SfmCAD: Unsupervised CAD Reconstruction by Learning Sketch-based Feature Modeling Operations (Supplementary Materials)

Pu Li[1,2] Jianwei Guo[1,2*] Huibin Li[2,1] Bedrich Benes[3] Dong-Ming Yan[1,2]
[1]MAIS, Institute of Automation, Chinese Academy of Sciences
[2]School of Artificial Intelligence, University of Chinese Academy of Sciences [3]Computer Science, Purdue University

1. Editability of SfmCAD

SfmCAD transforms semantically segmented voxels (a) into a sketch+path output (b), which can be directly used for designers to edit the reconstructed models. Fig. 1 illustrates the process of editing and re-creation based on the output from SfmCAD. We demonstrate in (b-e) how modifying paths can alter the model's structure without changing the geometric details of the shape. Subsequently, in (e-h), we show a series of modifications to the geometric details while maintaining the paths constant.

In particular, we start by removing two paths (b-c). Then, we alter the components' position and shape (c-d) by manipulating the Bézier curve control points of the path. We then remove the modified component in (d), subdivide the paths of the two legs of the chair, and use toggle cyclic to close the paths (e). Next, we replace the original sketches of the three lower components of the chair with a sketch of multiple circles, resulting in strip-like forms (f). We further enrich geometric details by increasing the twist angles of five parts (g). Finally, we perform a Boolean difference operation between the result in (g) and a series of cuboids, creating an array of perforations on the chair back (h).

The above procedures are performed using Blender software[1], but similar modifications can be easily made with other CAD software.

2. Combining Sweep and Loft

We conducted experiments on the ShapeNet dataset's chair category, employing sweep and loft operations with specific parameter configurations: we set N_p to 2 for the loft and 8 for the sweep. Fig. 2 demonstrates that our approach can effectively balance these operations. The loft operation demonstrates superior performance in handling flat shapes, whereas the sweep operation is more adept at managing elongated ones. This finding confirms our network's ability to modulate the influence of each operation on specific primitives.

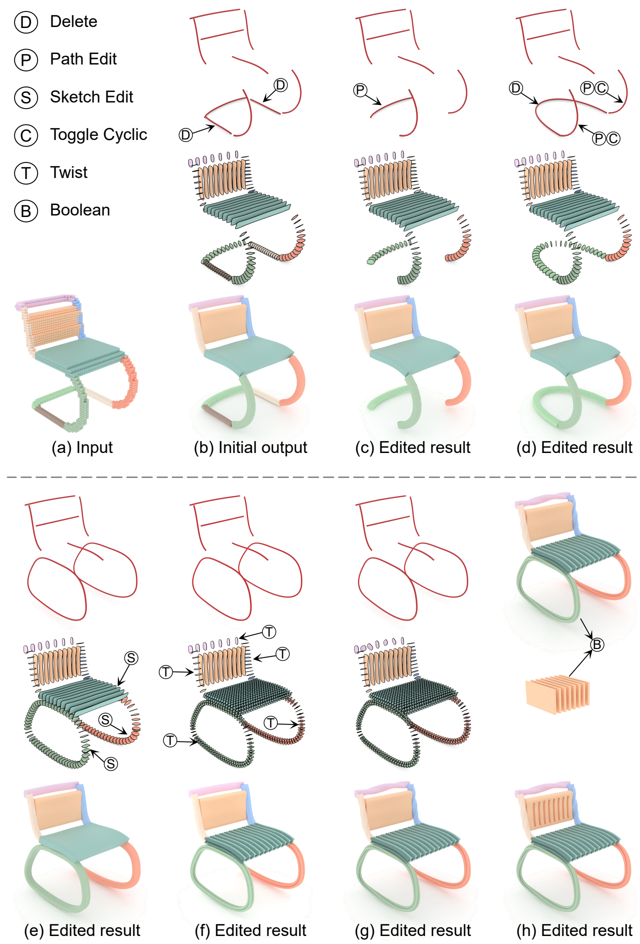

Figure 1. Varieties of methods for editing and further creating based on the output of SfmCAD. Columns (b-g) sequentially present the shape's path, sketch, and a representation of sketch+path, from top to bottom.

3. More comparison results

Comparison to CAPRI-Net [5]. We did not initially compare with CAPRI-Net because it's partitioning space representation leads to less directly editable outcomes. In con-

*Corresponding authors: jianwei.guo@nlpr.ia.ac.cn
[1]https://www.blender.org/

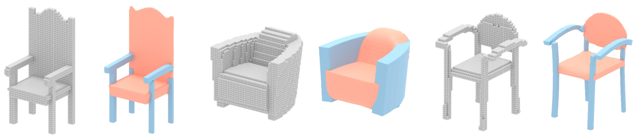

Figure 2. Interaction of **Sweep** and **Loft** operations.

Table 1. Quantitative comparison against CAPRI-Net.

	ABC dataset			ShapeNet dataset		
Methods	CD↓	ECD↓	NC↑	CD↓	ECD↓	NC↑
CAPRI-Net	**0.26**	6.34	**0.92**	**0.38**	**12.28**	**0.88**
Ours	0.39	**5.04**	**0.92**	0.63	14.10	0.87

trast, our method is designed to produce easily editable outputs using standard CAD primitives. The focus of our comparisons was to showcase methods that also offer this level of editability in their outputs. As requested, we now include a comparison with CAPRI-Net in Tab. 1 for reference, where our reconstruction accuracy is competitive on ABC and slightly worse on ShapeNet.

More qualitative comparisons. We show more comparison results between SfmCAD and UCSG-Net [1], CSG-Stump [3], ExtrudeNet [4], and SECAD-Net [2]. The qualitative results of each method on the datasets of ABC, ShapeNet, and PartNet are presented in Fig. 3, Fig. 4, and Fig. 5, respectively. All reconstruction results are generated via Marching Cubes at a resolution of 256^3, aligning with the main paper.

References

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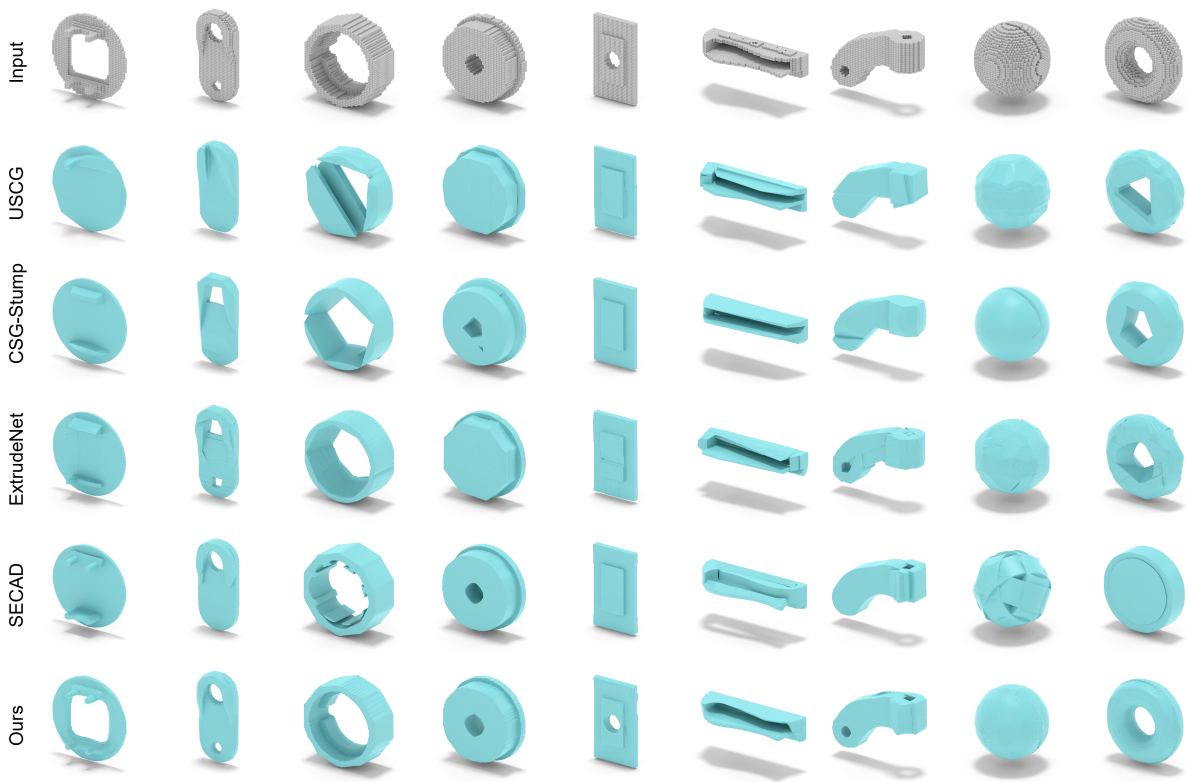

Figure 3. Visual comparison between reconstruction results on ABC dataset.

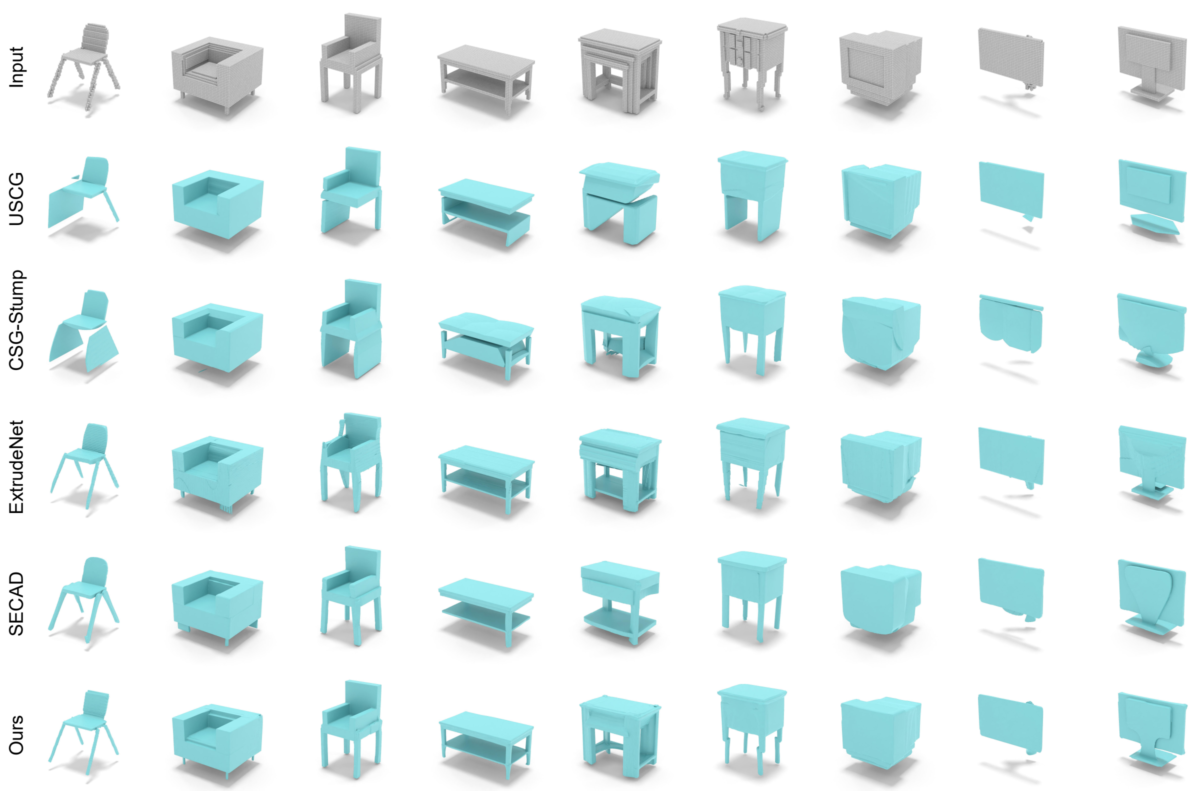

Figure 4. Visual comparison between reconstruction results on ShapeNet dataset.

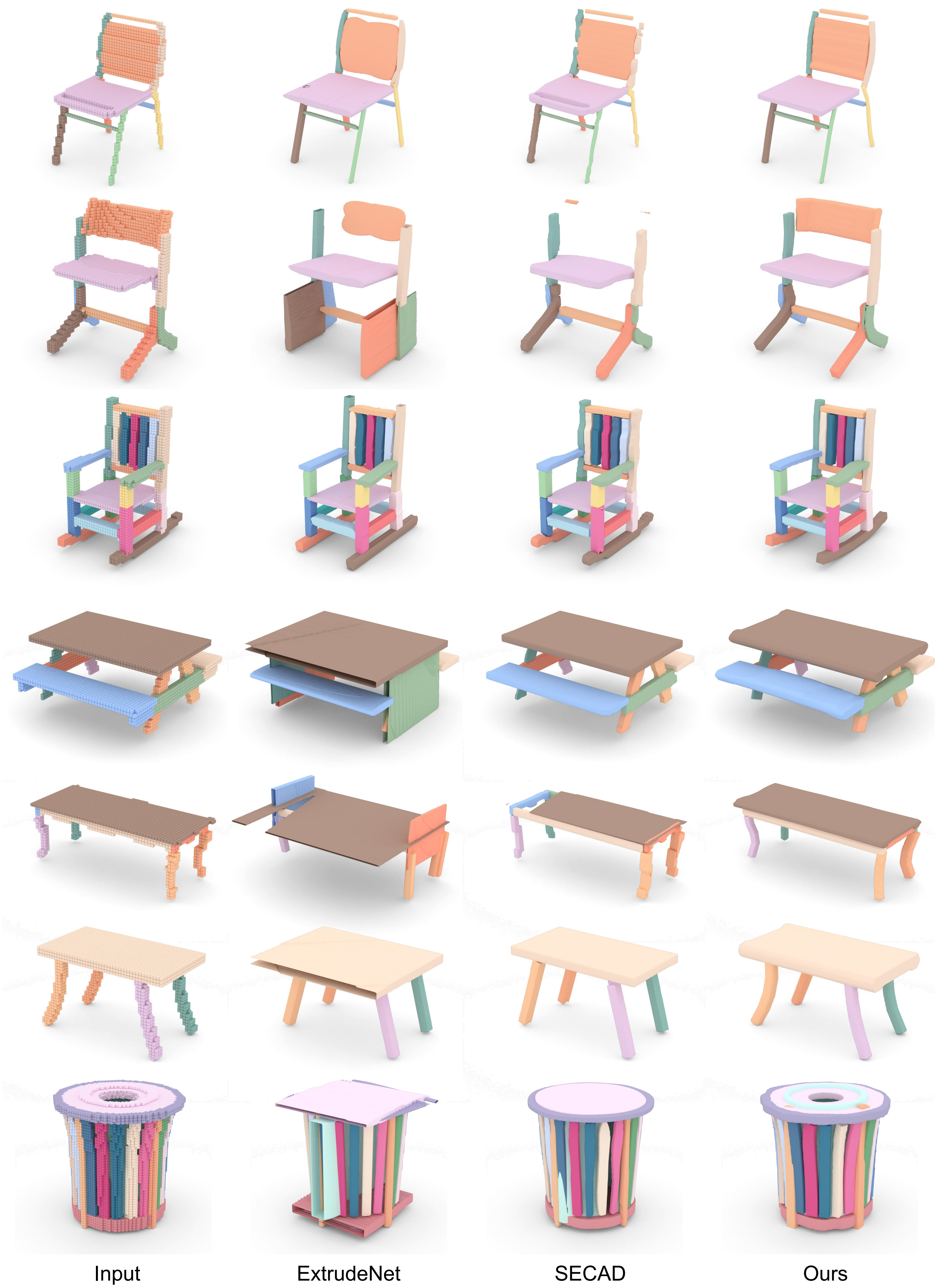

Figure 5. Visual comparison between reconstruction results on PartNet dataset.