Coarse-to-Fine 3D Shape Refinement

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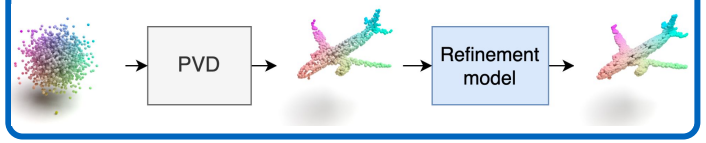
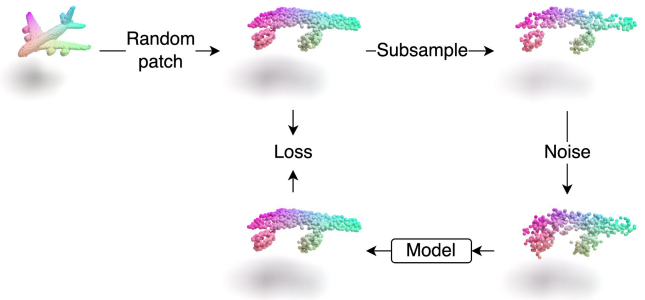
Improve point cloud models

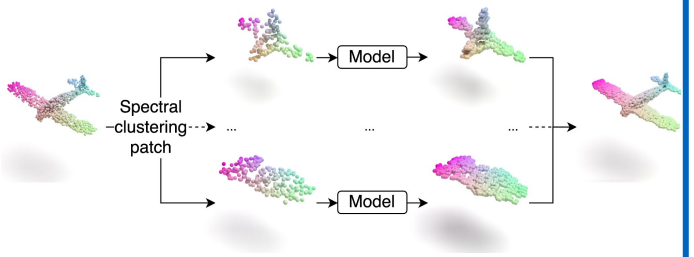
Input: Sparse and noisy point cloud of a predefined shape.
Output: Upsampled point cloud with refined surface.



Training

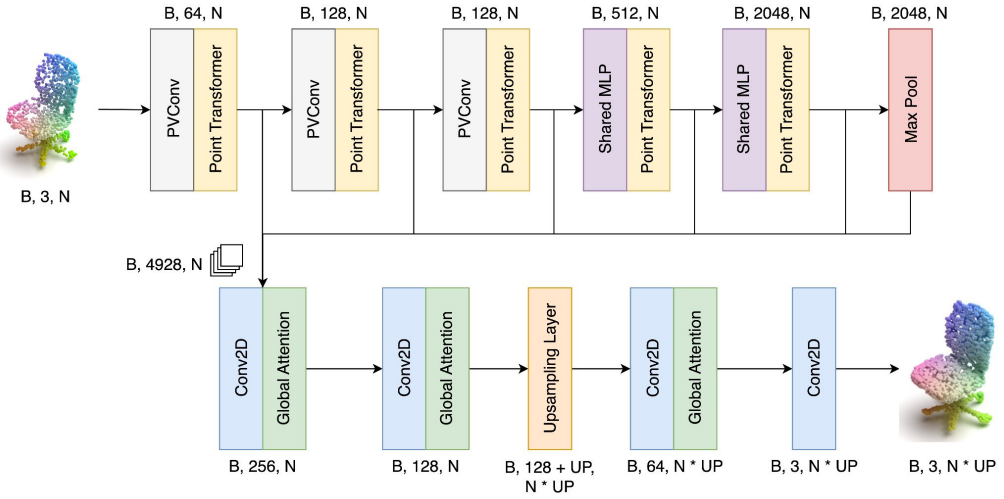


Inference



Spectral clustering for patch creation during inference ensures geometrically coherent patches of similar size.
The runtime tradeoff is too significant for training.

Architecture



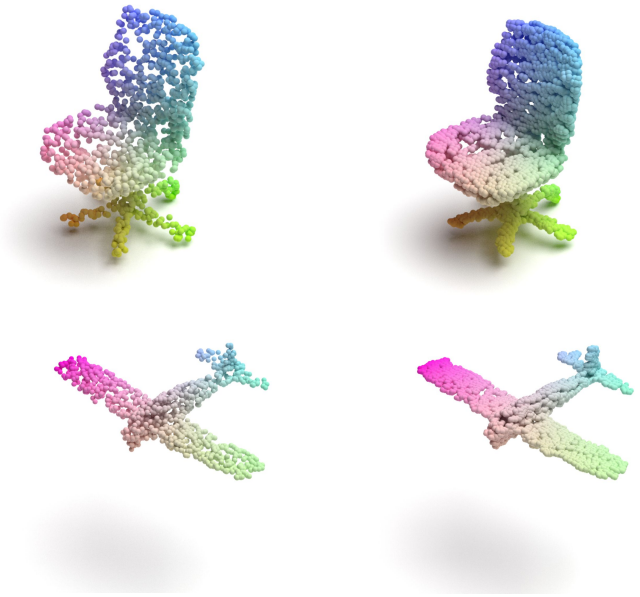
- We contribute a new shape refinement architecture by combining PointTransformer, Feature Expansion (based on PU-Net) and PVCNN
- MaxPool preserves the spatial dimensions of the input.
- Upsampling layer replicates the learned features and adds one-hot encoding to enable Conv2d to differentiate the replicated features.

Quantitative results

- Refinement of the PVD output for airplane and chair shapes.
- A score closer to 50% indicates better performance.

	Airplane		Chair	
Networks	1-NNA-CD	1-NNA-EMD	1-NNA-CD	1-NNA-EMD
PVD	**75.49%**	**68.51%**	58.37%	**56.01%**
PVD + Ours	79.87%	73.37%	**56.49%**	58.87%

Visual Results



PVD Output **Refined shapes**

Limitations

The sparsity and irregularity of some PVD outputs, along with insufficient detail to discern features, can make refinement difficult.