Flex3D: Feed-Forward 3D Generation with Flexible Reconstruction Model and Input View Curation

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TL;DR

A two-stage (1: multi-view generation + 2: feed-forward reconstruction) 3D generation framework that curates the optimal views from a large pool of 2D views before feeding them to a flexible reconstruction model designed to handle an arbitrary number of inputs.

Motivation

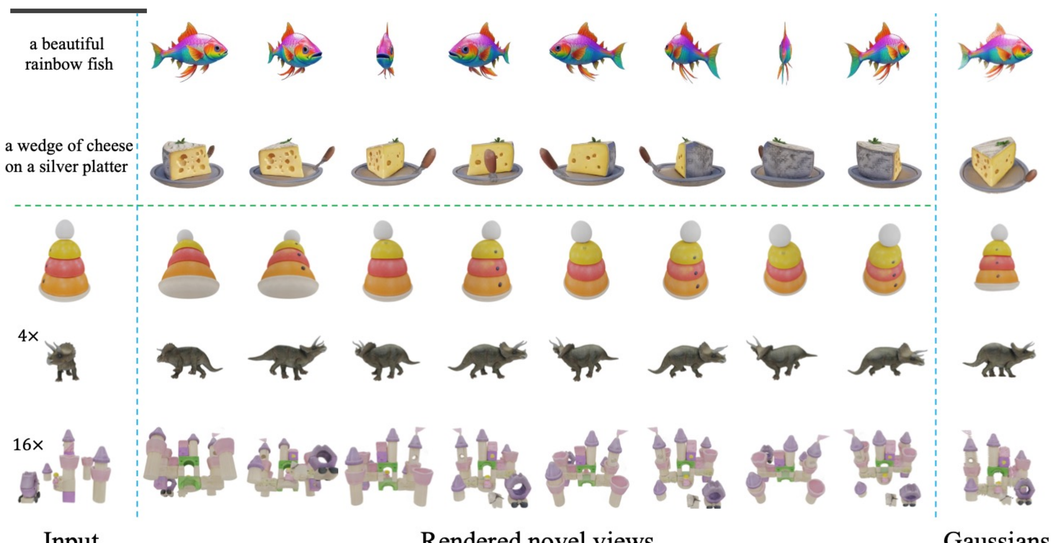
Existing widely used two-stage feed-forward 3D generation methods face common bottlenecks:

Stage (1): The multi-view generation stage often produces inconsistent and low-quality views.

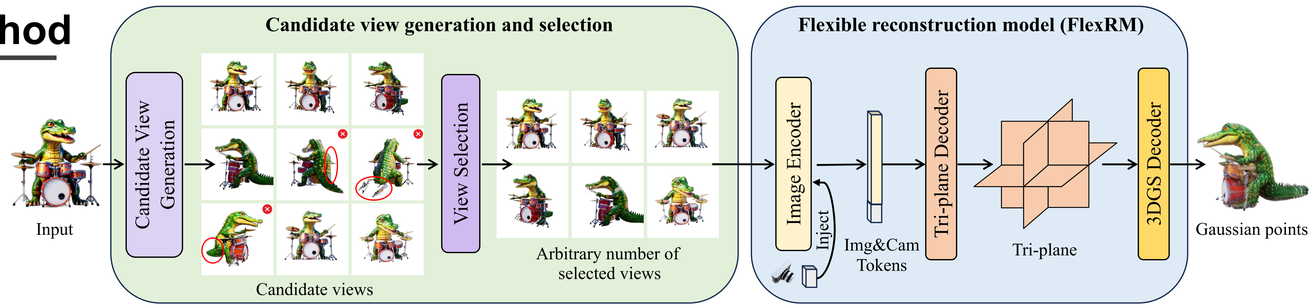
Stage (2): The reconstruction model typically requires a small, fixed number of input views.

Together, these limitations cap the quality of the final 3D output.

Generation results



Method



We first generate a large pool of candidate views with two fine-tuned diffusion models, one for azimuth (16 views) and one for elevation (4 views), then select best views using a quality classifier and a feature matcher for geometric consistency.

FlexRM is a fast, transformer-based model that generates 3D Gaussians from an arbitrary number of views. It can:

(1): Handles a variable number of views from arbitrary poses, strengthened by dedicated camera embeddings.

(2): Directly predicts 3D Gaussians from a tri-plane, using a residual scheme for high geometric accuracy.

(3): It learns to handle imperfect inputs by being exposed to noise injected into its own generated 3D Gaussians.

Comparison results

Reconstruction metrics

Method	Input views	PSNR↑	SSIM↑	LPIPS↓	CLIP image sim↑	CD↓	NC↑
OpenLRM	1	15.83	0.821	0.209	0.602	-	-
VFusion3D	1	19.10	0.827	0.158	0.759	-	-
FlexRM	1	**21.21**	**0.862**	**0.125**	**0.832**	-	-
InstantMesh	4	21.33	0.859	0.133	0.809	1.372	0.841
GRM	4	25.03	**0.899**	0.102	0.869	1.496	0.866
FlexRM	4	**25.55**	0.894	**0.074**	**0.893**	**1.205**	**0.878**
FlexRM	8	26.33	0.897	0.069	0.906	1.188	0.881
FlexRM	16	26.51	0.902	0.068	0.911	1.182	0.884
FlexRM	24	26.65	0.905	0.067	0.915	1.175	0.886
FlexRM	32	26.77	0.907	0.066	0.919	1.169	0.888