

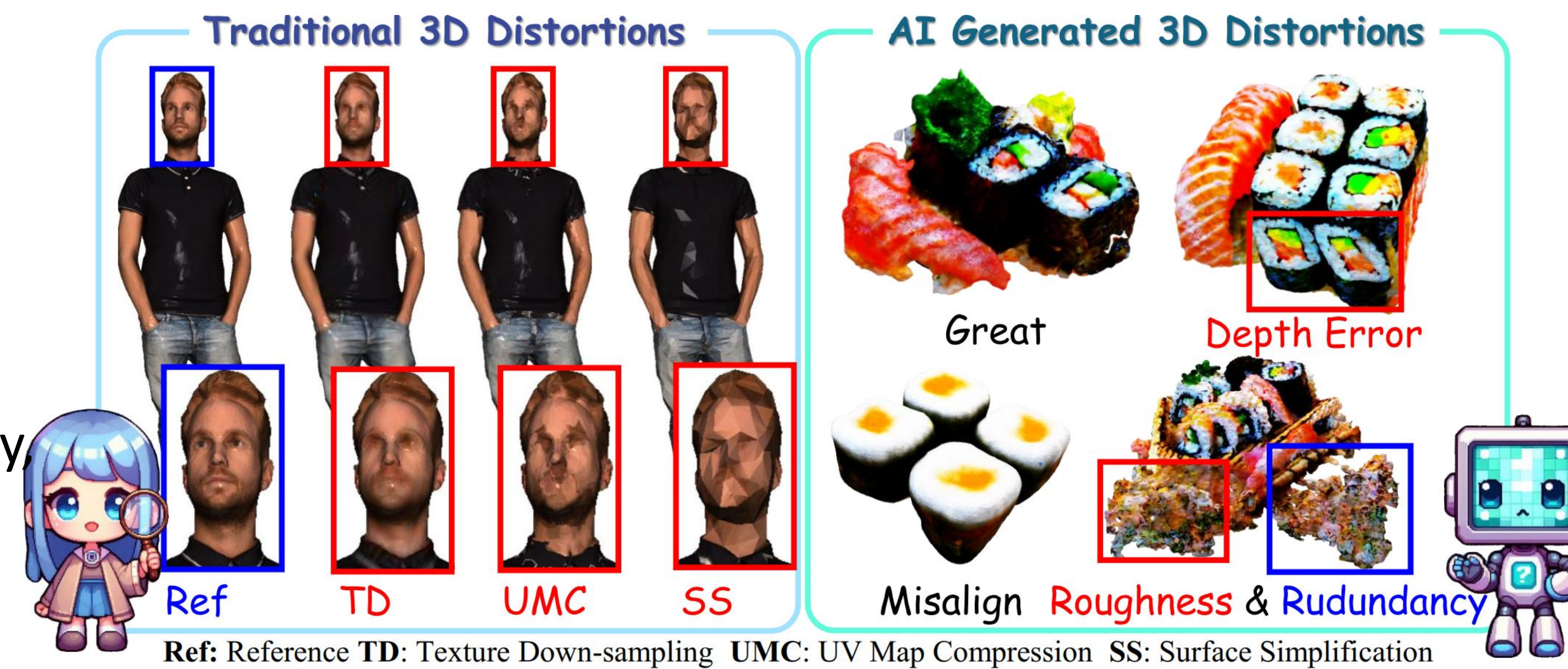
CAP: An Advanced No-Reference Quality Assessment Method for AI-Generated 3D Meshes

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<https://github.com/zyj-2000/CAP>

Introduction

The advent of generative AI has revolutionized 3D content design, significantly enhancing modelers' efficiency. However, the quality of generated 3D content, particularly Generated Meshes (GMs), remains a critical concern. GMs pose unique challenges for quality assessment due to their complex geometry, detailed texture mapping, and distortions that differ from traditional meshes. Existing methods fail to address these GM-specific issues. To tackle this gap, we introduce a novel no-reference quality assessment method, CAP.



Visualization of different types of distortion

Performance

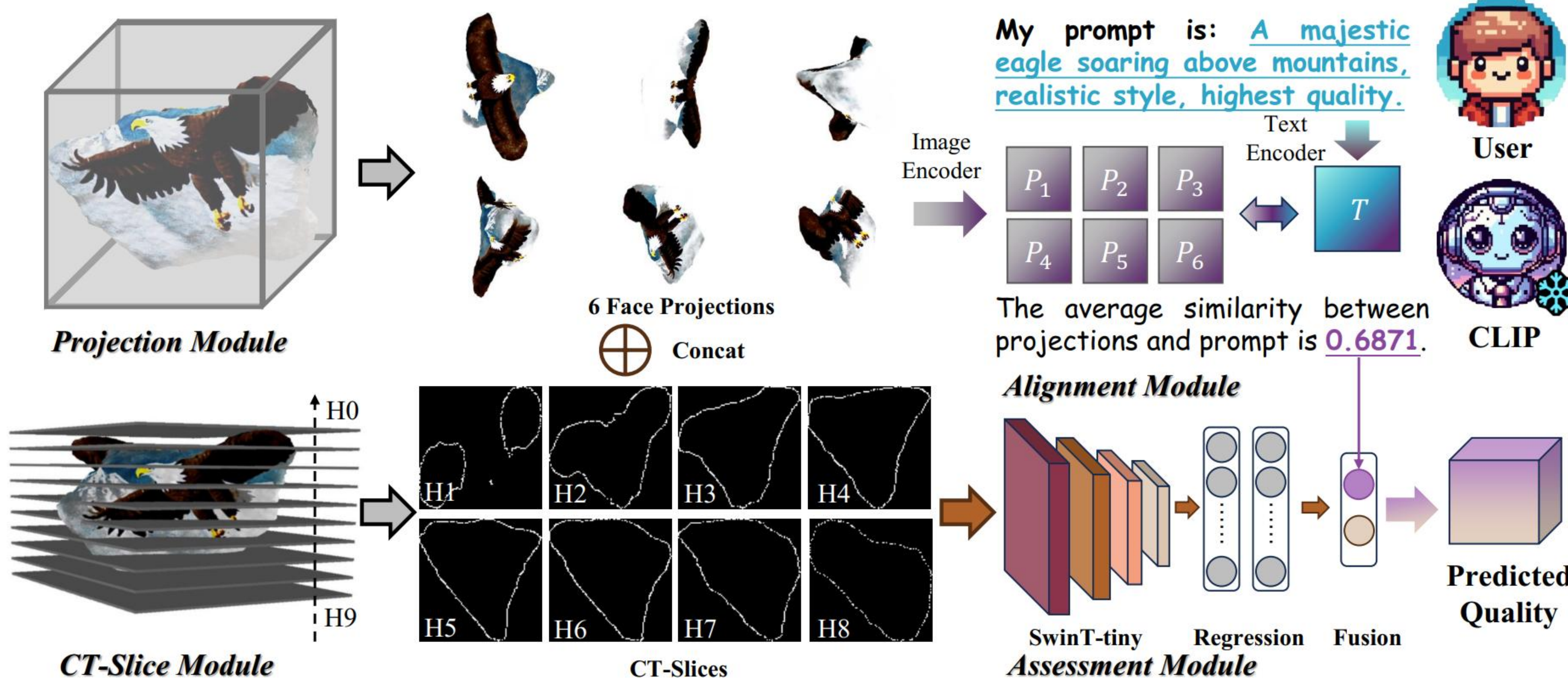
PERFORMANCE COMPARISON OF DIFFERENT METHODS ON 3DGCQA DATABASE. BEST IN RED, SECOND IN BLUE.

Type	Method	SRCC↑	PLCC↑	KRCC↑	RMSE↓
Hand-crafted Based	BRISQUE [40]	0.2091	0.3347	0.1444	0.7414
	CPBD [41]	0.2099	0.4797	0.1335	0.7217
	IL-NIQE [42]	0.1481	0.1573	0.1131	0.6600
	NFERM [43]	0.2797	0.4062	0.1999	0.7222
	NFSDM [44]	0.3189	0.4468	0.2235	0.6935
Deep-learning Based	NIQE [45]	0.2079	0.2594	0.1413	0.8050
	DBCNN [36]	0.5381	0.5147	0.3946	0.4700
	StairIQA [37]	0.3813	0.4566	0.2653	0.5802
	ViT-MQA [14]	0.3517	0.3724	0.2609	0.8780
	Dual-PCQA [15]	0.6583	0.6578	0.4718	0.4549
	Q-Align [38]	0.0746	0.0764	0.0498	0.8311
	CAP (Ours)	0.7098	0.7566	0.5386	0.4245

ABLATION STUDY RESULTS ON 3DGCQA DATABASE, WHERE C, A, P DENOTE CT-SLICE, ALIGNMENT AND PROJECTION MODULES, RESPECTIVELY. BEST IN RED, SECOND IN BLUE.

Model	SRCC↑	PLCC↑	KRCC↑	RMSE↓
C	0.4917	0.4923	0.3615	0.5972
A	0.3371	0.4093	0.2402	0.5781
P	0.5048	0.5689	0.3590	0.5580
A + P	0.5558	0.5896	0.3939	0.5241
C + P	0.6695	0.6611	0.4907	0.4470
C + A	0.5477	0.5683	0.4017	0.5399
C + A + P	0.7098	0.7566	0.5386	0.4245

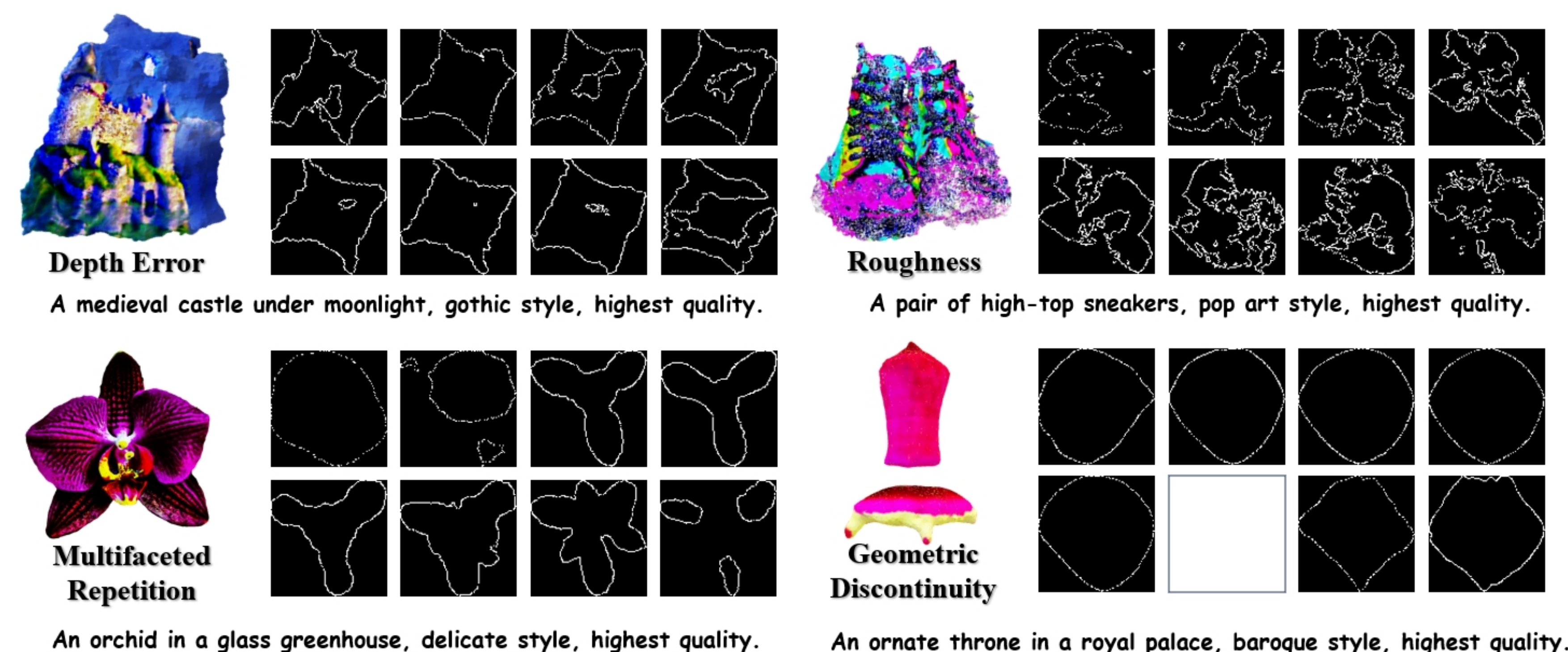
- CAP achieves state-of-the-art (SOTA) performance
- The CT-Slice and Projection modules demonstrate comparable performance in the ablation experiments



Framework of proposed CAP method

Framework

The CAP framework comprises four distinct modules. The Projection Module, CT-Slice Module, and Alignment Module are designed to assess distinct aspects of GM quality, focusing on external quality information, internal structural features, and prompt alignment, respectively. The Assessment Module integrates these insights by performing feature extraction, regression, and fusion to produce the final predicted quality score of the GM.



Slices of Generated Mesh with different distortion types

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