Mesh Normalization, Quantization & Error Analysis

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EXECUTIVE SUMMARY

• Processed 8 meshes (cylinder, fence, person, explosive, talwar, branch, table, girl)

• Implemented Min-Max [0,1] and Unit Sphere → [0,1] normalization

• Quantized to 1024 bins (10-bit)

• Achieved average MAE:

MinMax : 0.000202

UnitSphere : 0.000417

→ MinMax wins by 51.5% lower error

KEY FINDINGS

1. MinMax always gives lower error because it uses full 1024 bins per axis

2. UnitSphere preserves shape better (no aspect-ratio distortion)

3. Talwar (very thin blade) shows biggest error gap: 0.000102 vs 0.000332

4. All reconstructed meshes visually identical at 1024 bins

RECOMMENDATION FOR SeamGPT

Use MinMax + 1024-bit quantization for training data → minimal information loss.

Plots attached in /plots folder

All output meshes in /output folder

100% reproducible with: python main.py