ViewCraft3D: High-Fidelity and View-Consistent 3D Vector Graphics Synthesis

Chuang Wang[1*], Haitao Zhou[1*], Ling Luo[2†], Qian Yu[1†]

[1]Beihang University [2]Ningbo University

*Equal contribution †Corresponding author

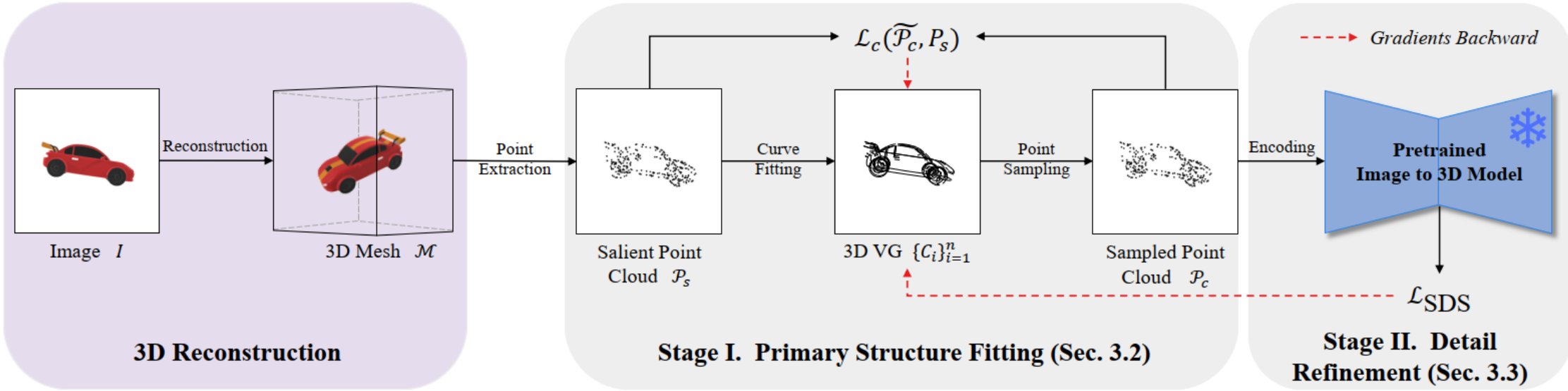
Task and Motivation

Input Image

3D SVG

- Existing methods predominantly rely on 2D generative priors
- 2D priors offer only conceptual-level guidance, lacking precise recovery of critical lines
- The generation process is time consuming

Framework Overview



Stage I Chamfer Distance loss:

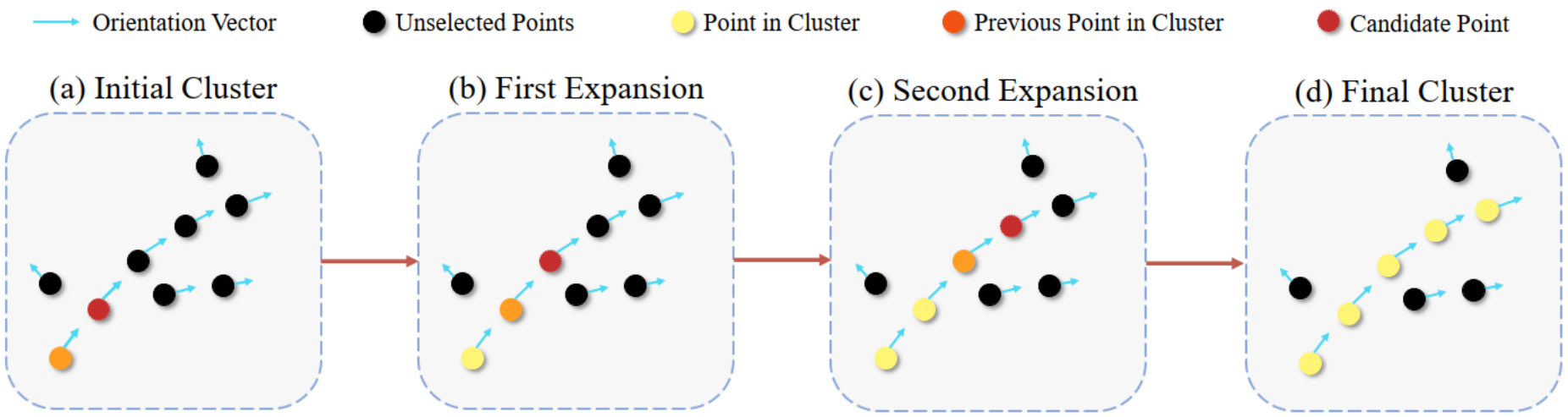
$$\mathcal{L}_c(\tilde{\mathcal{P}}_c, P_s) = \frac{\lambda}{|\tilde{\mathcal{P}}_c|} \sum_{p \in \tilde{\mathcal{P}}_c} \min_{q \in \mathcal{P}_s} \|p - q\|^2 + \frac{1}{|\mathcal{P}_s|} \sum_{q \in \mathcal{P}_s} \min_{p \in \tilde{\mathcal{P}}_c} \|p - q\|^2$$

Stage II 3D SDS loss:

$$\nabla_{\theta'} \mathcal{L}_{\text{SDS}} = \mathbb{E}_{t,\epsilon} \left[w(t) \left(\epsilon_\phi(z_t, \boldsymbol{I}; t) - \epsilon \right) \frac{\partial z}{\partial \theta'} \right]$$

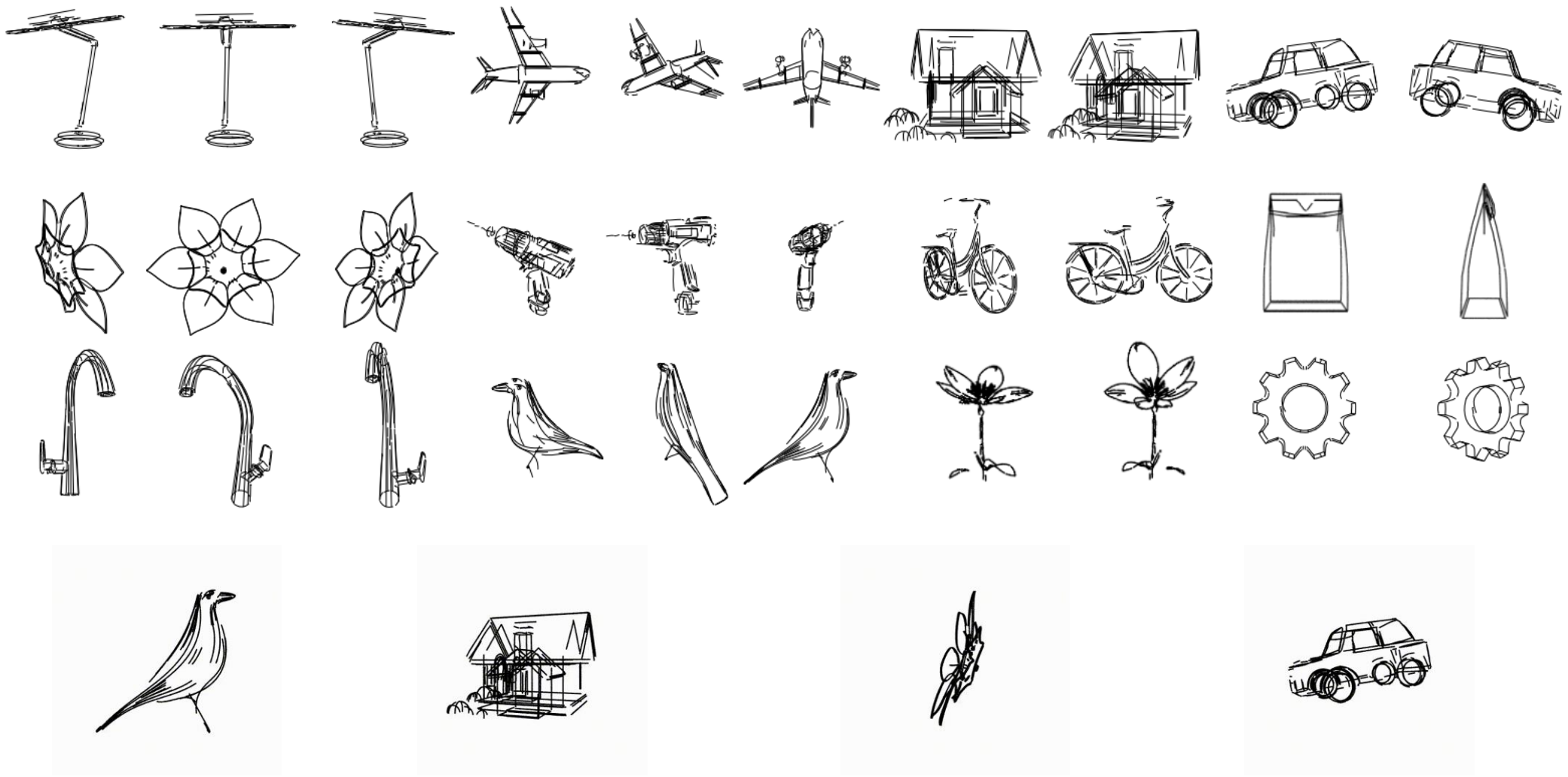
Primary Structure Fitting

- **Mesh to Salient Point Cloud**: using Sharp Edge Sampling(SES) process to extract salient structural points from the reconstructed mesh
- **Salient Point Cloud to Clusters**: Group discrete points based on spatial proximity and orientation alignment
- **Bézier Curves Fitting:** Fit 3D Bézier curves to each resulting cluster, and optimized via Chamfer Distance Loss

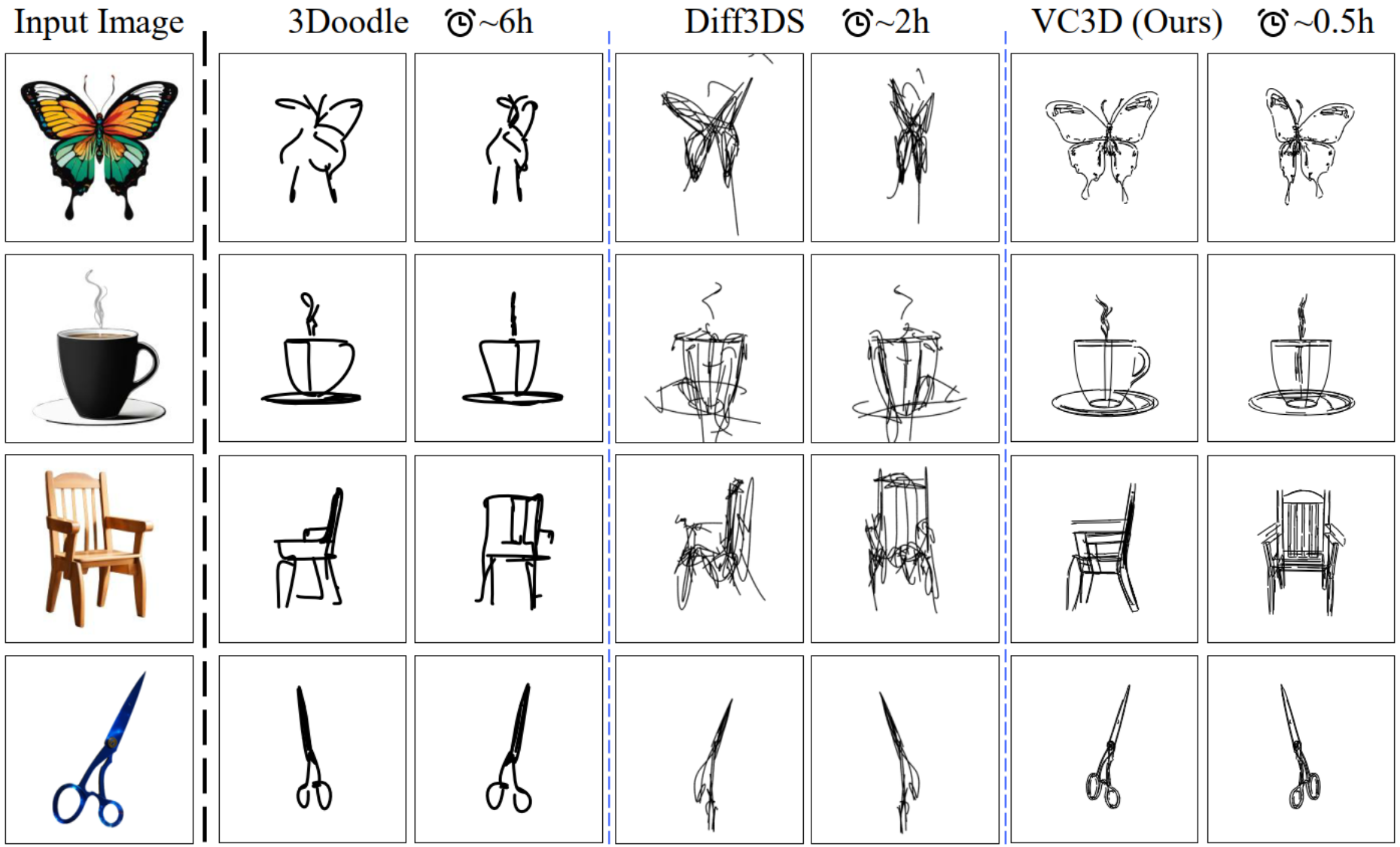


Visualization of point cloud clustering

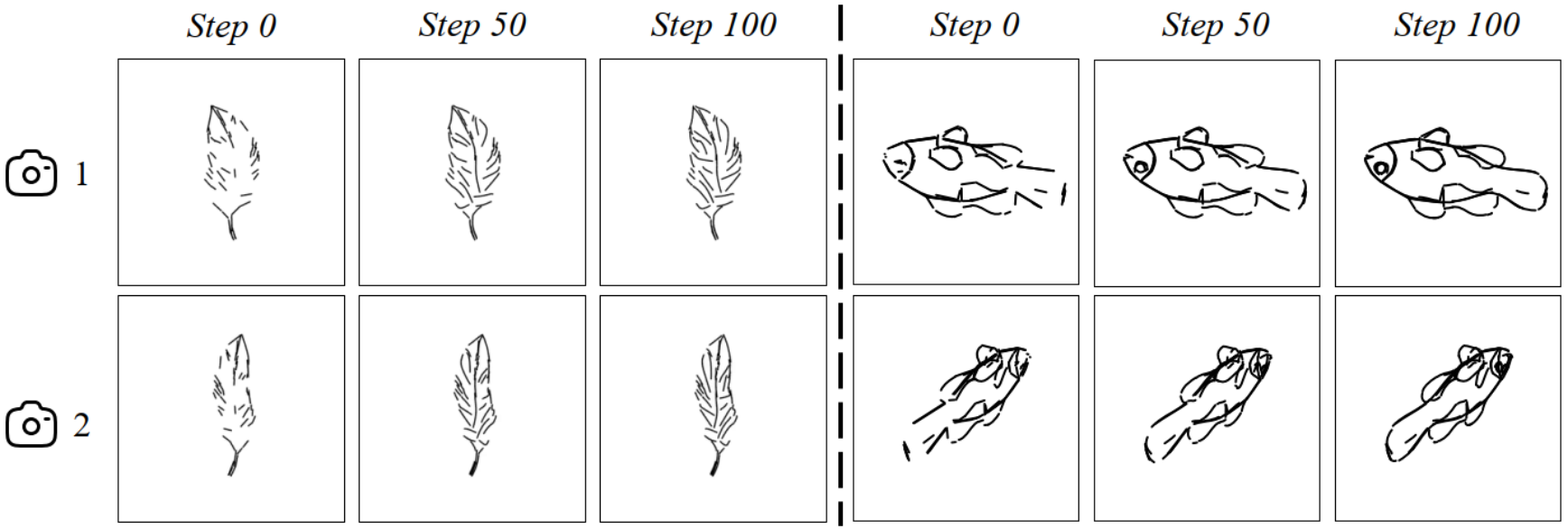
Visualization results



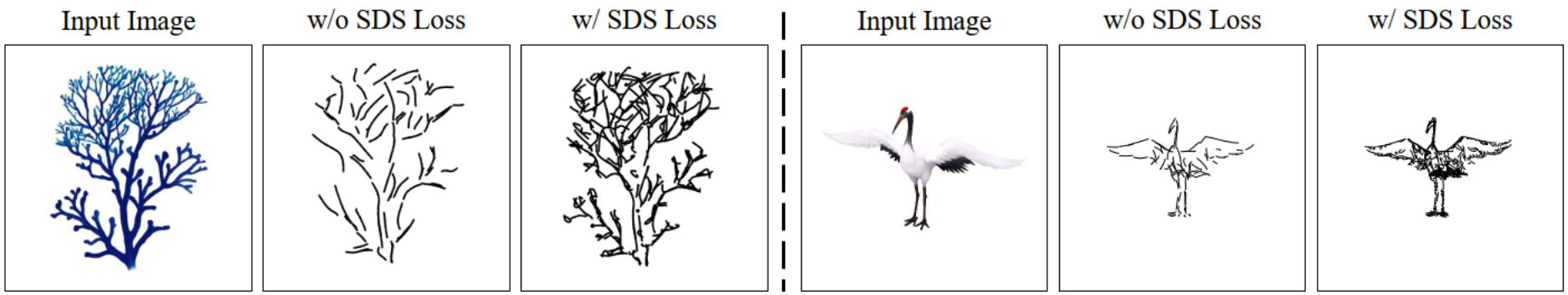
Comparison with Existing Methods



Ablation Studies



Optimization process of Stage I



Optimization effect of SDS loss

NEURAL INFORMATION PROCESSING SYSTEMS

Thank you for your attention!

https://zhtjtcz.github.io/VC3D_page/

Project Page