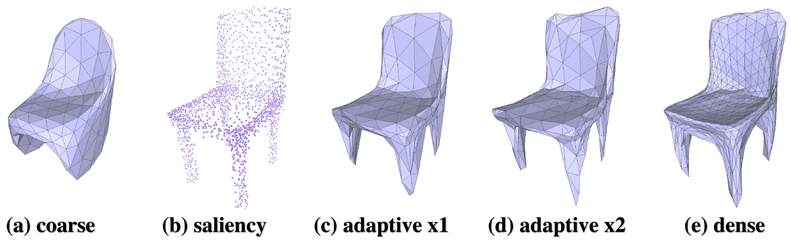
Saliency Guided Subdivision for Single-View Mesh Reconstruction

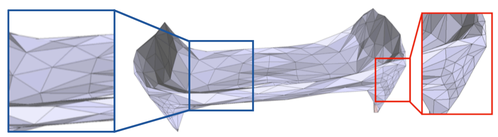
Hai Li*, Weicai Ye*, Guofeng Zhang, Sanyuan Zhang,Hujun Bao
State Key Lab of CAD&CG, Zhejiang University

3DV 2020 International Conference on 3D Vision
Online
November 25-28, 2020

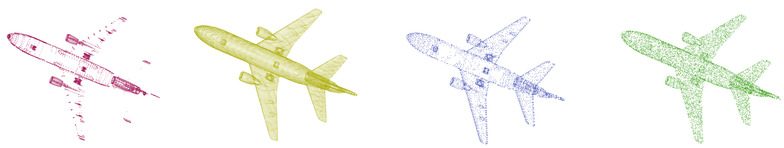
Introduction



Most existing deformation based methods produce uniform mesh predictions by **repeatedly applying global subdivision** to coarse mesh (a) and causes rapidly increasing vertices and faces which bring huge memory consumption and constrain the depth of subdivision (e).
Inspired by traditional **adaptive subdivision** method, we propose a novel salient points (b) guided subdivision method to generate adaptive mesh (c)(d) which achieve the trade-off between detail generation and memory consumption.



Dataset



original model
mesh from ShapNet

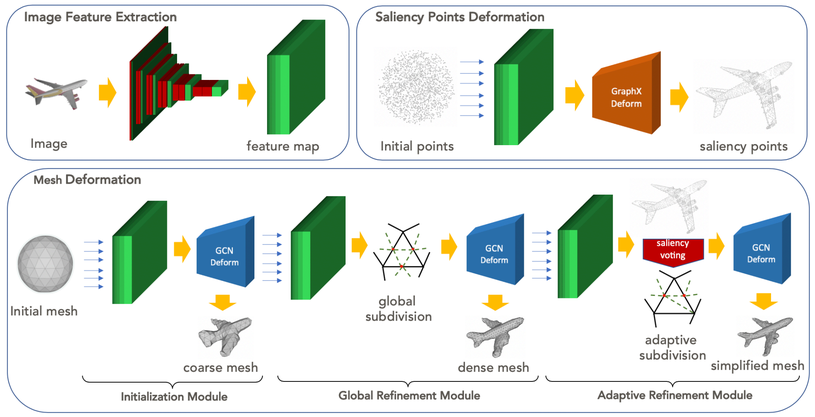
watertight model
high resolution
surface mesh

simplified model
mesh after decimation

sampled point
uniform sampled
surface points

We unified the dataset which preserves high resolution surface without inner structure with above 4 steps of preprocess and **use vertices of simplified model to supervise the saliency deformation.**

Framework

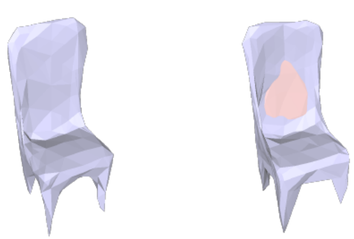


Our framework mainly consists of three networks. We balance the global structure and local details by introducing Adaptive Refinement Module which use points from Saliency Points Deformation Network to guide the selection of subdivision areas through voting strategy. Our network support **configurable settings** which means the last two modules of deformation network can be iterated as many times as desired respectively

Oriented Chamfer

$$L_{oc}(P,Q) = |P|^{-1} \sum_{(p,q)\in\Lambda_{P,Q}} \|p-q\|^2 + |Q|^{-1} \sum_{(q,p)\in\Lambda_{Q,P}} \|q-p\|^2$$

$$\Lambda_{Q,P} = \{(p, argmin_{(q|n_p\cdot n_q>\theta)}\|p-q\|)\}$$



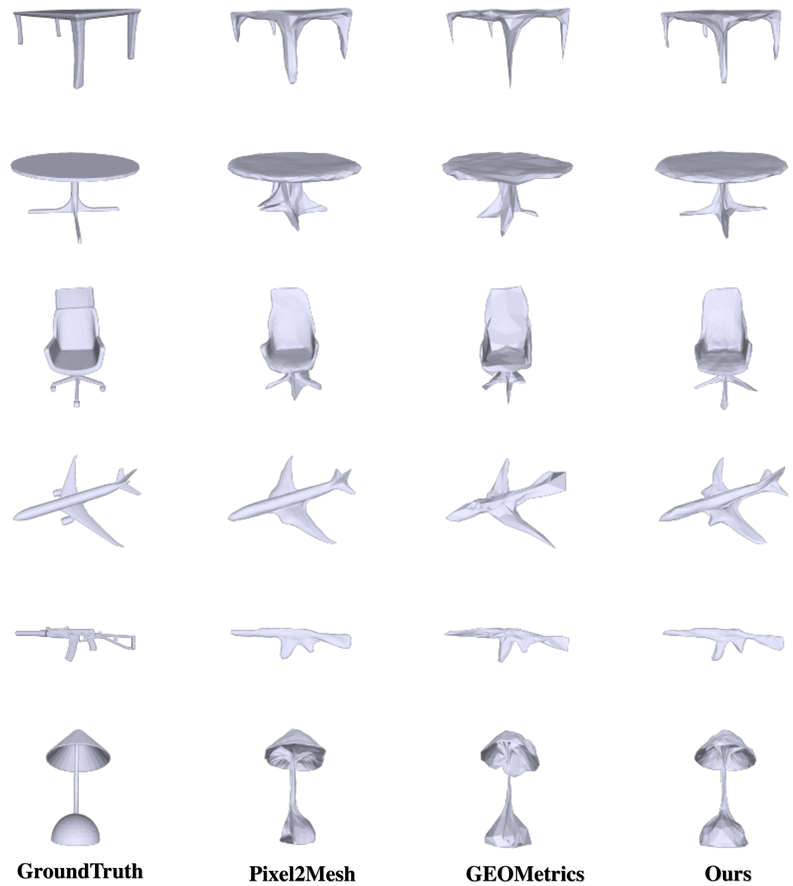
w/ oriented chamfer **w/o oriented chamfer**

We propose oriented chamfer loss to force the **normal consistency** of matching point pairs and mitigate the problem of surface intersection.

Results

Metric	Vertex Size	Face Size	F1 Score
P2M*	2466	4928	64.26
GEOMetrics*	558	1112	63.01
Ours(2a)	**411**	**818**	64.64
Ours(1g1a)	1026	2048	**67.20**
Ours(2g)	2562	5120	66.58

We compare to the prior works and explore our method under different configurations, The result reveals that our work with one global and one adaptive refinement modules(1g1a) obtaining the best performance.



GroundTruth **Pixel2Mesh** **GEOMetrics** **Ours**

Qualitative reconstruction results show that our method can generate obejct meshes with better details.