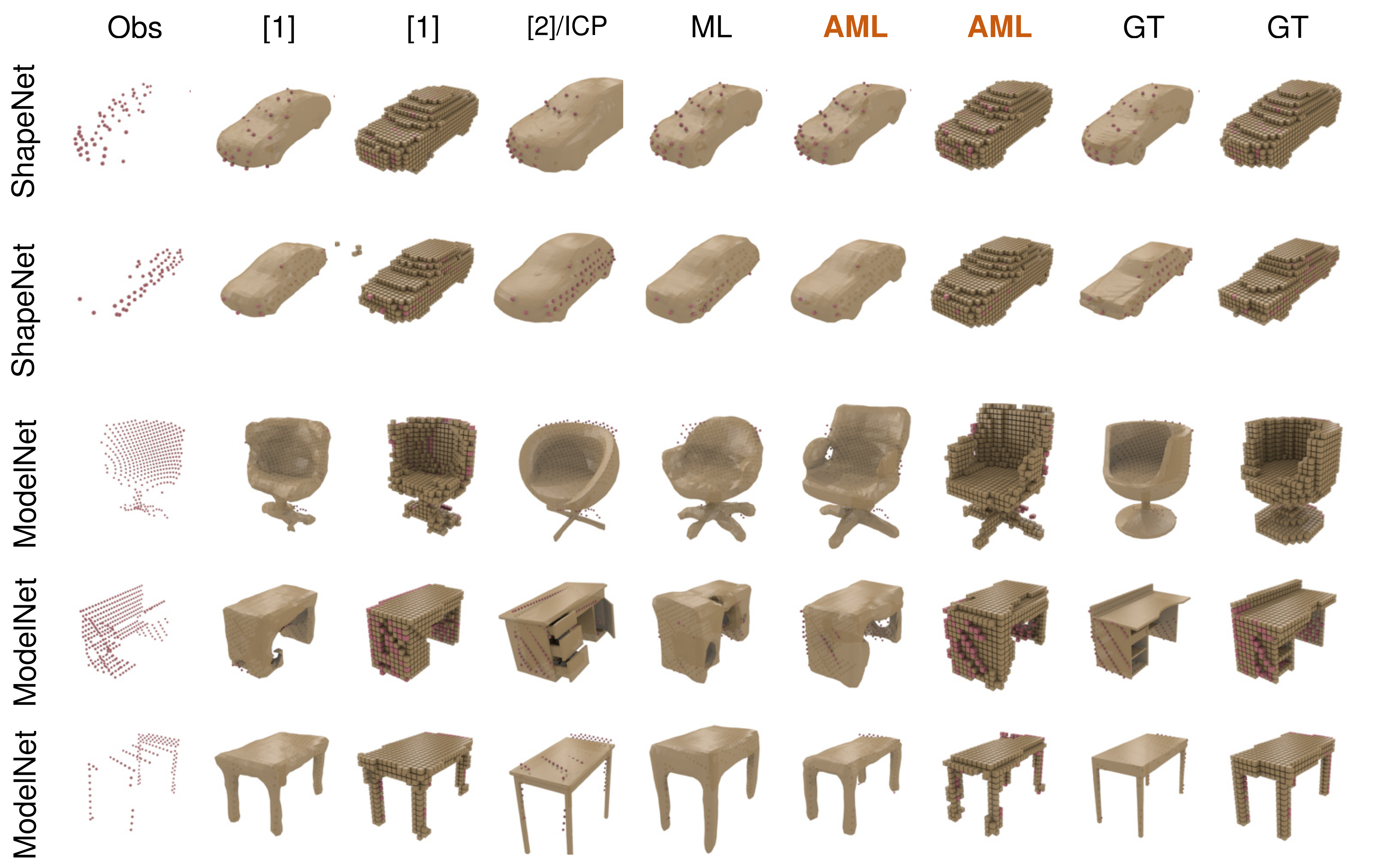


ModelNet10

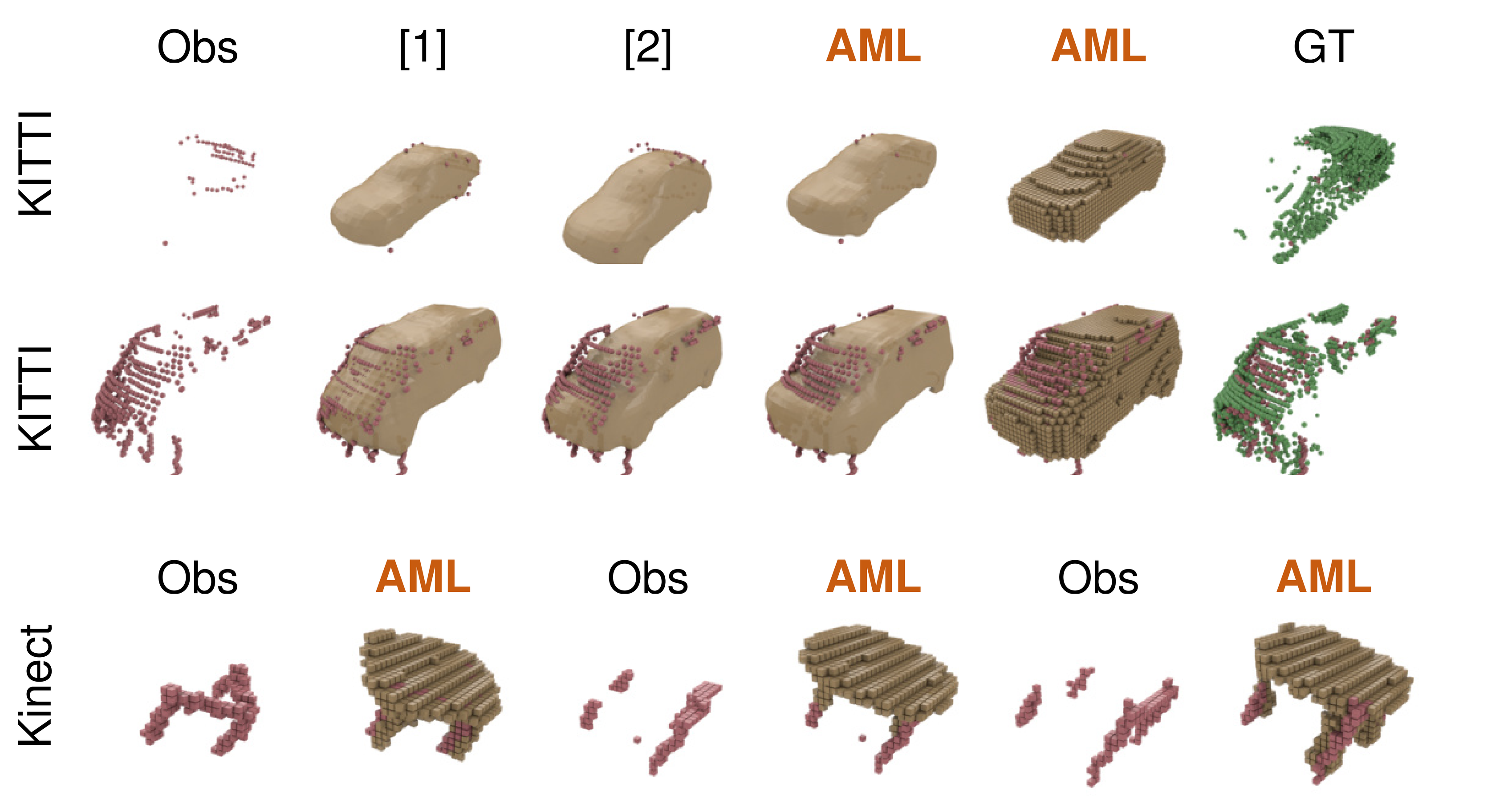
Occupancy Error ↓



Qualitative Results on ShapeNet and ModelNet (Synthetic)



Qualitative Results on KITTI and Kinect (Real)



Conclusion

We proposed a learning-based, but weakly-supervised, amortized maximum likelihood (**AML**) approach to 3D shape completion.

- Outperforms data-driven approach [2]; but 84 times faster.
- Competitive to learning-based approach [1]; but up to 96% less supervision.

Paper, Code and Data:
davidstutz.de/mlss2018

References

[1] A. Dai et al. "Shape Completion using 3D-Encoder-Predictor CNNs and Shape Synthesis". In: *CVPR*. 2017
[2] F. Engelmann et al. "Joint Object Pose Estimation and Shape Reconstruction in Urban Street Scenes Using 3D Shape Priors". In: *GCPR*. 2016
[3] A. Geiger et al. "Are we ready for Autonomous Driving? The KITTI Vision Benchmark Suite". In: *CVPR*. 2012
[4] A. X. Chang et al. "ShapeNet: An Information-Rich 3D Model Repository". In: *arXiv.org* 1512.03012 (2015)
[5] Z. Wu et al. "3D ShapeNets: A deep representation for volumetric shapes". In: *CVPR*. 2015
[6] B. Yang et al. "3D Object Dense Reconstruction from a Single Depth View". In: *arXiv.org* abs/1802.00411 (2018)