Master Thesis Expose

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Working Title:
Generative and Procedural Methods for Creating Room Impulse Responses: Acoustic Snapshots as an Artistic Expression

Abstract

Room impulse responses (RIRs) are important in capturing the acoustic characteristics of environments. This thesis explores generative and procedural methods for creating RIRs and their application as acoustic snapshots in the artistic domain. By leveraging computational techniques (such as procedural and ai generated) this research aims to expand the use of RIRs in sound art, music production and virtual reality offering innovative ways to engage with acoustic spaces.

Introduction

RIRs represent the acoustic snapshot of a space. Capturing how sound propagates, reflects and interacts within it. While mostly used in architectural acoustics and audio engineering, the potential of RIRs in artistic applications remains understudied.

This thesis aims to fill the existing gap by exploring generative and procedural methods for creating RIRs, using them as acoustic snapshots in artistic contexts. Generative methods involve using algorithms to synthesize RIRs based on interactive acoustic parameters, enabling artists to craft unique acoustic environments. Procedural methods, on the other hand, simulate the acoustics of virtual environments dynamically, offering a versatile tool for real-time applications. By investigating these methods, the research will demonstrate the feasibility and artistic value of using RIRs in creative practices.

Literature Review

Existing research on RIRs primarily focuses on their technical aspects and applications in acoustics. However, recent advancements in generative models and procedural modeling present new opportunities for creating and utilizing RIRs in innovative ways. This review will cover foundational concepts of RIRs, explore current generative and procedural methods and highlight potential artistic applications, such as sound art installations, concrete music and immersive audio experiences in video games.

The study by Borra, Antonacci, and Sarti (2022) proposes a data-driven approach for RIR reconstruction using deep prior techniques. This method utilizes convolutional neural networks (CNNs) to reconstruct RIRs without relying on extensive training datasets, making it highly adaptable to different environments and conditions. This approach highlights the potential of AI in generating realistic RIRs for immersive audio applications.

A comprehensive overview of RIR measurement techniques and their applications in acoustics can be found in the article by Savioja and Xiang, which discusses simulation-based auralization of room acoustics. This paper outlines the principles of RIR measurement and the significance of accurate acoustic simulations for various applications, including architectural acoustics and virtual reality.

The application of RIRs in artistic contexts, such as sound art and music production, can benefit from procedural modeling techniques. These methods dynamically simulate virtual environments to create unique acoustic experiences. Exploring the intersection of procedural generation and artistic expression can lead to novel installations and performances that engage audiences in new ways.

Methodology

This research will employ both generative algorithms and procedural modeling techniques to create RIRs. Generative methods will involve the use of computational models to synthesize RIRs based on interactive acoustic parameters. Procedural methods will utilize algorithms to simulate the acoustics of virtual environments dynamically. The effectiveness of these methods will be evaluated through case studies in artistic applications providing practical insights into their potential and limitations.

Expected Results

The thesis expects to demonstrate the feasibility and artistic value of using generative and procedural methods to create RIRs. It aims to show that these methods can produce realistic and engaging acoustic snapshots, enriching artistic projects across various domains. The research will also highlight the challenges and future directions in this interdisciplinary field.

Conclusion

This thesis aims to contribute to both theoretical and practical knowledge and offer new tools, perspectives for artists and researchers. The findings will open the way for further exploration of RIRs in creative practices that enhancing our understanding of sound and space.

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