

ADVANCED DATA COMPRESSION TECHNIQUES

SLOT: E2+TE2

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TOPIC: Lossless Audio Compression: Conversion of Uncompressed WAV to FLAC for Efficient Storage and Transmission

Abstract:

WAV files are known for their excellent sound quality, but they take up a huge amount of storage space, which makes them impractical for everyday use, large-scale sharing, or archiving. This project explores how converting WAV files into the Free Lossless Audio Codec (FLAC) format can help. Unlike lossy formats (which reduce size by cutting out some audio details), FLAC keeps the audio exactly the same while shrinking file sizes by about 40–60%. To test this, we used a mix of open-source tools—including FFmpeg, the FLAC utilities, and Python libraries like *pydub* and *scipy*—to automate conversions, measure how much space was saved, and double-check that the audio quality remained untouched. The results clearly show that FLAC is a powerful option for saving storage space and speeding up file transfers without any loss in fidelity. This makes it especially valuable for areas like music archiving, professional audio work, and digital media platforms, where both quality and efficiency matter. Looking ahead, it would be worth comparing FLAC with other lossless formats, such as ALAC or WavPack, and seeing how these compression methods can fit into cloud-based systems for large-scale, real-time use.