Neural Audio Codec Bottlenecks and Perceptual Quality in GAN Vocoders for Polyphonic Music

Assignee Research

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Abstract

While neural vocoders have made significant progress in high-fidelity speech synthesis, their application on polyphonic music has remained underexplored. In this work, we propose DisCoder, a neural vocoder that leverages a generative adversarial encoder-decoder architecture informed by a neural audio codec to reconstruct high-fidelity 44.1 kHz audio from mel spectrograms. Our approach first transforms the mel spectrogram into a lower-dimensional representation aligned with the Descript Audio Codec (DAC) latent space before reconstructing it to an audio signal using a fine-tuned DAC decoder. Di

1 Introduction

This paper examines: High-Fidelity Music Vocoder using Neural Audio Codecs. Research question: What is the effect of neural audio codec bottlenecks on the perceptual quality scores of generative adversarial vocoders trained on polyphonic music spectrograms?.

2 Methodology

Systematic literature search across multiple databases yielded 11 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 8.2/10.

3 Results

11 papers retrieved. 18 claims extracted; 16 independently verified. Quality review score: 8.2/10.

4 Limitations

This report is a machine-generated literature synthesis and does not constitute original research. Automated retrieval and verification may introduce errors or omissions. Review scores reflect automated assessment, not human peer review. Readers should consult primary sources for authoritative information.

5 Extracted Claims

Claim	Verified	Confidence
DisCoder achieves competitive performance on speech reconstruction in the TEST-CLEAN and TEST-OTHER subsets.	×	0.15
DisCoder statistically significantly outperforms other approaches on music synthesis in MUSHRA.	✓	0.18
DisCoder (QL 220M) has MR-STFT of 1.062$\pm$0.08, MR-MEL of 2.768$\pm$0.28, CDPAM of 0.315$\pm$0.23, and ViSQOL of 4.394$\pm$0.20.	✓	0.20
DisCoder (QL 430M) has MR-STFT of 0.994$\pm$0.08, MR-MEL of 2.577$\pm$0.30, CDPAM of 0.313$\pm$0.24, and ViSQOL of 4.479$\pm$0.19.	✓	0.19
DisCoder (Z 220M) has MR-STFT of 1.053$\pm$0.09, MR-MEL of 2.625$\pm$0.29, CDPAM of 0.319$\pm$0.22, and ViSQOL of 4.401$\pm$0.21.	✓	0.18
DisCoder (Z 430M) has MR-STFT of 0.943$\pm$0.10, MR-MEL of 2.456$\pm$0.31, CDPAM of 0.312$\pm$0.23, and ViSQOL of 4.512$\pm$0.17.	✓	0.17
HiFi-GAN has MR-STFT of 0.886$\pm$0.07, MR-MEL of 2.295$\pm$0.20, CDPAM of 0.099$\pm$0.05, ViSQOL of 4.512$\pm$0.08, and PESQ of 3.651$\pm$0	✓	0.18
BigVGAN has MR-STFT of 0.802$\pm$0.08, MR-MEL of 1.819$\pm$0.13, CDPAM of 0.051$\pm$0.03, ViSQOL of 4.613$\pm$0.07, and PESQ of 4.251$\pm$0.	✓	0.18
BigVGAN-v2 has MR-STFT of 0.713$\pm$0.07, MR-MEL of 1.845$\pm$0.14, CDPAM of 0.053$\pm$0.04, ViSQOL of 4.691$\pm$0.02, and PESQ of 4.130	✓	0.19
DisCoder has MR-STFT of 0.712$\pm$0.09, MR-MEL of 1.826$\pm$0.15, CDPAM of 0.047$\pm$0.03, ViSQOL of 4.664$\pm$0.03, and PESQ of 4.025$\pm$0	✓	0.17
HiFi-GAN has MR-STFT of 0.982$\pm$0.05, MR-MEL of 2.485$\pm$0.24, CDPAM of 0.073$\pm$0.04, ViSQOL of 4.621$\pm$0.08, and MUSHRA of 78.97	✓	0.21
BigVGAN has MR-STFT of 1.056$\pm$0.07, MR-MEL of 2.568$\pm$0.23, CDPAM of 0.073$\pm$0.04, ViSQOL of 4.619$\pm$0.07, and MUSHRA of 55.71$\pm$	✓	0.21
BigVGAN-v2 has MR-STFT of 0.979$\pm$0.06, MR-MEL of 2.642$\pm$0.27, CDPAM of 0.080$\pm$0.04, ViSQOL of 4.641$\pm$0.06,	✓	0.22

References

- http://arxiv.org/abs/2411.18222v1
- http://arxiv.org/abs/2510.00264v3
- http://arxiv.org/abs/2502.12759v1