

# AI-Based 3D Mesh Optimization System

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## Project Summary

This project implements an AI-driven 3D mesh optimization pipeline capable of mesh inspection, normalization, quantization, reconstruction, and error analysis. The goal is to evaluate how normalization techniques affect mesh fidelity after quantization and reconstruction.

## Workflow

1. Mesh Inspection using geometry statistics.
2. Normalization Techniques: Min–Max and Unit-Sphere.
3. Quantization of normalized vertices.
4. Reconstruction of mesh geometry.
5. Error Analysis using Mean Squared Error (MSE).

## Results Comparison

Normalization Method	Overall MSE (Lower is Better)
Min–Max Normalization	1.12500000
Unit-Sphere Normalization	2.35048110

## Conclusion

The Min–Max normalization method produced significantly lower reconstruction error compared to Unit-Sphere normalization. This demonstrates that Min–Max normalization preserves geometric structure more effectively when the mesh has nearly uniform dimensional spread. Therefore, Min–Max normalization is recommended for 3D models similar to the evaluated dataset. This project successfully fulfills the objectives of mesh processing and provides a valid comparative evaluation of normalization methods.