3D Curvix: From Multiview 2D Edges to 3D Curve Segments

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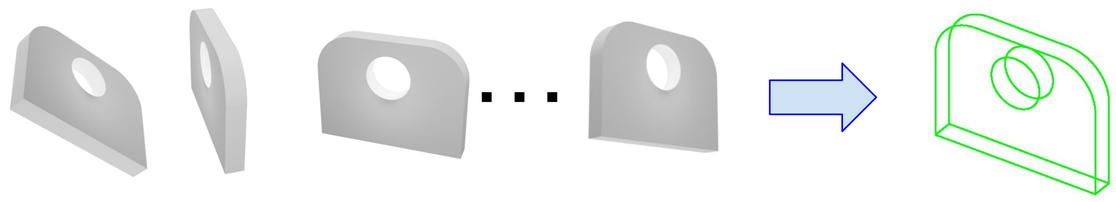
Introduction

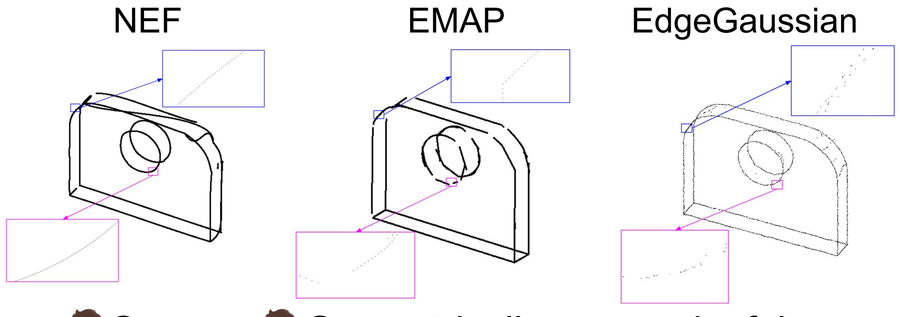
Reconstruction from higher-level primitives

- Texture-poor images have ample *edges/curves* but not interest points.
- Given known relative poses between multiple images, how to reconstruct 3D edges/curves of a texture-poor object?



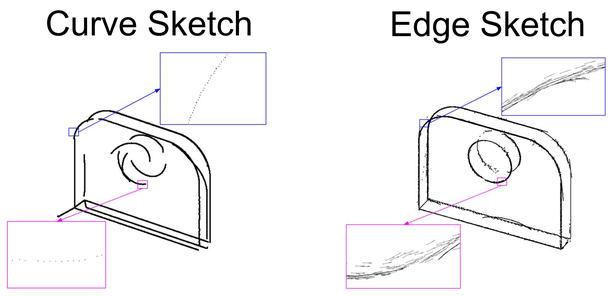
3D Edge/Curve Reconstruction Problems

- Learning-based methods:



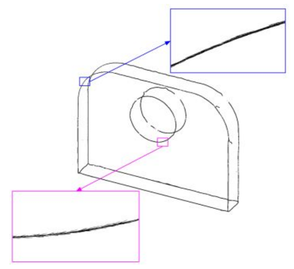
Sparse Geometrically unmeaningful

- Non-learning-based methods:



False positives Redundant noisy edges

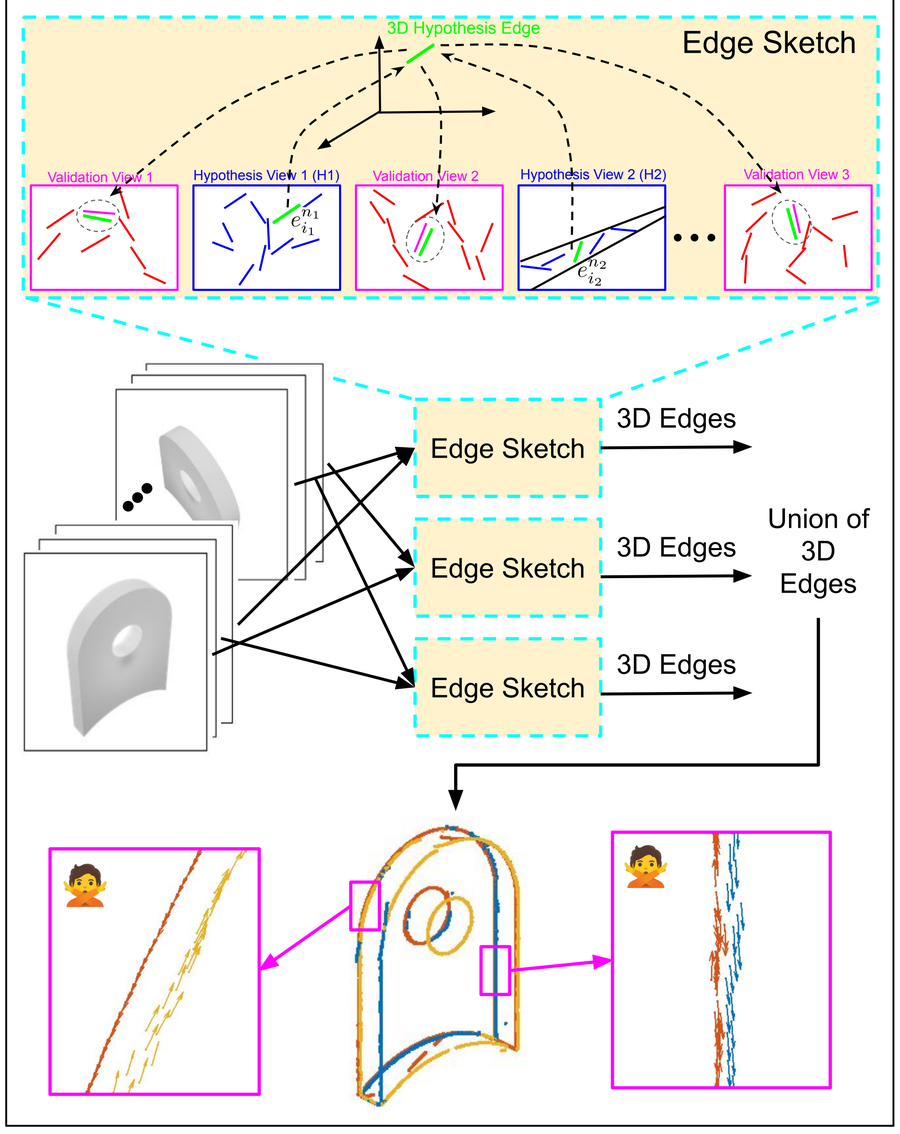
3D Curvix



Dense 3D edges to 3D curves

3D Edge Sketch

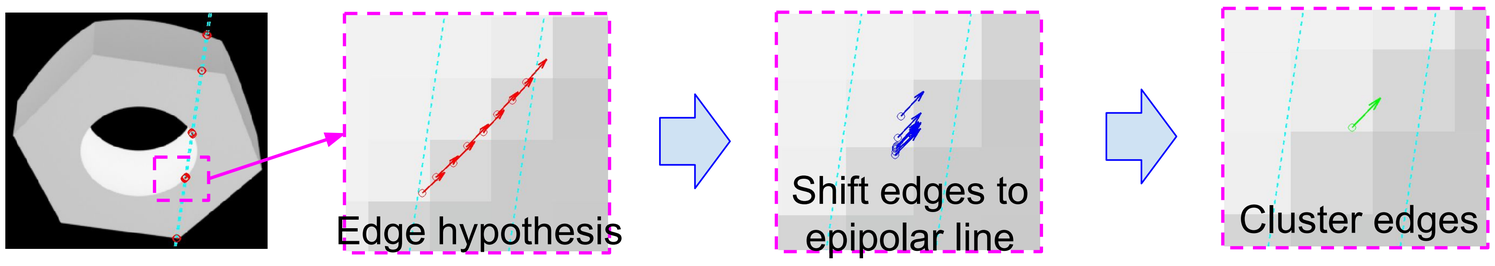
Preliminary:



GitHub Source Code:

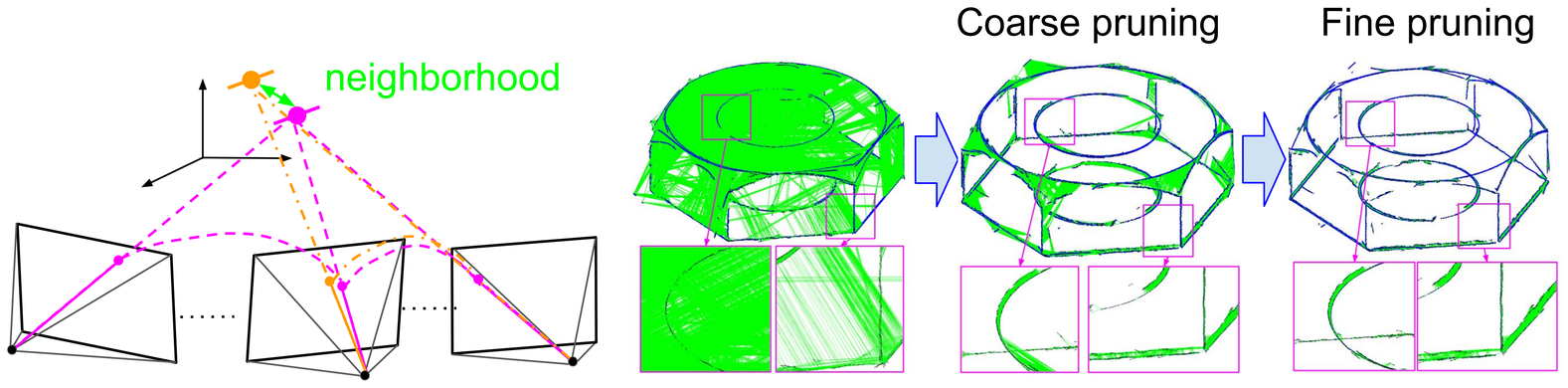
3D Curvix

Consolidating Redundancy in Forming Edge Hypothesis

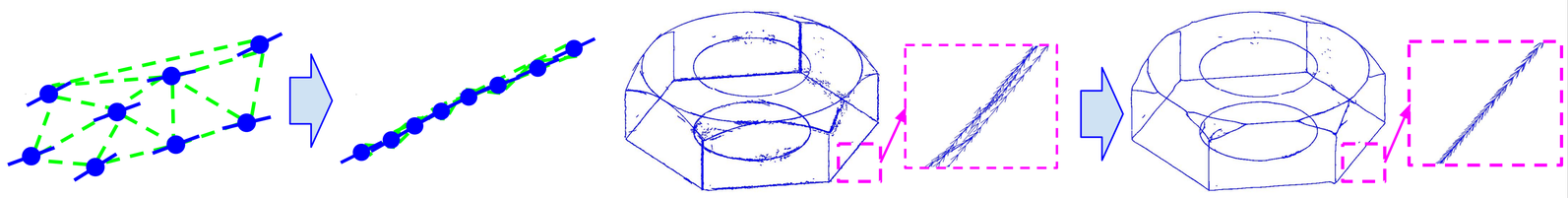


Consolidating Multiview Redundancy Through Neighborhood Graphs

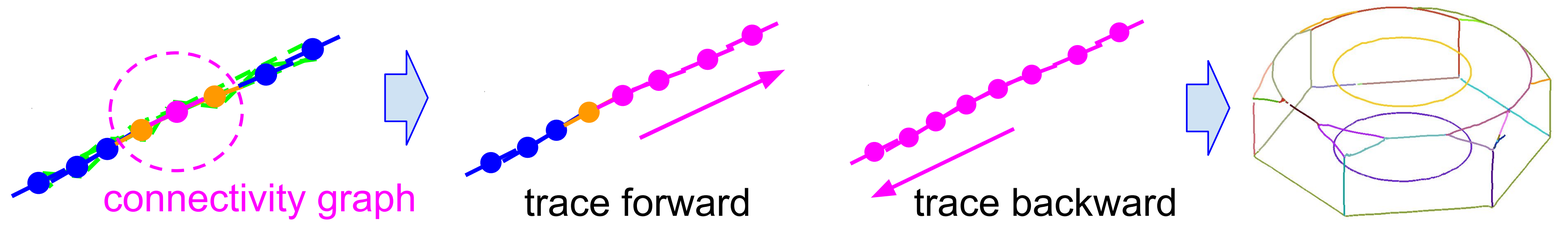
- Constructing weighted neighborhood graph



- Collapsing the connected 3D edges into a smooth, continuous edges

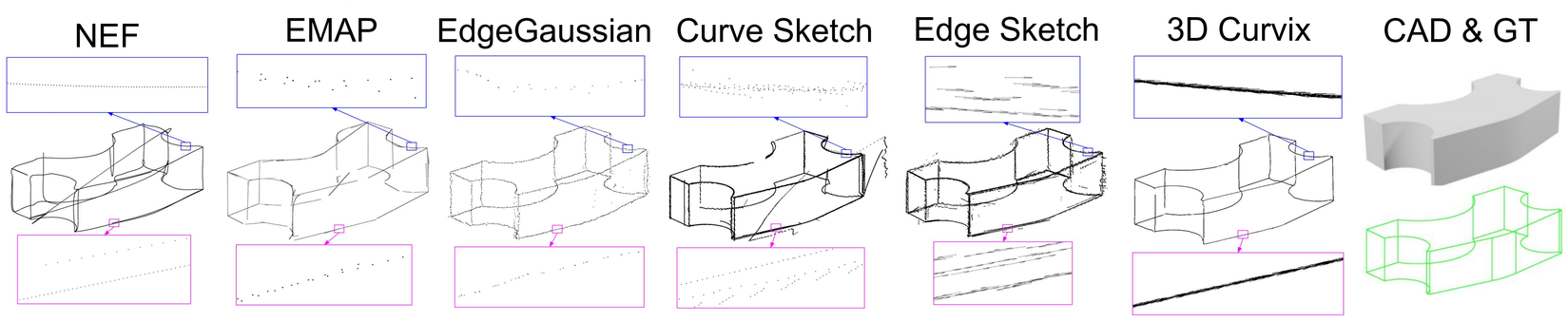


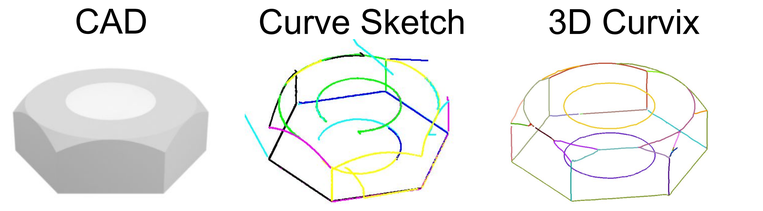
Grouping 3D Edges into 3D Curves Through Connectivity Graphs



Experiments

Qualitative Comparisons:





Quantitative Comparisons:

3D edges

Methods	Acc(↓)	Comp(↓)	P_5(↑)	P_{10}(↑)	P_{20}(↑)	R_5(↑)	R_{10}(↑)	R_{20}(↑)	F_5(↑)	F_{10}(↑)	F_{20}(↑)
NEF	14.2	15.3	7.2	52.3	87.2	16.0	66.6	94.1	9.7	57.7	89.6
EMAP	9.4	9.3	43.1	82.7	93.4	47.2	79.4	91.3	51.7	85.9	91.9
EG	10.1	9.3	39.3	83.2	94.1	48.6	81.9	93.7	51.7	85.9	91.9
3D CS	19.9	17.5	45.7	84.9	94.0	9.7	33.3	69.4	15.8	49.2	78.9
3D ES	11.4	4.8	57.6	90.3	95.8	42.9	82.3	94.4	49.2	88.0	93.6
3D Curvix	**5.5**	**4.1**	**60.9**	**91.3**	**98.8**	**54.8**	**82.9**	**97.7**	**69.8**	**90.5**	**96.8**

3D curves

Methods	IoU_5(↑)	IoU_{10}(↑)	IoU_{20}(↑)
NEF	0.142	0.263	0.714
3D CS	0.022	0.151	0.574
3D Curvix	**0.458**	**0.775**	**0.867**