

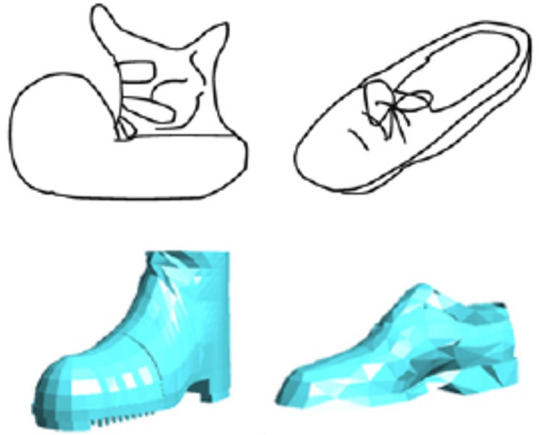
3D Shape Reconstruction from Free-Hand Sketches

Jiayun (Peter) Wang, Jierui Lin, Qian Yu, Runtao Liu, Yubei Chen, Stella X. Yu
UC Berkeley/ICSI



<https://github.com/samaonline/3D-Shape-Reconstruction-from-Free-Hand-Sketches>

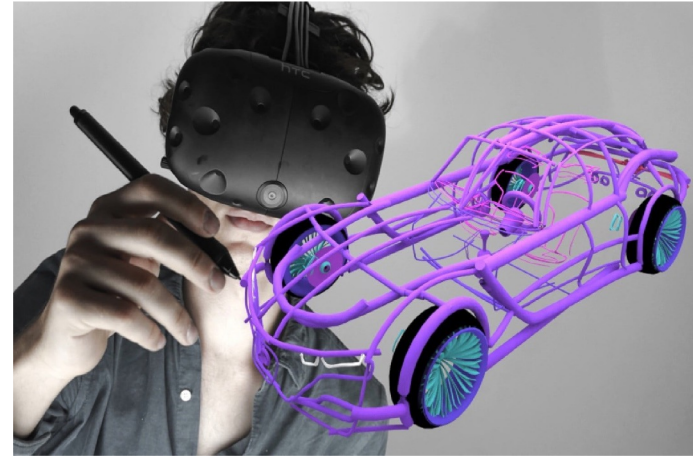
Sketch to 3D: Applications



Online shopping

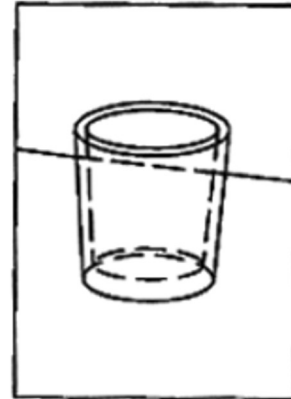
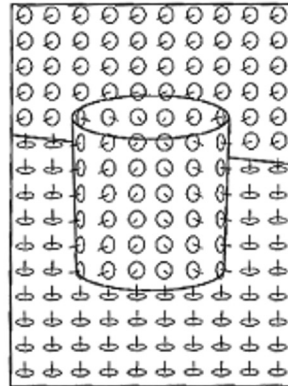
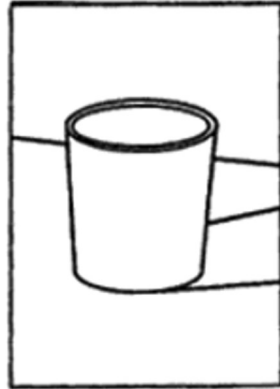
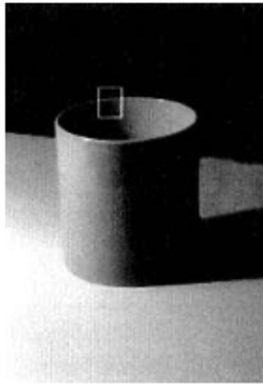
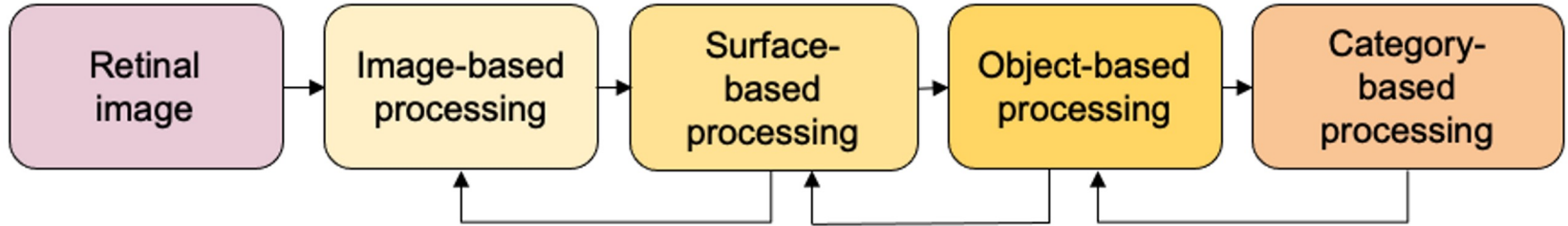


Interactive design



VR/AR

Marr's Theory: From Primal Sketch to 3D Models

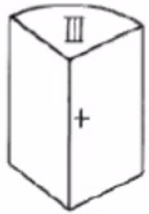


Cup
"Grab me"
....

sketch → 3D

Sketch to 3D: Huffman-Clowes Line Labeling

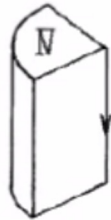
- Every line in natural pictures of **polyhedron objects** should have exactly one of the four labels
 - Convex (+), concave (-), or occluding (\rightarrow , \leftarrow)



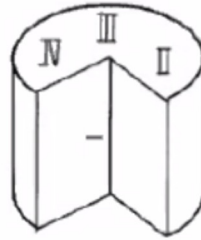
(a)



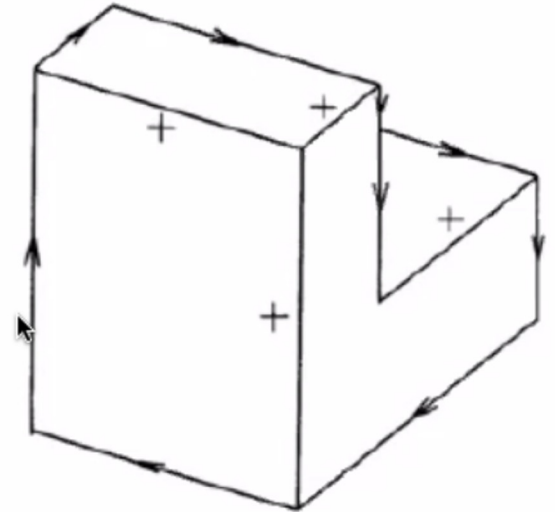
(b)



(c)

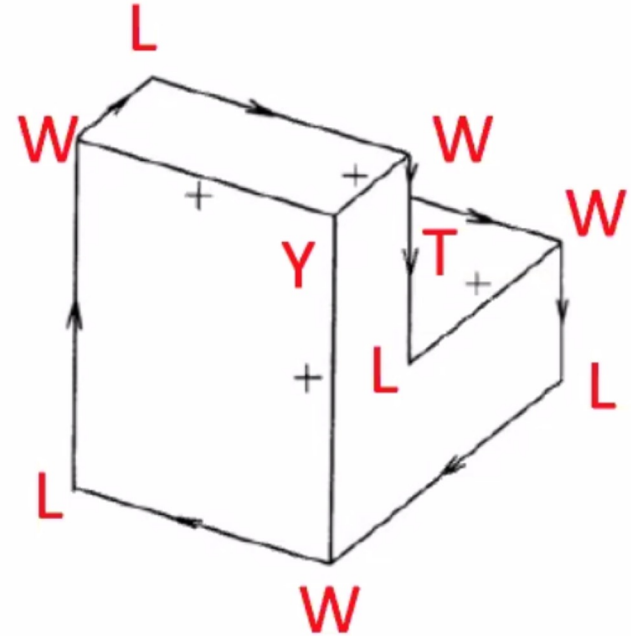


(d)

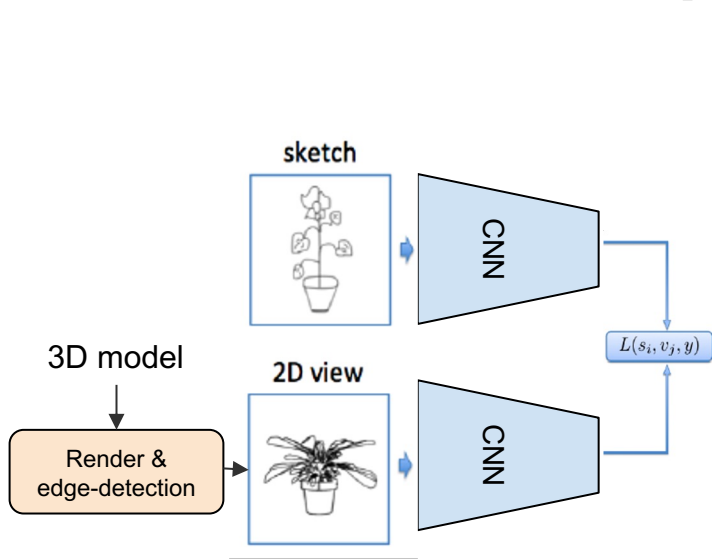


Sketch to 3D: Huffman-Clowes Line Labeling

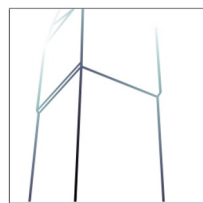
- **12 valid configurations** for trihedral vertex
 - L-, Y-, W-types
 - Represents just 11.5% of all possible configurations
- **T-junction** occurs when an edge occludes another partially.
 - Does not correspond to a three-dimensional vertex.



Sketch to 3D: Deep Learning Works



Input image

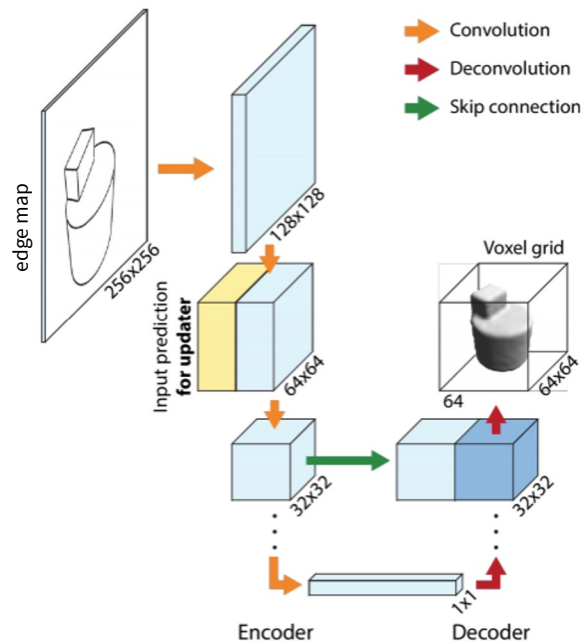


3D wireframe



Novel view

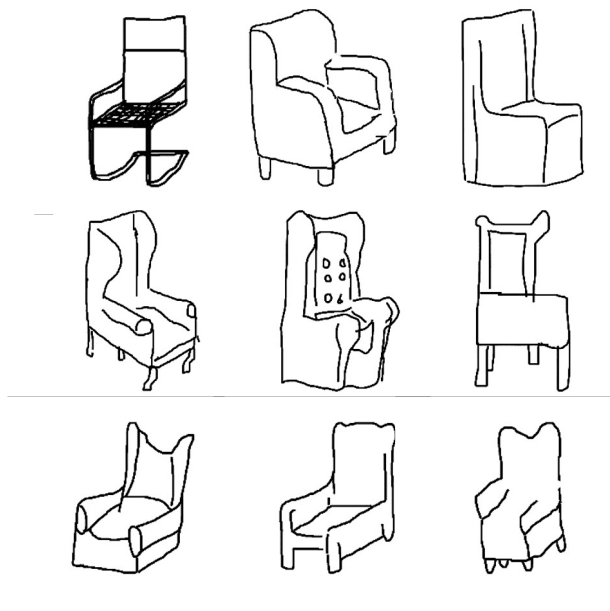
Image to 3D wireframe



Edge-map to 3D voxel

Wang et al. (2015)
Delany et al. (2018)
Zhou et al. (2019)

Sketch to 3D Challenges: Lack of Paired Data



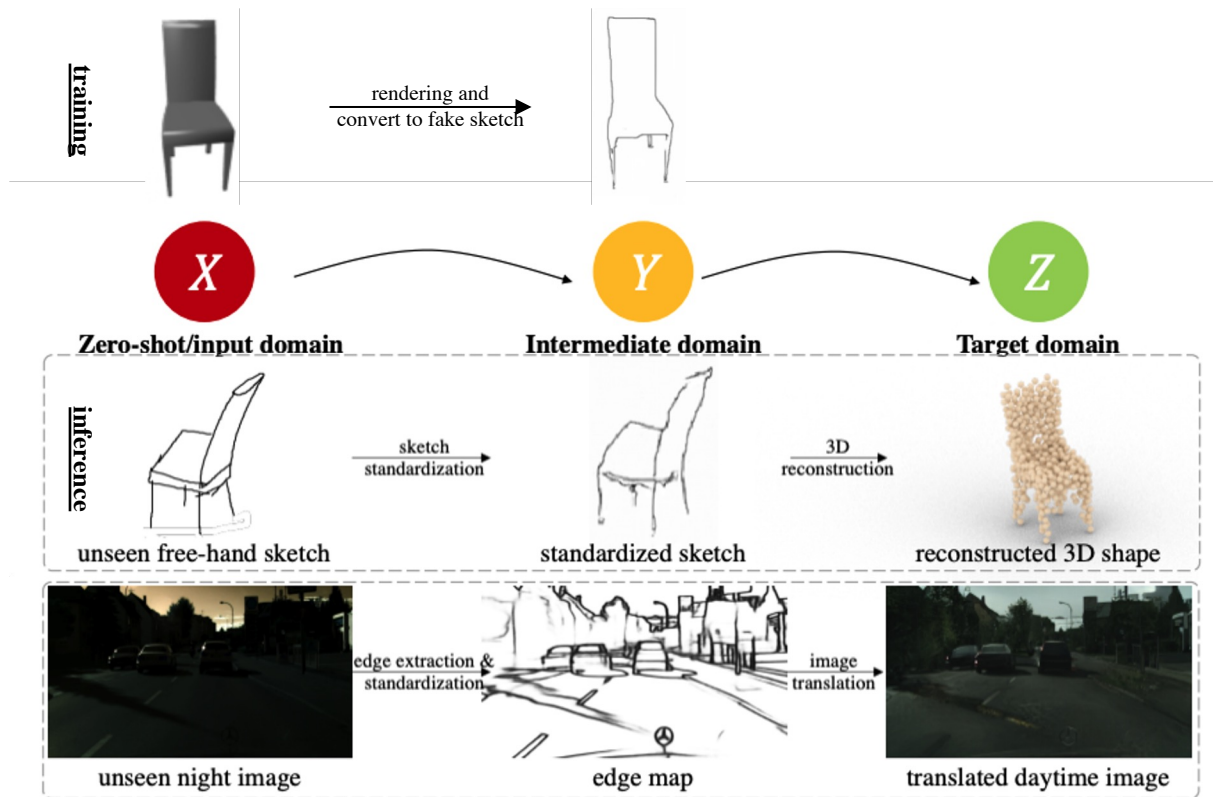
Sketchy Dataset
125 categories, 75k images



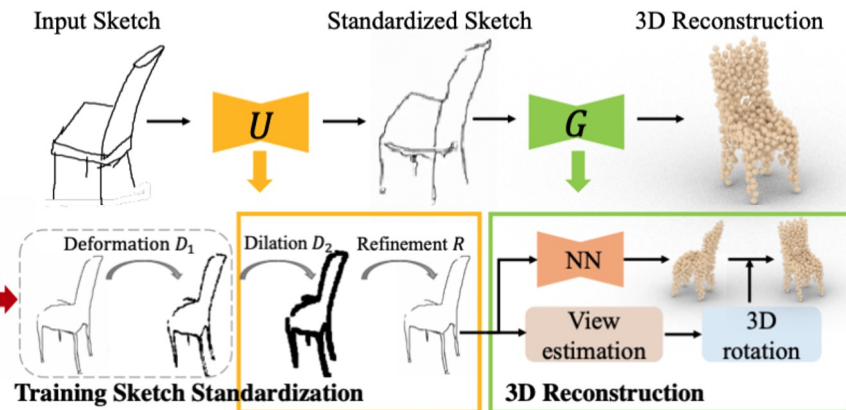
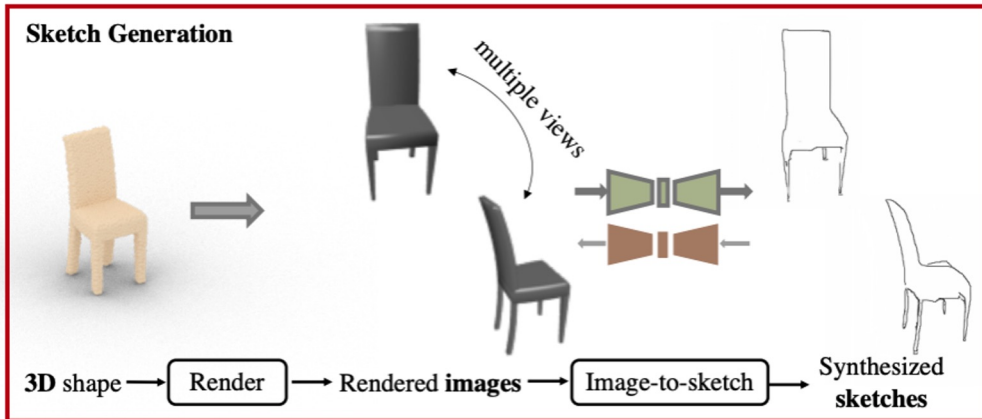
ShapeNet Dataset
55 categories, 51k 3D models

Instance supervision to domain supervision

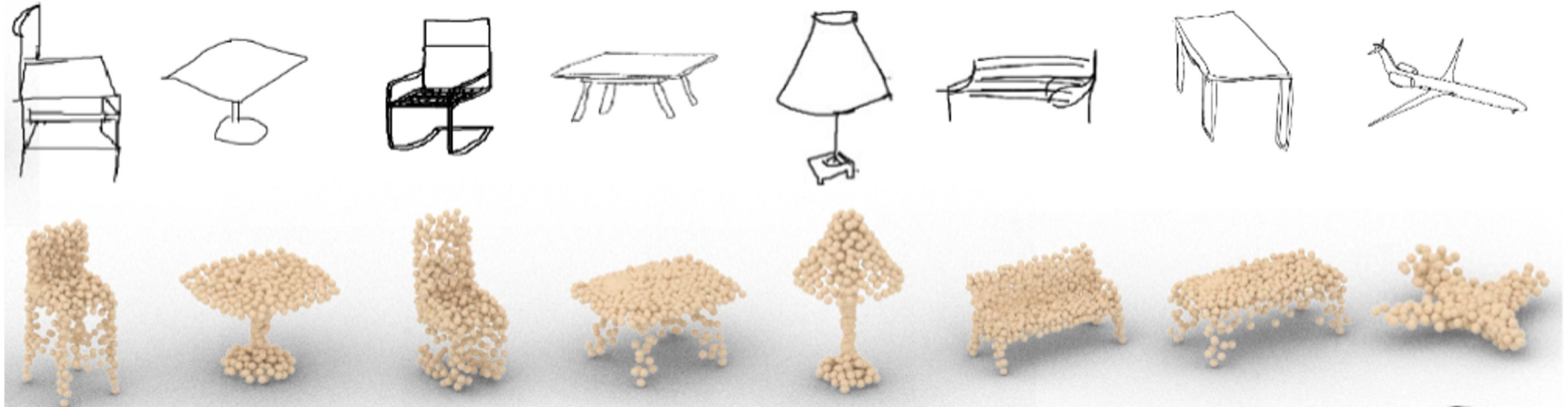
Domain Standardization



Sketch to 3D - Pipeline

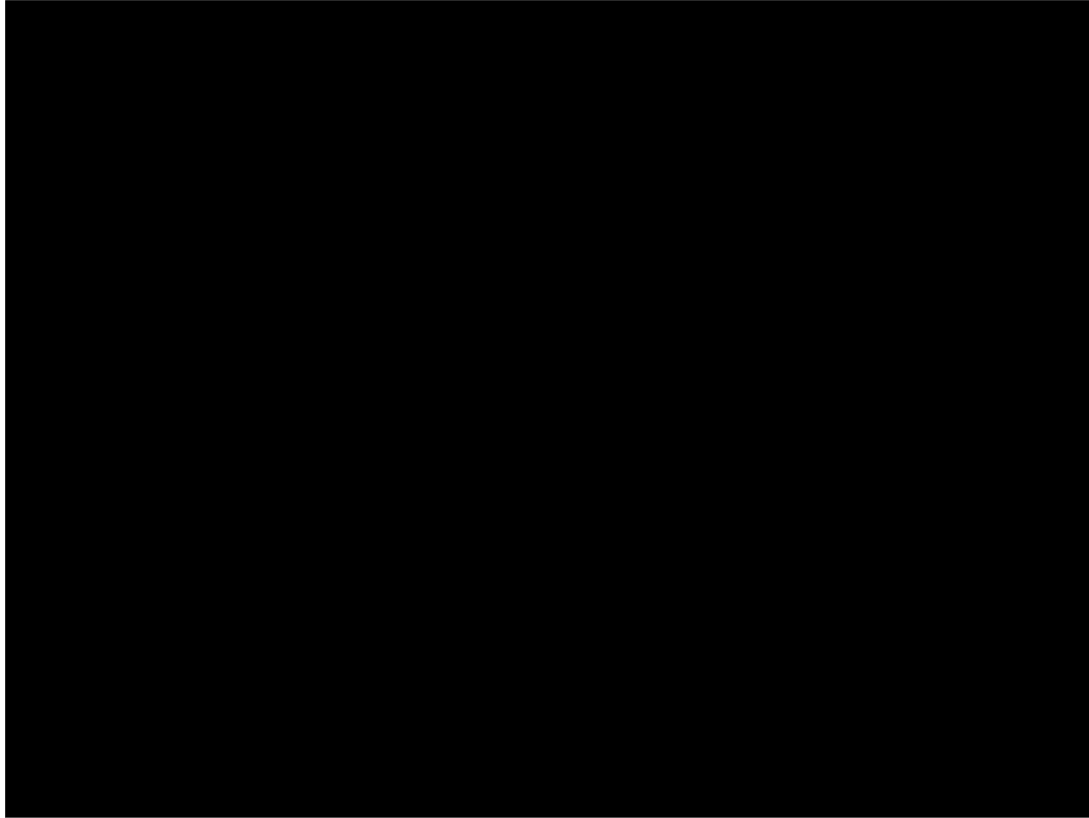


Sketch to 3D - Category Agnostic

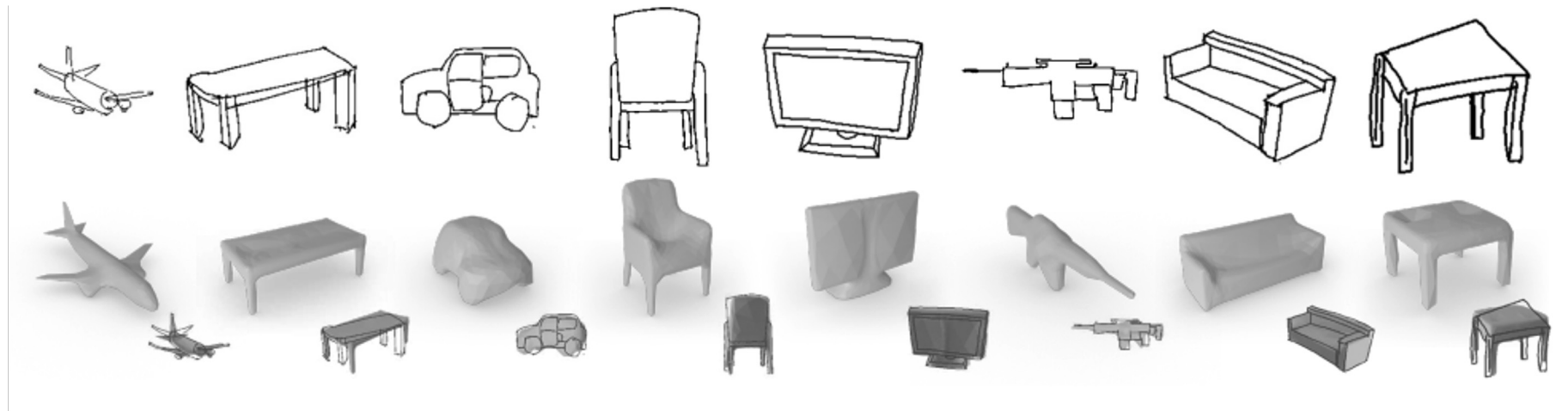


Takeaway: sketch to 3D does not require category information (validation of Marr's theory).

Sketch to 3D: Demo



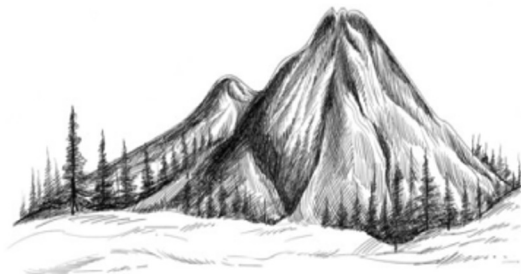
Follow-Up Work



Sketch2Model (Zhang et al.)

Follow-Up Work

sketch



style reference



synthesized photo



Scene Sketch (Wang et al.)
<http://pwang.pw/scenesketch.html>