Résumé de thèse de Gwendal Le Vaillant, défense du 20/2/25

Sound Synthesis Parameters: Matching and Interpolation using Generative Neural Networks

This thesis addresses key challenges in manipulating sound synthesizers, which have shaped modern music production and have defined new music genres. Specifically, it focuses on the tasks of sound matching and sound morphing using conventional synthesizers.

Given the complexity of manipulating extensive parameter sets, called presets, the study introduces a scalable, synthesizer-agnostic approach to sound matching for creating presets from target sounds. The model is validated using a widespread frequency modulation synthesizer with a large set of interdependent parameters and a semi-modular architecture.

This thesis also introduces a novel variational auto-encoder model tailored for black-box synthesizer preset interpolation, which enables the intuitive generation of new presets from pre-existing ones. Leveraging multi-head self-attention networks, the model learns latent representations of synthesis parameters, aligning these with perceived timbre dimensions through attribute-based regularization. Objective evaluations of timbre linearity and smoothness show that the auto-encoder is able to gradually transition between diverse presets. The model's performance is also demonstrated through subjective experiments. It can be adapted to any conventional non-differentiable synthesizer, and can perform other tasks such as extrapolations and automatic modulations of presets. These contributions advance sound design by offering automated, generative tools for sound matching and preset interpolation.