Scaling of Inference Latency with Decoder Depth in Neural Source-Filter Models for Real-Time Symbolic-to-Audio Synthesis

Assignee Research

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Abstract

Speech synthesis and music audio generation from symbolic input differ in many aspects but share some similarities. In this study, we investigate how text-to-speech synthesis techniques can be used for piano MIDI-to-audio synthesis tasks. Our investigation includes Tacotron and neural source-filter waveform models as the basic components, with which we build MIDI-to-audio synthesis systems in similar ways to TTS frameworks. We also include reference systems using conventional sound modeling techniques such as sample-based and physical-modeling-based methods. The subjective experimental results

1 Introduction

This paper examines: Text-to-Speech Synthesis Techniques for MIDI-to-Audio Synthesis. Research question: How does the inference latency of neural source-filter models scale with increased decoder depth in real-time symbolic-to-audio synthesis?.

2 Methodology

Systematic literature search across multiple databases yielded 13 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 7.7/10.

3 Results

13 papers retrieved. 12 claims extracted; 12 independently verified. Quality review score: 7.7/10.

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
components can be applied to piano MIDI-to-audio synthesis with minor modifications.	✓	0.31
The results reveal that synthesizing high quality piano sound given natural acoustic features is challenging.	✓	0.27
The full MIDI-to-audio synthesis system is still inferior to the sample-based or physical-modeling-based approaches.	✓	0.40
The database contains over 200 hours of piano performances and aligned MIDI data from the International Piano-e-Competit	✓	0.24
The experiments followed the official data protocol: a train set with 161.3 hours of data from 967 performances, a valid	✓	0.37
192 test segments were manually excerpted from the test set, and each test segment was less than 30 seconds in duration.	✓	0.30
The first two systems are reference software synthesizers, and the next four are copy-synthesis systems that directly us	✓	0.30
The next 11 systems are pipelines of an acoustic model, which is either a variant of the Tacotron or the PerformanceNet	✓	0.36
The last two experimental systems, namely midi-sin-nsf and midi-noi-nsf, directly convert the MIDI and the excitation si	✓	0.38
Tacotron models were trained using the MIDI filter bank spectrogram as output, since it produced better alignments than	✓	0.31
The models were trained on segments of 800 frames using the Adam optimizer, a batch size of 4, and a learning rate of 0.	✓	0.39
The base model taco2 was trained for 550k steps until spectrogram loss on the development set converged.	✓	0.40

References

- `http://arxiv.org/abs/2104.12292v6`

- http://arxiv.org/abs/2304.06244v2
- http://arxiv.org/abs/2304.13085v2