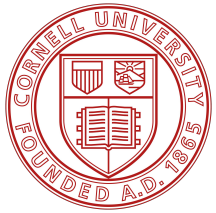
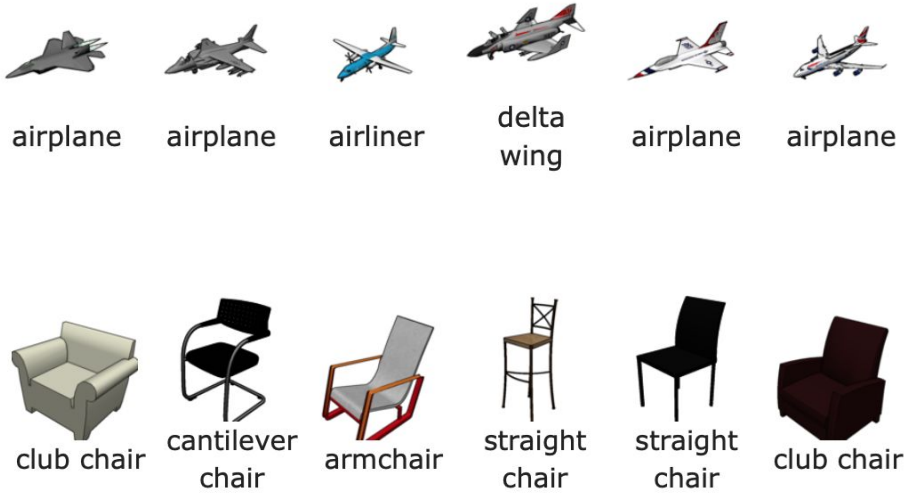
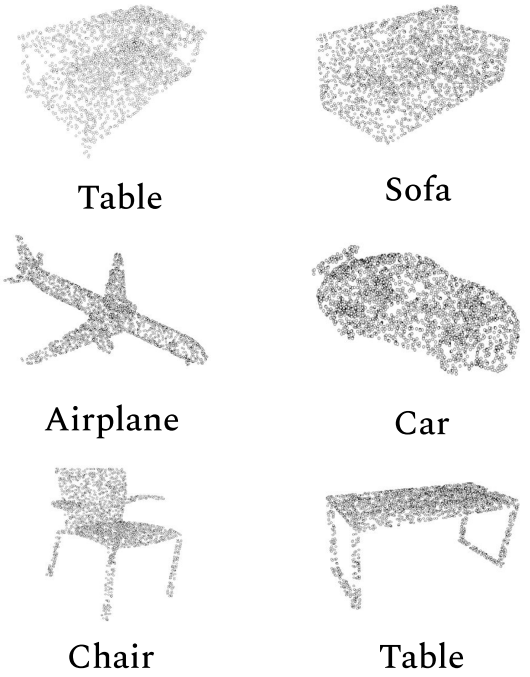


Self-supervised Learning of Point Clouds via Orientation Estimation

Omid Poursaeed, Tianxing Jiang, Han Qiao,
Nayun Xu, Vladimir Kim

Labeling 3D data is expensive





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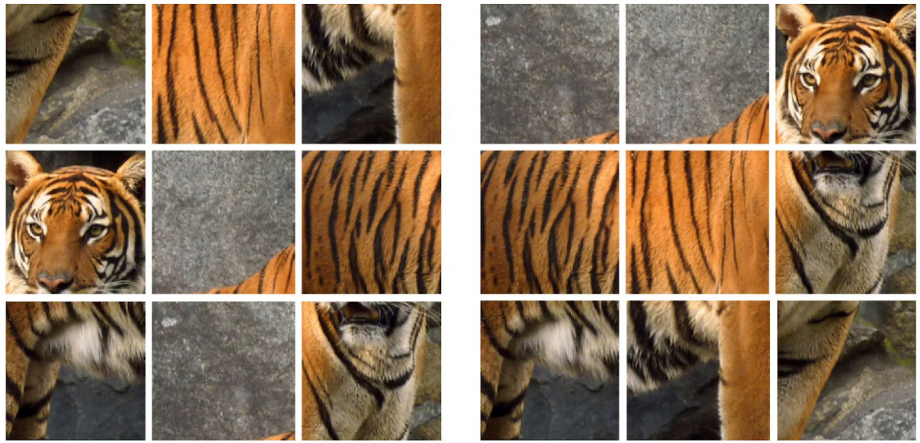
Learning with less supervision

Self-supervised Learning: Using a pretext task to learn representations that are useful for solving downstream tasks

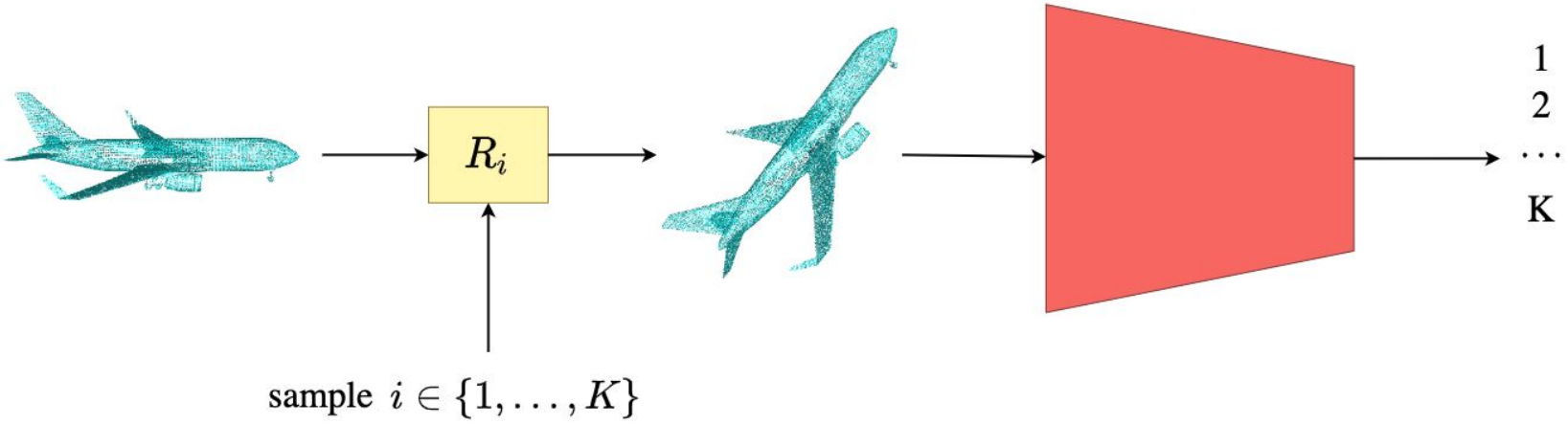
Pretext tasks:

- Shuffling and rearranging parts
- Colorizing grayscale image
- Inpainting
- Counting
- **Rotation**



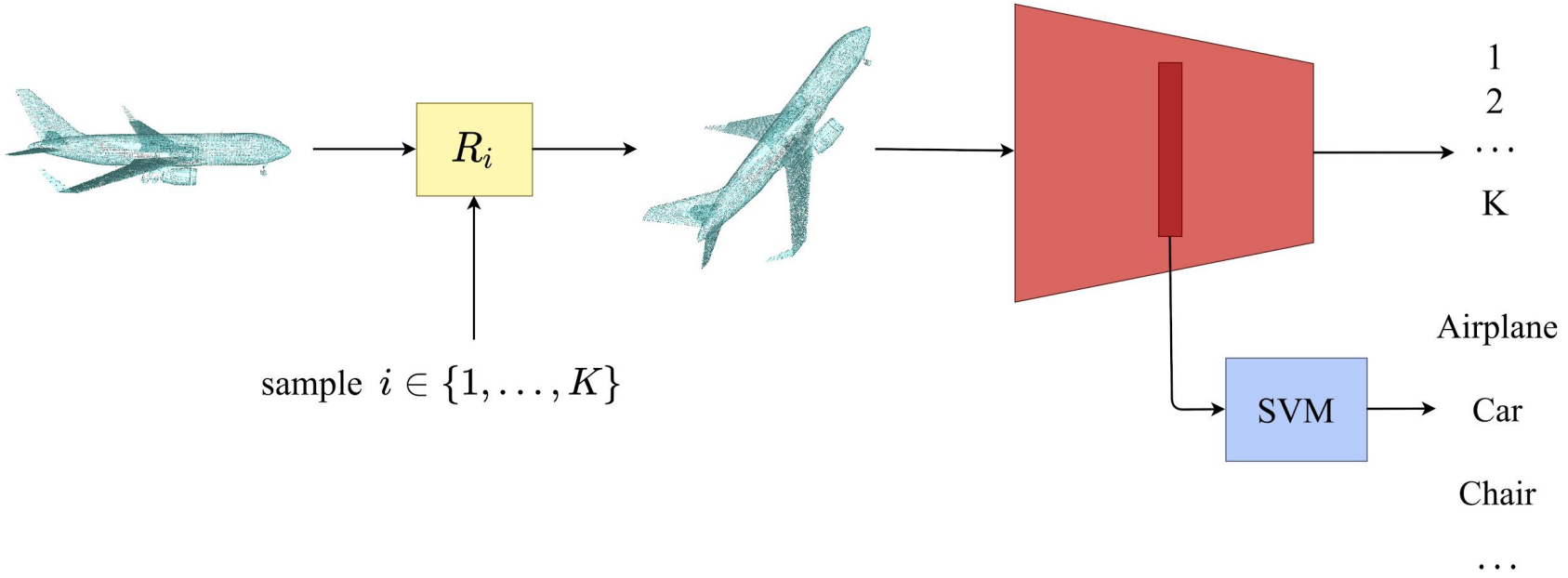
Self-supervised Learning of Point Clouds via Orientation Estimation, Poursaeed et al., 3DV 2020

Rotation Prediction on Point Clouds



Self-supervised Learning of Point Clouds via Orientation Estimation, Poursaeed et al., 3DV 2020

Self-supervised Learning of Point Clouds



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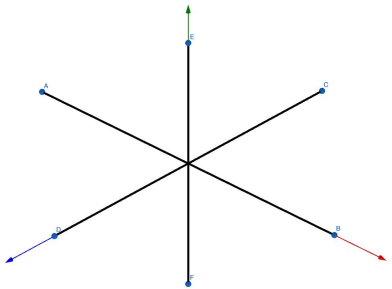
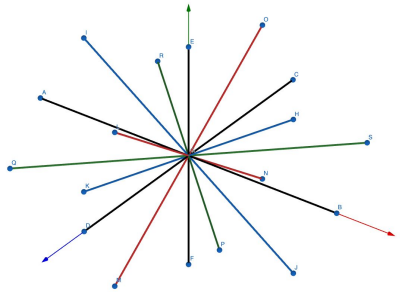
Distribution of Angles

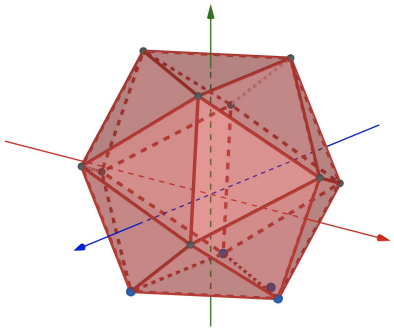
K = 6

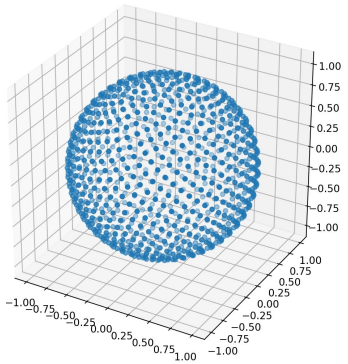




K = 18

K = 32





K = 54

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Classification Accuracy on ModelNet40

Previous work	
VConv-DAE [65]	75.50%
3D-GAN [80]	83.30%
Latent-GAN [1]	85.70%
FoldingNet [85]	88.40%
VIP-GAN [23]	90.19%
Context Prediction (DGCNN) [63]	90.64%
Context Prediction (PointNet) [63]	87.31%
Ours (DGCNN)	
6 angles	90.06%
18 angles	**90.75%**
32 angles	89.41%
Ours (PointNet)	
6 angles	87.5%
18 angles	88.5%
32 angles	88.6%
Ours + Context Prediction	**91.84%**

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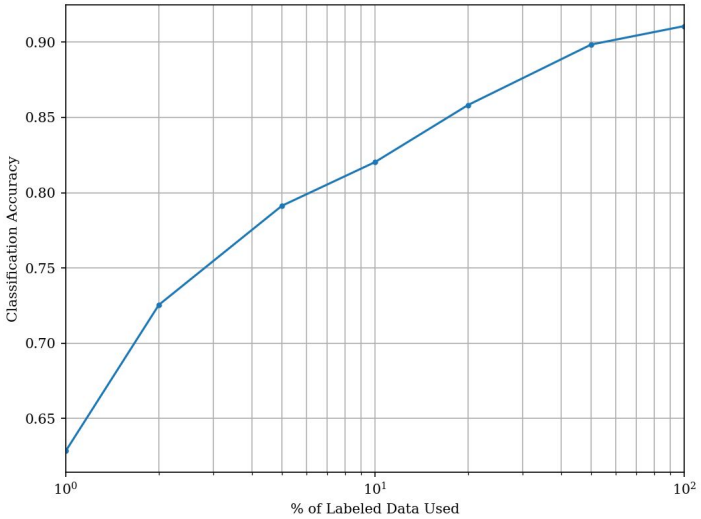
Learning with Fewer Labels



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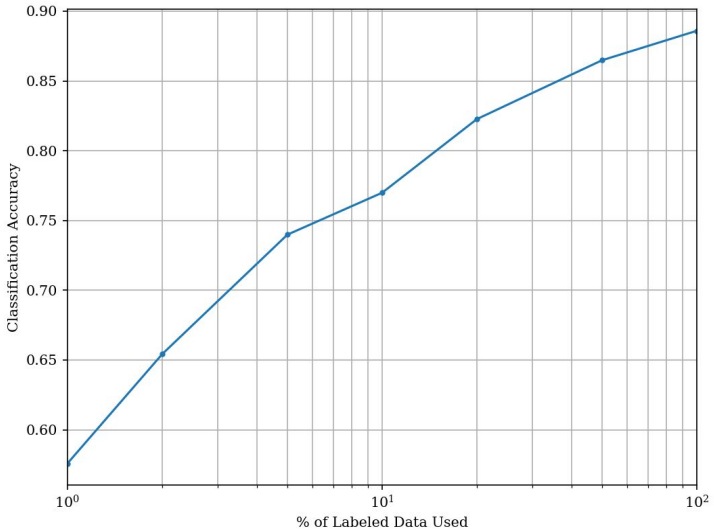

K = 32

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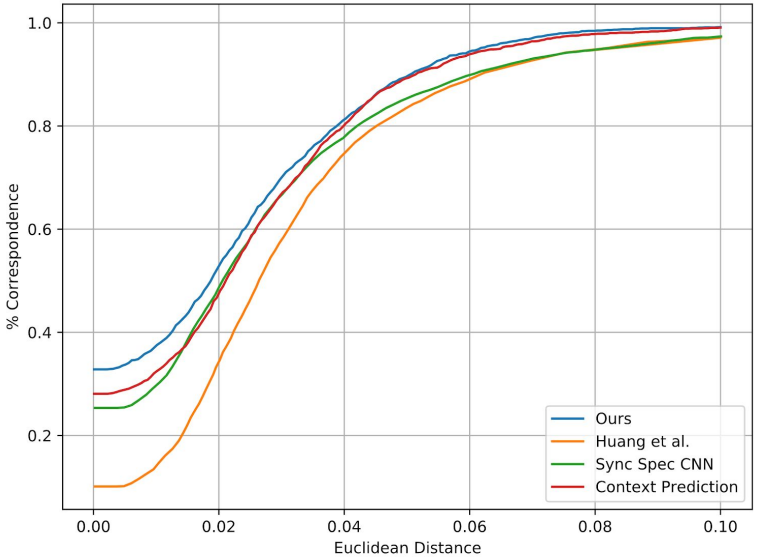
3D Keypoint Prediction

Pre-training on rotation prediction and fine-tuning on keypoint regression



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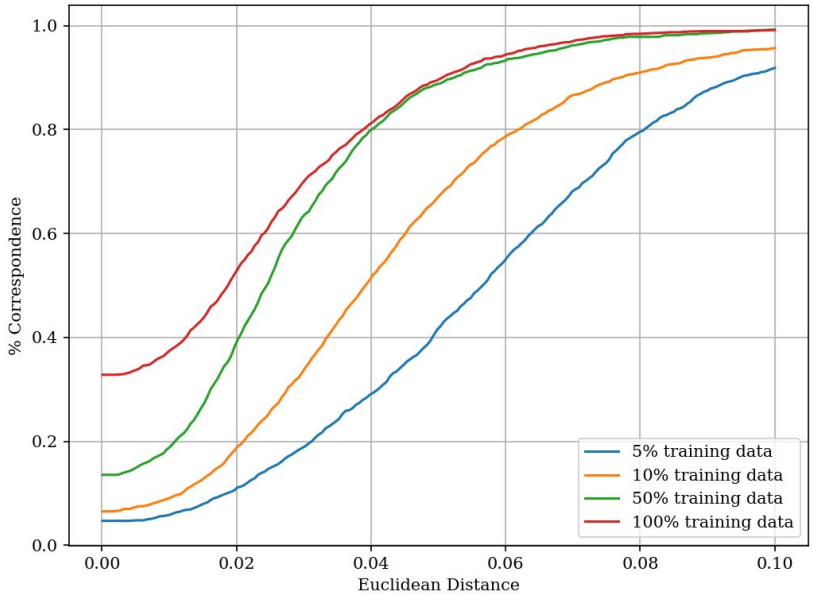
3D Keypoint Prediction with Fewer Labels



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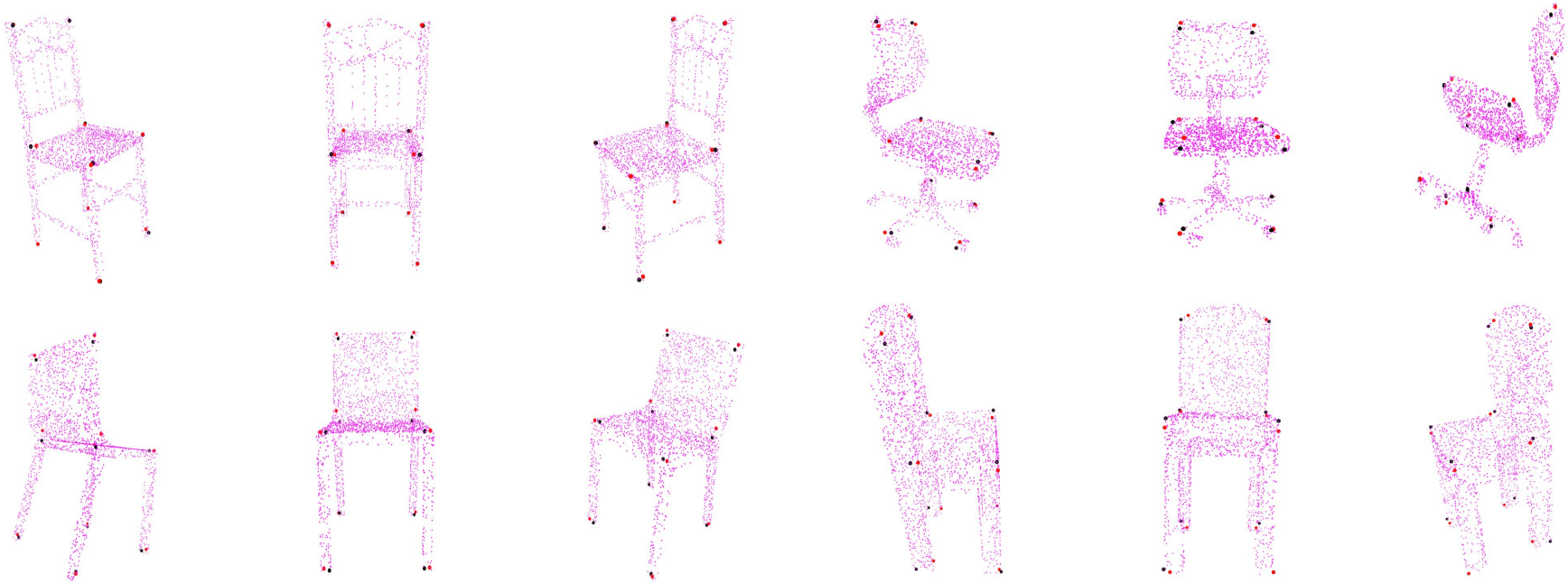
3D Keypoint Prediction



Self-supervised Learning of Point Clouds via Orientation Estimation, Poursaeed et al., 3DV 2020