

Design and Implementation of an Interactive Electronic Drums System Tailored for Individual Performers

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1. Problem Statement

While commercial electronic drum systems are designed for versatility across various environments, they often fail to sufficiently reflect the unique playing habits and expressive nuances of individual performers. In particular, during performances involving rapid repetitive strikes or wide dynamic shifts, I observed that the musical textures and sonic variations intended by the performer were often restricted or unnaturally rendered.

2. Design Objectives

- **Real-time Analysis:** Analyze the performer's input patterns in real-time.
- **Dynamic Modulation:** Enable acoustic processing methods to change dynamically based on input characteristics.
- **Expressive Expansion:** Ensure the technology expands musical expression rather than limiting it.
- **Production Quality:** Reproduce high-quality drum samples with multi-track outputs to enhance the engineer's mixing capabilities.

3. System Architecture

The system follows a streamlined signal chain:

Standard E-Drum Trigger → MIDI Analysis → Real-time Mapping Logic → Audio Sample Play → Sound Processing & Modulation → Multi-Channel Output Sound

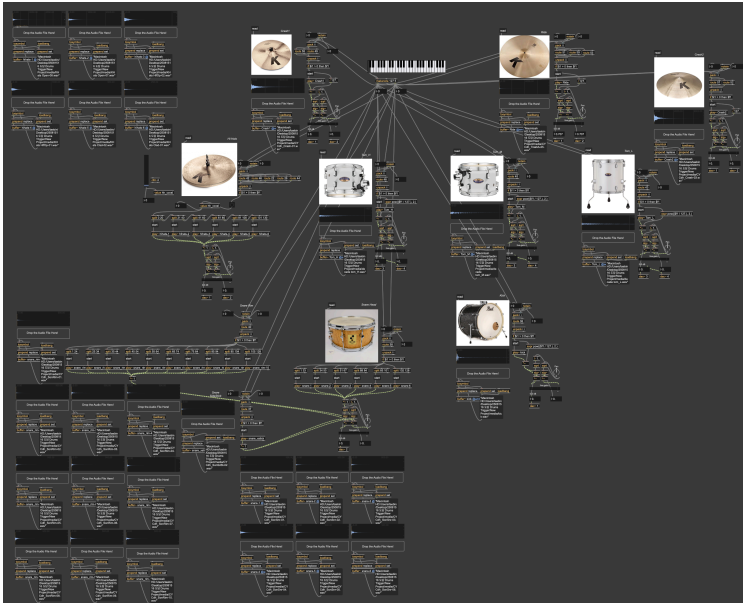
Playing patterns were categorized based on:

- Inter-onset Intervals (IOI): Time between strikes.
- **Repetition Count:** The number of successive hits.
- **Velocity Fluctuations:** Dynamic changes in striking force.

The acoustic response characteristics were designed to vary dynamically according to these parameters.

4. Implementation Method

The system was implemented using the **Max/MSP** environment. It receives MIDI output from a standard electronic drum kit as a trigger input, extracts the performer's playing patterns, and maps them to sound-processing parameters. For instance, the system was designed to progressively shift the timbre during continuous strikes, recreating the organic textural changes found in authentic acoustic drums within the performer's digital environment.



5. Results and User Feedback

Performers perceived that their playing habits were immediately reflected in the sound, providing feedback that the system broadened their range of musical expression. This confirmed that technology can serve as a tool to **extend the performer's sensory actions** rather than merely replacing them.

6. Project Significance

This project is an attempt to redefine the electronic drum not just as a simple input device, but as an **interactive interface** between the performer and the system. It holds significance as a case study in **Arts Engineering**, prioritizing human expression and sensation over a purely technology-centric approach.