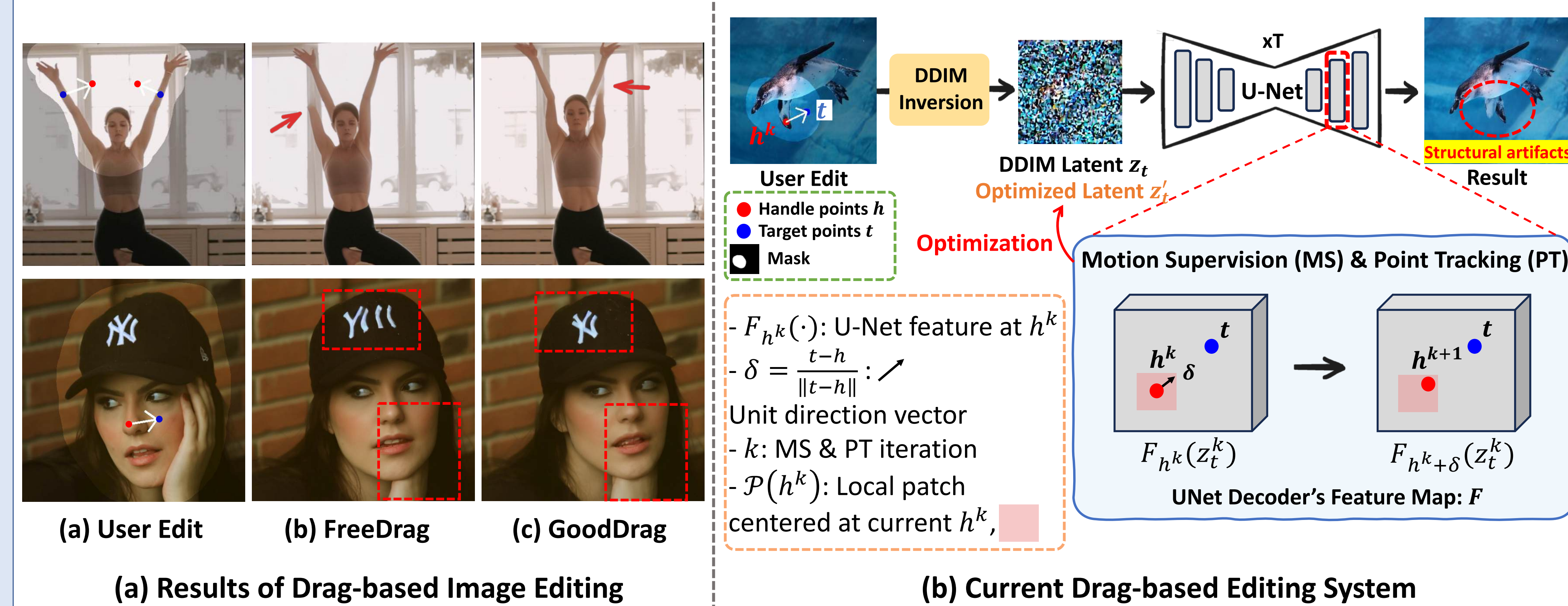


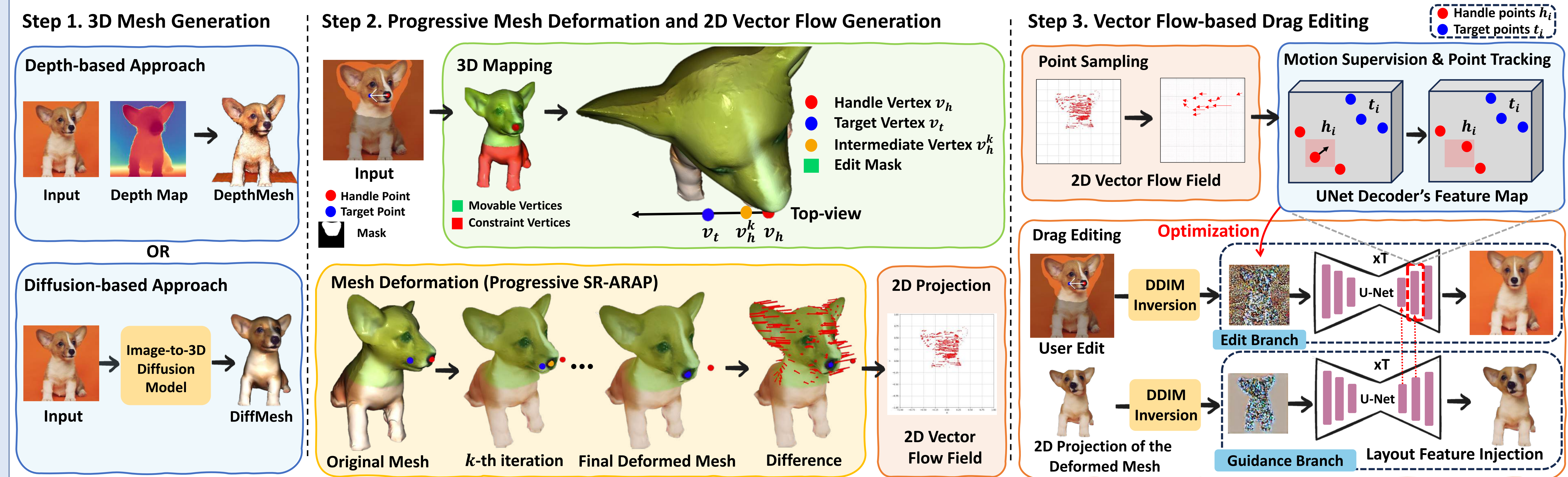
FlowDrag: 3D-aware Drag-based Image Editing with Mesh-guided Deformation Vector Flow Fields

Gwanhyeong Koo, Sunjae Yoon, Younghwan Lee, Ji Woo Hong, Chang D. Yoo
Korea Advanced Institute of Science and Technology (KAIST)

Problem: Geometric Inconsistency in Drag-based Image Editing



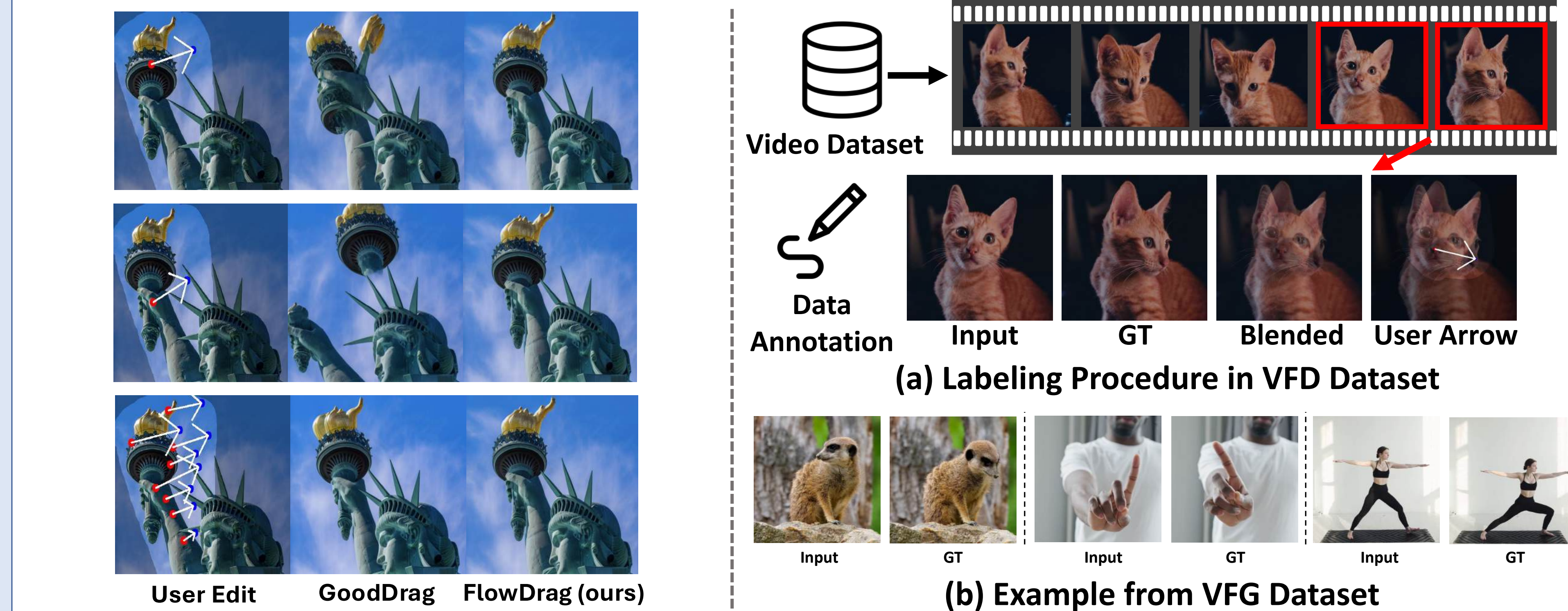
Proposed Method



We propose FlowDrag, a Geometry-aware 3-Step Drag Editing Pipeline.

- 3D Mesh Generation:** build *DepthMesh* (fast) or *DiffMesh* (complete) from the input image.
- Progressive Mesh Deformation:** apply SR-ARAP on the mesh then project vertex displacements into a dense 2D vector flow.
- Vector Flow-based Drag Editing:** leverage the flow and mesh projection to guide motion supervision & point tracking.

Observation & VFD Dataset



Findings: When users place drag points that already respect an object's geometry, geometric inconsistencies are greatly reduced.

Challenge: Manually specifying numerous precise points is laborious and often impractical. **How can we derive accurate geometric guidance from just a few user-defined points?**

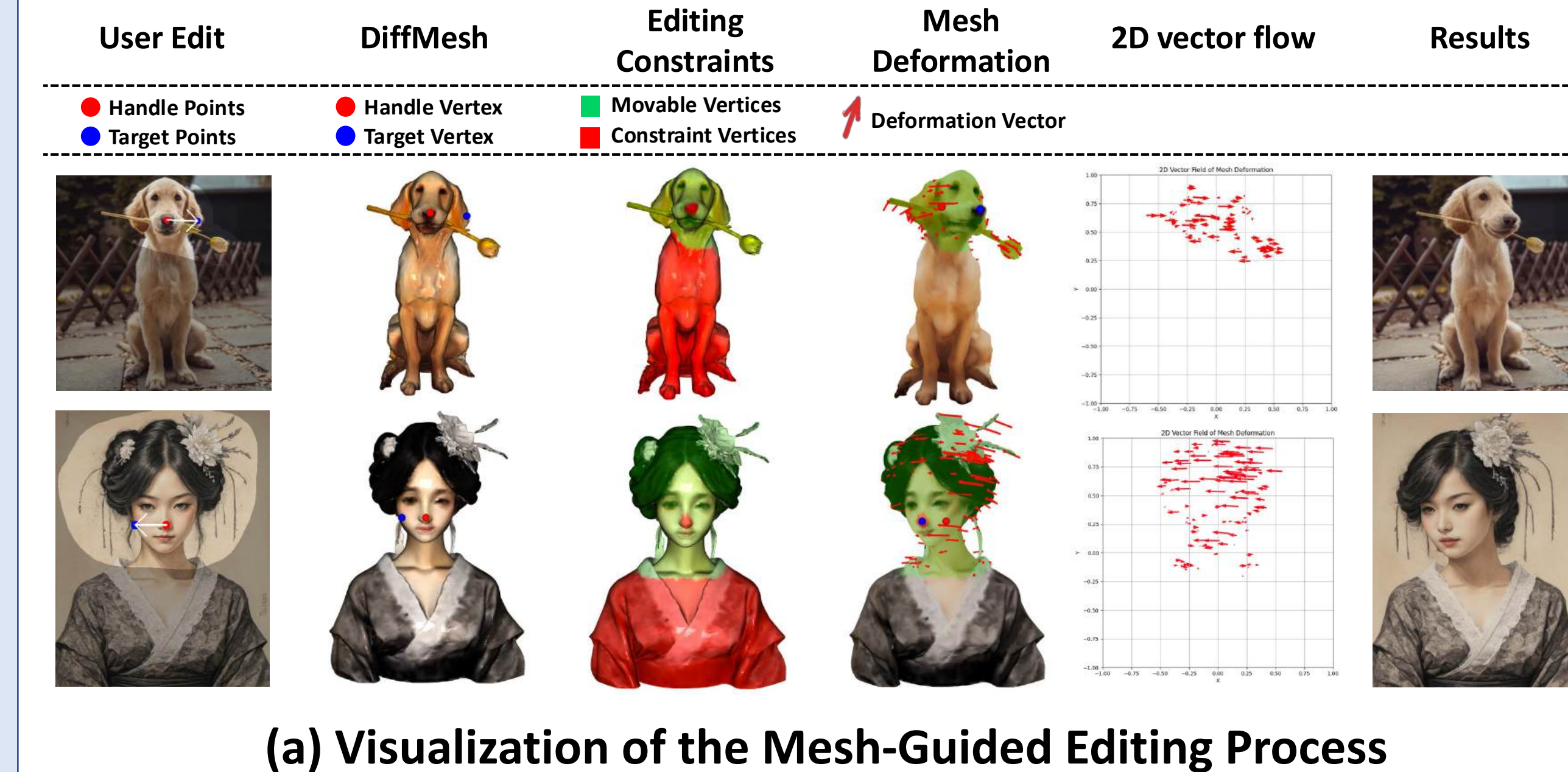
Current drag editing benchmarks offer no ground-truth (GT) images, making it impossible to measure edit accuracy objectively.

Our Solution: VFD (Video Frame Drag) Dataset

We construct 250 input/GT pairs from adjacent frames in DAVIS and Pexels¹ videos, with human annotators labeling matching points as drag directions, providing reliable references for geometry-aware evaluation.

¹Pexels: copyright-free videos at (<https://www.pexels.com/>)

Experiments



Method	PSNR↑	1-LPIPS↑	MD↓
VFD-Bench			
DiffEditor (Mou et al., 2024)	16.23	0.67	43.35
DragDiffusion (Shi et al., 2024)	17.55	0.76	38.42
DragNoise (Liu et al., 2024)	16.58	0.71	40.52
FreeDrag (Ling et al., 2023)	17.38	0.72	42.78
GoodDrag (Zhang et al., 2024)	18.14	0.79	35.31
FlowDrag (Ours)	18.55	0.82	28.23

(b) Performance of Recent Drag-based Editing Methods on the VFD-Bench dataset

Results

