BOOTSTRAPPING ARTICULATED 3D RECONSTRUCTION FROM IMAGES

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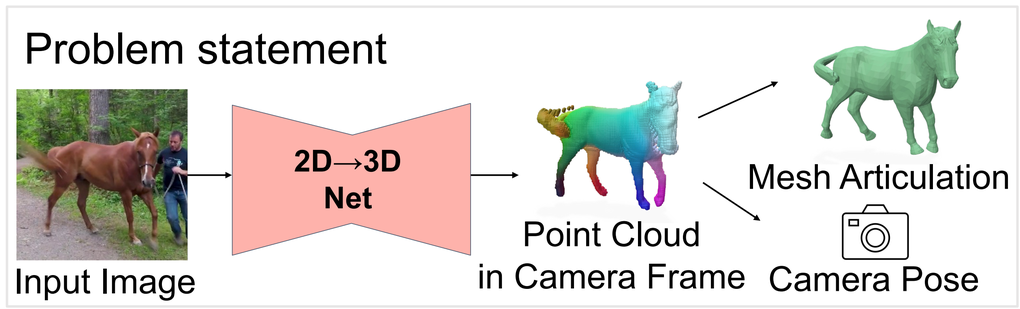
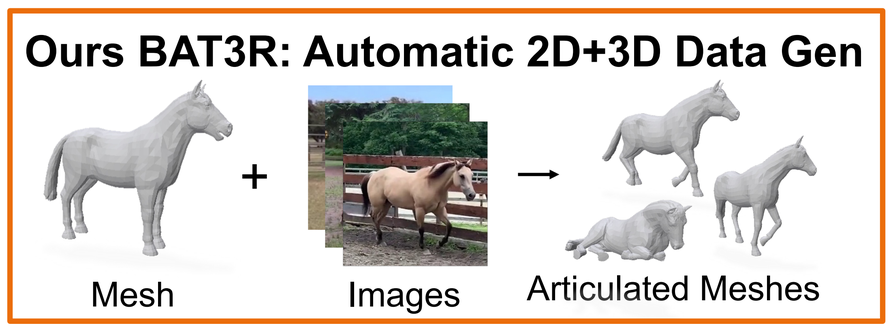
jakubzadrozny.github.io/bat3r

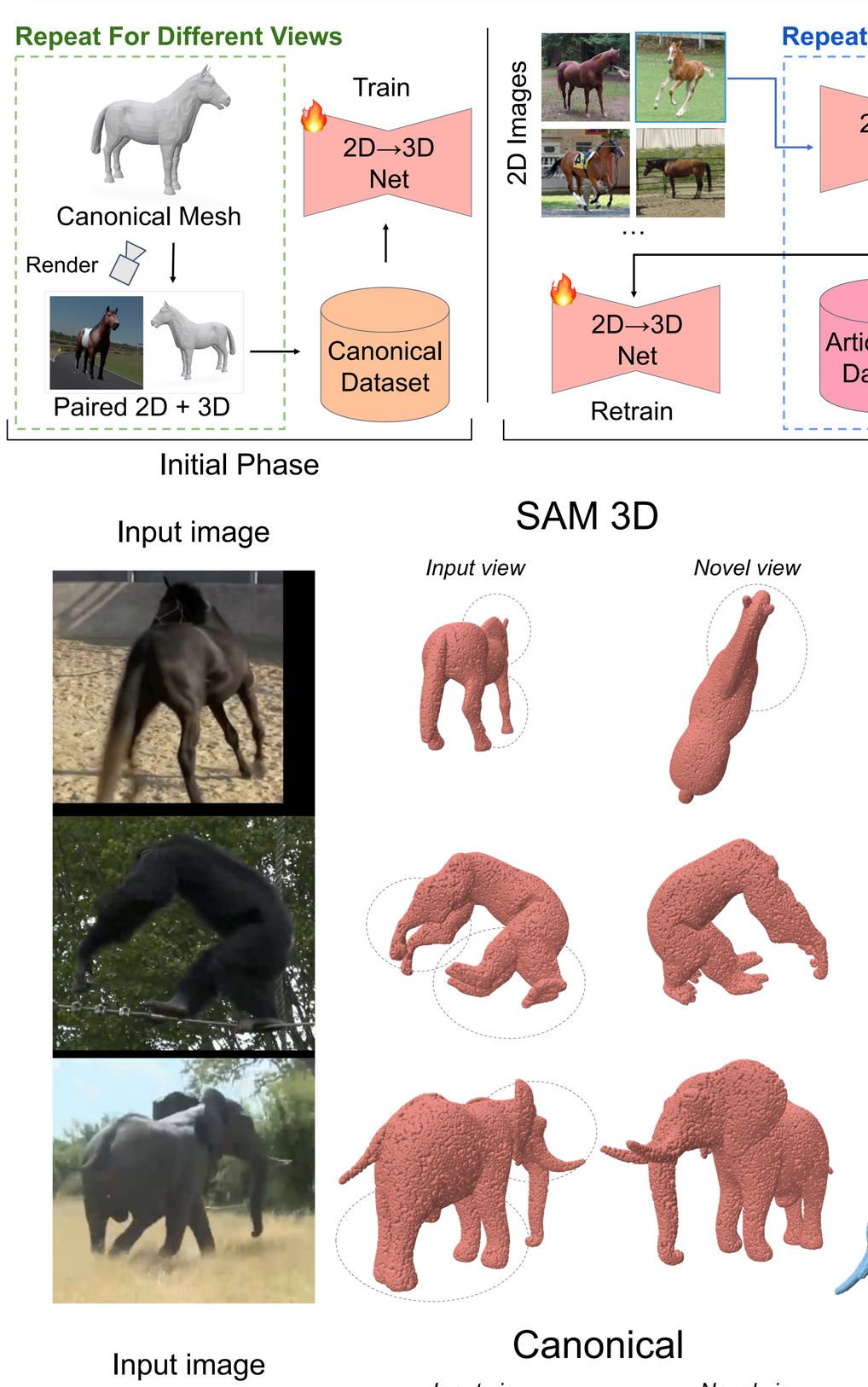
Abstract

Articulated 3D reconstruction typically requires massive datasets. Our iterative framework uses only unannotated 2D images and a template mesh. We align it to weakly predicted dual point maps yielding synthetic data to self-refine our predictor. We approach fully-supervised baselines and outperform generic models on complex articulations. Our framework guarantees topological correctness and scales effortlessly to novel categories by drastically reducing 3D data requirements.





Data Efficiency: We approach fully-supervised performance using just one template mesh and unannotated 2D images.



Sound Geometry: Geometric regularizers ensure physically plausible meshes, preventing stretching and self-intersections.

Viewpoint Bootstrapping: We use highly reliable lateral predictions to bootstrap learning for challenging front and rear views.

Foundation Models: Generic models (SAM3D, Trellis.2) hallucinate limbs or force symmetry. Our template mesh fitting guarantees anatomical correctness.

Table 1: Base quantitative evaluation (following DualPM)

Method	Aligned RMS CD[1] (cm) ↓			Model-view RMS CD[2] (cm) ↓		
	Horse	Cow	Sheep	Horse	Cow	Sheep
MagicPony	11.19	10.29	--	20.82	25.39	--
3D-Fauna	11.86	10.54	9.61	15.70	14.08	12.24
Trellis*	*6.93*	6.80	*5.91*	36.82	26.54	26.56
DualPM	**4.30**	**3.18**	**3.30**	**5.49**	**4.03**	**4.22**
Canonical	7.88	*6.66*	6.62	*9.87*	*7.85*	*7.70*
Ours	5.65	4.17	4.35	7.73	5.30	5.04

[1]ICP-aligned RMS Chamfer Distance (CD) | [2]Model-view RMS CD | **1st**, 2nd, and *3rd* best.
*Trellis(.2) generates unaligned shapes in arbitrary coordinate frames, resulting in high model-view errors. While ICP registration improves scores, alignment failures on complex poses still artificially inflate the final metric.

*Table 2**: Extended eval (foundation models)*

Method	CD[1](cm) ↓	MV CD[2] (cm) ↓
	Horse	
Trellis.2*	8.92	40.03
SAM3D	6.42	8.71
DualPM	**3.84**	**5.42**
Canonical	7.84	10.83
Ours	5.10	7.92
Ours (real-wrld)	*6.01*	*8.37*

**Metrics in Table 1 and 2 are not directly comparable. Table 2 contains a much broader comparison, but uses a slightly different (accelerated) implementation of the metric and alignment