Deconstructing Deconstructed Club (DDC)

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CART 398 - CREATIVE ARTIFICIAL INTELLIGENCE:

Fig. 1. Bass Guitar, 2007. Feliciano Guimarães from Guimarães, Portugal, CC BY 2.0, via Wikimedia Commons. (https://commons.wikimedia.org/wiki/File:Bass_guitar_(477085398).jpg)

CCS Concepts: Computing methodologies → Machine learning → Machine learning approaches → Classification and regression trees; Human-centred computing → Human computer interaction (HCI) → Interaction devices → Sound-based input/output.

Additional Keywords and Phrases: Embodied interaction, Parameter mapping, FluCoMa, Instrument manipulation, Analog to digital conversion, Abstract exploration, Audio slicing.

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1 INTRODUCTION

Deconstructing Deconstructed Club (DDC) is an embodied interaction machine learning project that explores the relationship between the perceived auditory expectations of the bass guitar translated into abstracted digital outputs of samples taken from the deconstructed club genre. Deconstructed club is a relatively new genre from the late 2010's, evolving from its predecessors of drum and bass, jungle, techno, and house music. It is categorically known for its abstract sound structures and avant garde style of recontextualizing the way that music can be created and perceived. *DDC* builds upon this experimental genre by using a regression based supervised machine learning approach to map the auditory parameters of the bass guitar into a WAV data set of spectral slices. The software used to create *DDC* was Max 8, in addition it uses the FluCoMa toolkit package to access machine learning objects such as the fluid.mlpregressor, fluid.onsetslices, fluid.mfccs, and fluid.pitch. Inspired by the works of Laetitia Sonami's Spring Spyre and Lady's Glove, as well as Atau Tanaka's experimentations with the Meta Gesture, *DDC* exists as Jaden's personal development into creative artificial machine learning, music production, embodied interactions, and articulating new voices in preexisting instruments. In the paper written by Rebecca Fiebrink and Laetitia Sonami for the NIME 2020 conference, Sonami goes into the concept of the relationship between the instrument and performer, "I started to understand 'what the instrument wants'. Only recently has it become more of an 'exchange' between the instrument and me, the performer. Not just forcing my intentions onto it, but letting it inform the composition and performance." (3) Building on this conceptually, *DDC* changes the preset framework for music creation using the bass guitar's natural frequency range, instead opting to dismantle the standardised relationship imposed upon it allowing for a new interpretation of embodied control through sampling. Changing the fundamental position that the bass guitar plays as a supporting role in keeping the groove and outlining the harmonic structure within a band, into a standalone audio interface that can directly define an entire composition. FluCoMa supports this type of audio manipulation with a suite of available tools pertaining to machine learning objects within Max 8 that changes the way that musicians can create music. Some musicians that have been working and collaborating with FluCoMa directly includes: composer/programmer Alex Harker and oboist Niamh Dell's piece titled *Drift Shadow* which processes the timbral qualities of the oboe in real time, sound artist Lauren Sarah Hayes' *Moon via Spirit* which employs the use of a game controller to trigger different events, Alice Eldridge and Chris Kiefer's duet performance with their *Feedback Cello* which acts as a shared adaptive instrument, composer Hans Tutschku and pianist Mark Knoop performance *Sparks* which merges the mechanical complexities of the piano with electronic counterparts through NMF (non-negative matrix factorisation), and Rodrigo Constanzo's *Kaizo Snare* that employs a corpus-based workflow along with real-time sound matching using audio descriptors to transfigure a drum kit into a do it yourself turntable. All of these projects involve some form of an embodied interaction which influenced the creative process while developing *DDC*.

2 EMBODIED INTERACTION

Coming from a background that is relatively inexperienced with music creation, both compositionally and technically, the process for music creation had to remain fairly open for experimentation and allow for the ease of access to those unfamiliar with the intricacies of the bass guitar and programming environments. The case for embodied interaction for *DDC* takes away the pressure that is normally surmounted on the performer and consequently places it on the instrument. Allowing for more creative freedom to be given to an inexperienced performer with the release of control and the introduction of a new interactive language presented on the fretboard. The embodied interaction that is present within *DDC* mainly comes in the form of the gestural plucking of the bass strings and fretboard exploration of the bass guitar. Purposefully transfiguring the interaction language of the bass guitar into the interaction language of a turntable or sampler. The vision for the project was to deconstruct the embodied interaction that someone might commonly use with the bass guitar and further breakdown the deconstructed club genre abstracting it through the process of spectral slices taken from a data set of WAV samples.

2.1 Technologies Used

Software used for *DDC* comes in the form of the Max 8 patcher with the FluCoMa toolkit package containing many of the objects used for audio analysis and machine learning. Everything is done within Max reconfiguring the prebuilt sample patches provided by FluCoMa to suit the goal of the project, specifically the 2D corpus exploration patch to enable audio slicing and controlling a synth with a neural network patch to train the regression dataset. Currently, two input method patches exist for the project, one that uses MFCCs to provide a wider range of the timbral soundscape that the bass guitar produces, and another that uses solely pitch detection. The preferred method that was used for the project ended up being the pitch detection as sound was captured more accurately (see Fig. 2.), MFCCs produced more struggles that occurred when filtering out noise (see Fig. 3.). Hardware wise, sound was transmitted through an analog to digital converter in the form of a USB to 6.5mm jack cable, a USB to USB-C converter, a Squier bass guitar, and a MacBook Air running Max 8. Within the Max 8 audio-to-digital object the input device can be switched from using the MacBook microphone to the USB to 6.5mm jack cable to receive clean audio directly from the bass guitar's pickups. Using the fluid.pitch object from the FluCoMa package the associated input pair of pitch and confidence is matched with a selected output pair that is decided within the sub patch that slices the audio samples which is then selected via a slider. After deciding on a suitable input-output pairing the settings are added to a fluid.dataset buffer called pitchbuf, which is stored for later use to train the multilayer perceptron regression model. Once a suitable amount of input-output pairs have been established and fitted to the model, the patch can now be swapped from selecting points to predicting points to begin the performance.

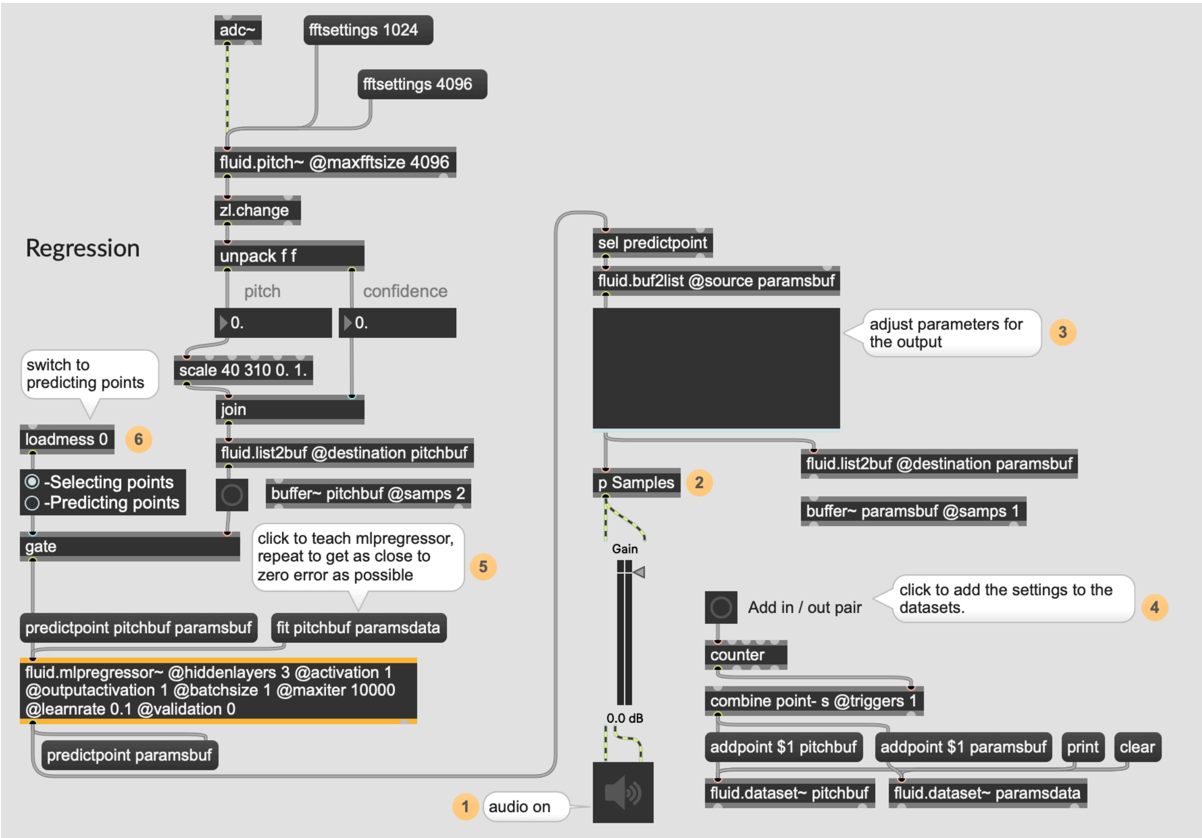

Fig. 2. Regression Patch Using Pitch Detection

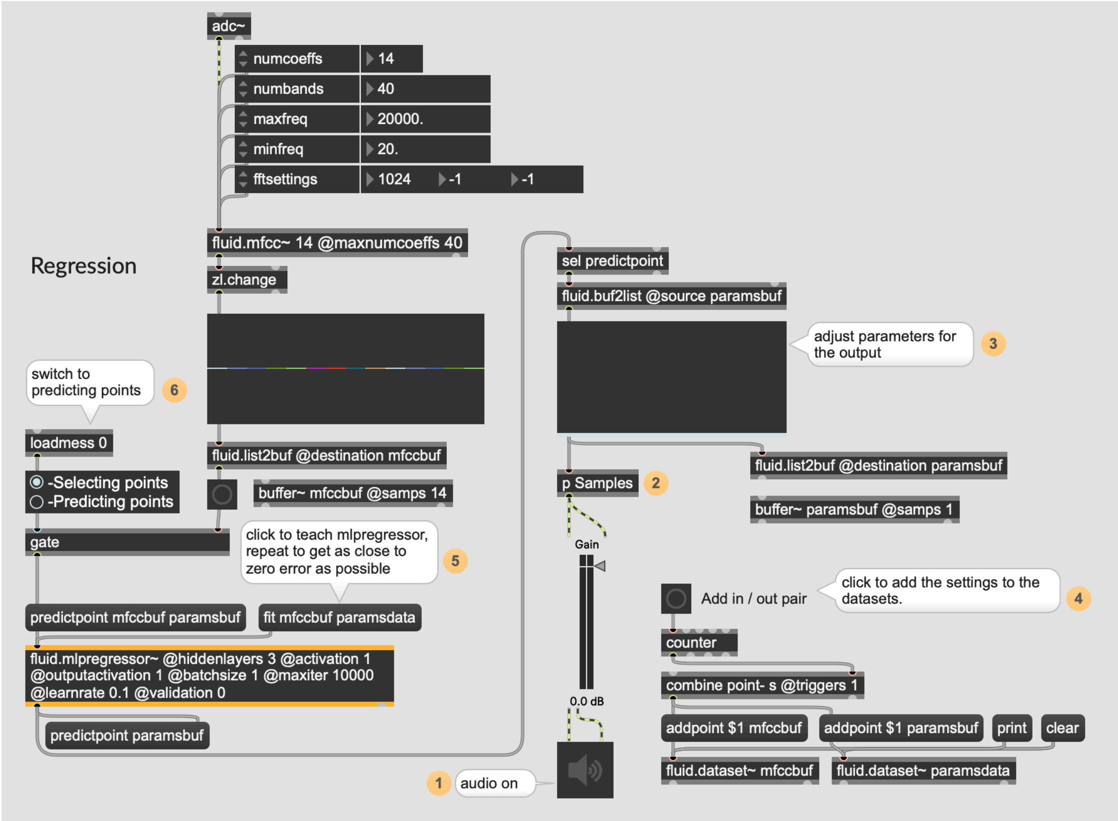

Fig. 3. Regression Patch Using MFFCs

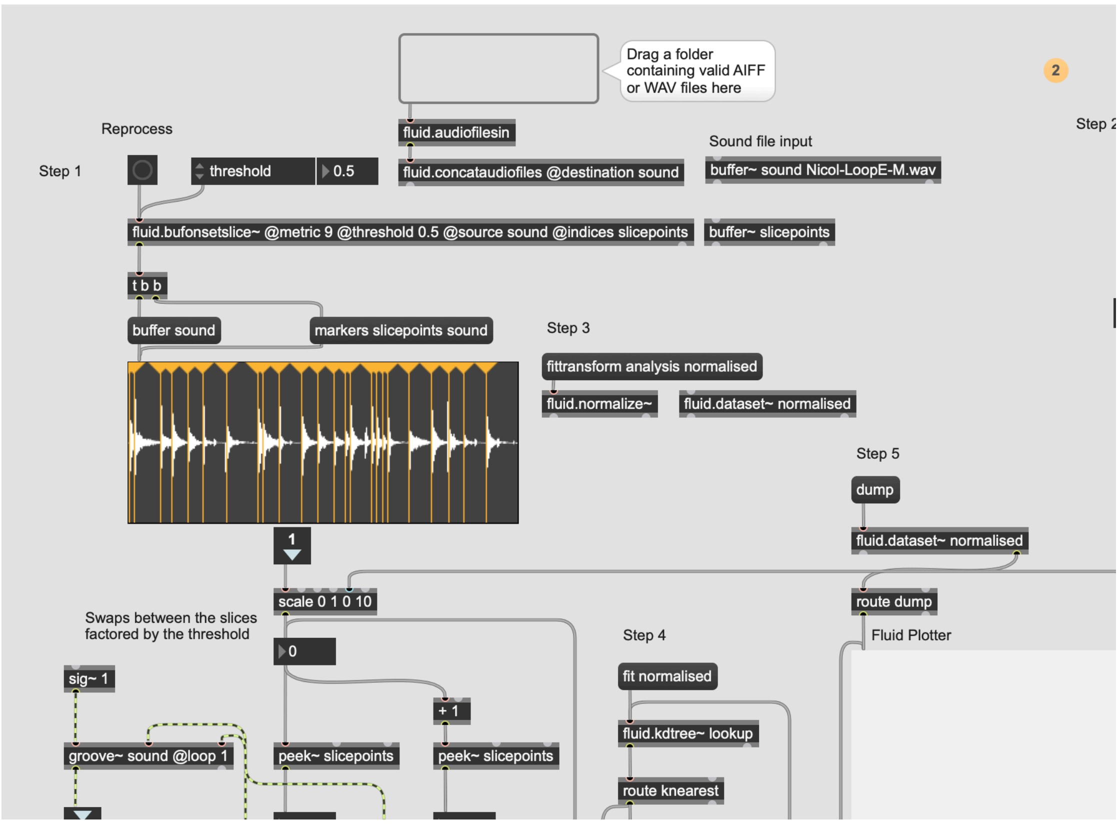

Fig. 4. 2D Corpus Subpatch Used For Audio Slicing

2.2 ML Task & Infrastructure

DDC uses a supervised approach multilayer perceptron regression based machine learning model with input being variable depending on the sound data being processed, for the MFCC patch the data set takes a set of samples of 14 inputs that translates to one output slider, and for the pitch detection patch the data set is configured to take two inputs being pitch and confidence to one output slider. The parameters for the MLPRegressor a set as follows: two hidden layers with three perceptrons each, logistic sigmoid function for activation and output activation which determines the function each neuron in the hidden layer(s) will use, a batch size of one that adjusts the MLP's internal parameters during training, 10000 max iterations which indicates how many epochs to train the model, a learning rate of 0.1 which determines how much the neural network should adjust its internal parameters during training.

2.3 Data Set

The data set was collected using the Sample Google Chrome extension which allows for recording short sound clips within a Google Chrome tab. Recordings were created from a playlist that was curated on YouTube that contains 42 videos most of which are from the deconstructed genre along with various retro video games. Each sample ranges from a few seconds to 15 seconds, all saved as WAV files and processed within Max 8. Choosing 31 WAV files from the playlist, they are then stored within a folder that equates to around 119mb of audio samples. Depending on the threshold set for audio slicing, changes the amount of data points that the slider for output can access and influences the spectral range, the amount of data points usually ranges around a few hundred after processing.

3 PROCESS

Initially, during the early development of this project I lacked a lot of confidence in what I wanted to achieve with the knowledge that I had obtained from the class. The actual concept for the idea for the project was meant to be a more generative take on the machine learning pipeline rather than an embodied experience. Only after realising that with my ignorance and lack of knowledge on the generative side of machine learning, I felt that the idea would still make a sensible enough project translated into a physical form leaving the interpretation and generative music to be left up to the performer-instrument relationship. When writing my proposal for the project I felt quite lost with the vast amount of capabilities and options that machine learning could provide to my creative arts programming background. I settled on this idea because it represented my ambition to move into a music production field that I generally have little experience with aside from the occasional experimentation messing with DAWs and learning the bass guitar. Respectively, *DDC* also encapsulates my general admiration for the amount of work that goes into music creation and love for discovering new abstract music forms. From proposal to presentation the uneasy feeling of misdirection was still looming in the depths of my subconscious telling me that I should give up or change the idea entirely. Pushing past these negative thoughts, I began exploring the capabilities that Max 8 could provide for the project moving forward. Starting out, I had almost zero experience with the program and spent many of the first few weeks just learning how to navigate the program properly. Generally, I found it quite challenging to understand what I was meant to do with the program as there was very little introduction to the interface or objects being shown within the example patches. Eventually, I began following a few YouTube tutorials about the very basics of using Max 8 and learned about the differences between objects and messages which still slightly confuses me today. Probably the most helpful things that I learned through these tutorials were the shortcuts that make everything more streamlined and the help command which gives detailed documentation about every object within Max 8 and FluCoMa. After these beginner tutorials, I discovered the vast versatility the Max 8 was able to provide, not just in sound production but also in visuals and machine learning capabilities with FluCoMa. Following along with the 2D corpus tutorial provided by the FluCoMa developers was instrumental with my success moving forward with this project, and gave me a great boost in my confidence while using the program. I still find myself having some troubles with Max 8 and FluCoMa, specifically when it comes to introducing pitch into the example patch which requires the data to be scaled to be used properly with the MLPRegressor which I had to figure out myself after rewatching the tutorials. Nearing the end of the project, I came to a realisation about how much I was able to learn about artificial intelligence and Max 8 in such a short amount of time, going from a complete beginner to creating something halfway decent. Still there is much to learn and improve on as I am fairly ignorant of the full extent of available possibilities.

4 FUTURE WORK

In my research into artists that are creating similar projects, I came across Constanzo and his work on the Kaizo Snare in collaboration with the FluCoMa team. Moving forward with this project into the future I will investigate the methods employed by him, specifically his use of real-time sound matching and signal decomposition to provide more potential ways to interface with the bass guitar to produce audio. On his website he goes extremely in depth about the process of making the Kaizo Snare, as well as the other projects that he worked on in the past such as C-C-Combine which is a Max patch that he created in 2012 and repurposed for the use of corpus manipulation in Kaizo Snare. *DDC* in its current form is still very much incomplete and could benefit from prototypes being iterated from it here on out diverging away from the altered example patches to their own standalone patches. As it exists now, *DDC* is only mapping to one output via a slider, in the future it would be easy enough to scale the project sideward to allow for multiple sliced samples to be selected at once, each dedicated to a particular section found within a music composition (drums, rhythm, vocals, bass, melody, etc.) allowing for more layered complexity. A larger data set of existing WAV files would also benefit the project allowing for a more customizable selection of output sounds and introducing generative sound processing to accompany these slices. Another big issue that I ran into when working with machine learning models was noise, particularly when no one is interacting with the bass guitar and sounds are still being produced, clamping or filtering off these unwanted fluctuations would greatly improve the professionalism and musical elements of the project. Furthermore, additional elements could be added to the interaction with the bass guitar in the form of built accessories that provide their own function to the piece, such as a metal guitar pick which could influence the sound composition through reverberation or other effects.

APPENDIX

Github Documentation (Max patches, samples, and credit):

https://github.com/bbparasite/Deconstructing-Deconstructed-Club

Deconstructed Club Playlist:

https://youtube.com/playlist?list=PL0da5moBaCVcilfOgiqnMGtQ2di3e3XJm&si=NkbyvHnLe8U0oVVX

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