Demo: Benchmarking and Visualizing Compression Errors in Volumetric Streaming Systems

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ABSTRACT

Volumetric streaming is a powerful medium that transmits volumetric data, which primarily includes color and depth information, over a network in real-time. While color data can be effectively compressed using standard video codecs, compressing depth data poses a significant challenge as we need to change the bitrate for transmission over standard video codecs. Streaming depth data using standard video codecs introduces visual artifacts that degrade the quality of volumetric streaming workflows. To address this issue, we propose a demonstration exploring efficient compression techniques for color and depth data that minimize visual artifacts while preserving visual fidelity. Using a physical tabletop game filmed with volumetric cameras, we compare two voumetric streaming video workflows. The first workflow streams and renders the color and depth data directly from the camera in an uncompressed format, which is used as the ground truth. The second workflow encodes and streams the data in a compressed format. The comparison is conducted on a desktop system to evaluate performance for analyzing factors such as data transmission, compression quality, and overall system responsiveness.

CCS CONCEPTS

• **Information systems → Multimedia streaming**.

KEYWORDS

volumetric video streaming, volumetric data compression

ACM Reference Format:
Krutik Pandya, Flemming Laursen, Jason Lobo, Gael Melo, Detim Zhao,, Sun-Yen Tan and Robert LiKamWa. 2025. Demo: Benchmarking and Visualizing Compression Errors in Volumetric Streaming Systems. In *The 26th International Workshop on Mobile Computing Systems and Applications (HOTMOBILE '25), February 26–27, 2025, La Quinta, CA, USA.* ACM, New York, NY, USA, 1 page. https://doi.org/10.1145/3708468.3715680

1 INTRODUCTION

Streaming color and depth data over standard video codecs leads to artifacts due to bitrate constraints[1]. In this demonstration, we examine the performance of traditional streaming codecs when applied to volumetric videos, focusing on key metrics such as data transmission, compression quality, visual artifacts, and system responsiveness. By providing side-by-side comparisons of uncompressed and compressed volumetric video. Using "Rock 'Em Sock 'Em Robots" as our subject tabletop game captured using Azure Kinect, we highlight the limitations of standard video streaming codecs in handling color and depth data.

2 APPROACH

The ground truth will be a video recording streamed and rendered in Unity from the Kinect camera, which will serve as a reference for uncompressed volumetric video, showcasing the highest fidelity. Meanwhile, the compressed pipeline will encode and apply traditional video compression algorithms (such as H.264, HEVC, or JPEG XS) to the same content and observe the differences in the color and depth data streams, analyzing visual artifacts and quality reduction. The demo aims to highlight the following key topics:

- **Data Comparison**: Analyzing visual fidelity and artifacts by comparing uncompressed and compressed volumetric data streams.
- **Compression Artifacts**: Demonstrating the loss of 3D point-cloud detail, blurring of movement, and color inaccuracies that arise when compression is applied to fast-moving, dynamic scenes.
- **Real-World Relevance**: The demo will also touch on the practical implications of streaming volumetric video in live gaming or VR experiences, showing the impact of bandwidth limitations and the need for specialized compression solutions in high-quality video streaming.

This demo helps in understanding the limitations of traditional video streaming compression for color and depth data and sparks conversation around future exploration in data compression, networking, and rendering for volumetric video systems.

ACKNOWLEDGMENTS

This material is based upon work supported by the National Science Foundation under Grant No. 1942844. The research was sponsored by the Army Research Laboratory and was accomplished under Cooperative Agreement Number W911NF-23-2-0225.

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HOTMOBILE '25, February 26–27, 2025, La Quinta, CA, USA

ACM ISBN 979-8-4007-1403-0/25/02
https://doi.org/10.1145/3708468.3715680