Machine Learning in Audio Effects

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Excel@FIT 2024

Audio Effects

Either analog or digital, audio effects modify the sound characteristics of instruments and are a necessary component in music creation.
This can alter from a light modification of the signal to a drastically changing the instrument signal from its original sound.

Motivation

Problem Description

- Guitar sound is a key to performance or recording
- Estimating the choice order, and setting of effects requires musical and audio-engineering know-how
- Current Literature on machine learning for this task is very limited

Goals

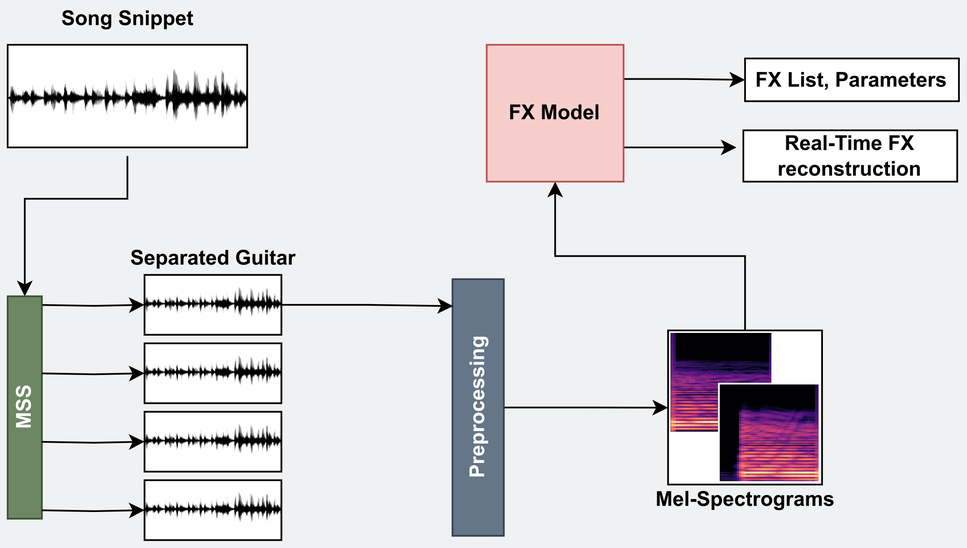
- Isolate guitar sound from a recording
- Train a neural system estimating the effects and their parameters from guitar track
- Test it by using numerical metrics and listening tests.

Data

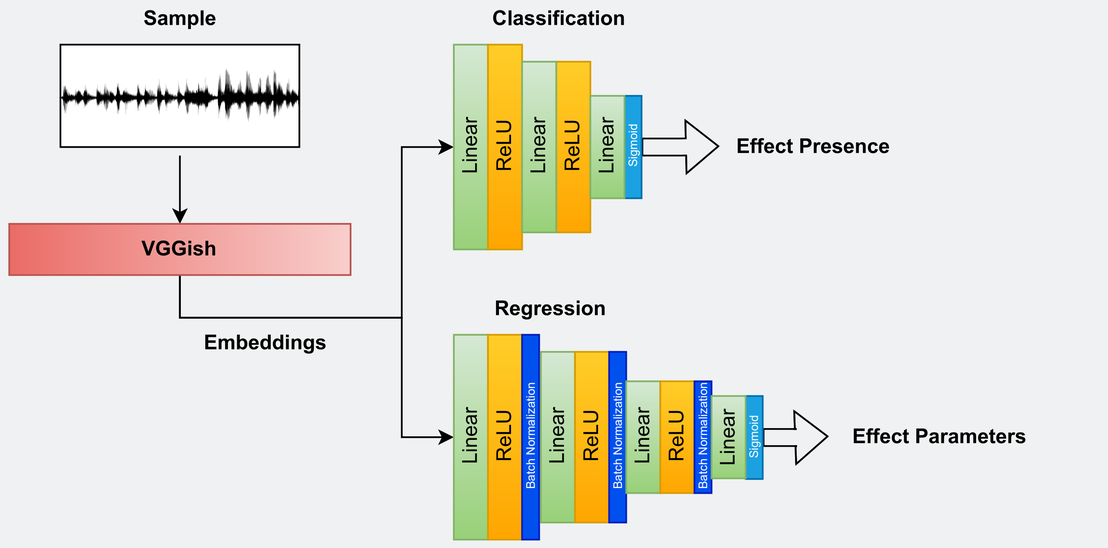
Augmented version of IDMT Guitar Samples dataset was used for this specific work.

- 110k guitar samples with a total duration of 61 hours.
- Each sample contains between 0 and 12 effects with random parameters.
- Created using a Python wrapper that enables data augmentation with audio effects.
- Used effects: `BitCrush`, `Chorus`, `Clipping`, `Compressor`, `Delay`, `Distortion`, `High-pass filter`, `Ladder filter`, `Low-pass filter`, `Limiter`, `Phaser`, and `Reverb`

System Architecture



Model Architecture



Results

Detection accuracy:

BitCrush	Chorus	Clipping	Compressor	Delay	Distortion	High-pass Filter	Low-pass Filter	Ladder Filter	Limiter	Phaser	Reverb
77.5 %	83.8 %	67.4 %	65.8 %	74.9 %	67.7 %	74 %	88.5 %	73.5 %	76.4 %	78.7 %	69.2 %

Parameter estimation error:

BitCrush	Chorus	Clipping	Compressor	Delay	Distortion	High-pass Filter	Low-pass Filter	Ladder Filter	Limiter	Phaser	Reverb
0.24	0.24	0.23	0.24	0.24	0.23	0.30	0.24	0.24	0.25	0.23	0.37