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Music Computing

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Bsc Music Computing Major Project Proposal

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Data Mining and Sound Analysis Techniques for Creating a Smart Sampler

Often, as an electronic musician, I will be listening to a song and be entirely confused with how a certain sound was made, or be going about my daily life when I hear a great noise and would like to be able to use it in an isolated musical context, however trying to recreate such noise events can be arduous and sometimes impossible with my current tech setup.

For my project I have decided to create an electronic instrument, to combat this. I intend to design and create a sampler with built in sound recognition technologies that will be able to record audio and either sample it or offer similar royalty free samples from a database, which can then be manipulated further, and re-sampled

This project will combine data mining (trawling through a large database of samples and using algorithms to find nearest neighbor to a given sound etc.), sound analysis techniques like implementing FFT analysis and  “acoustic fingerprinting”, as well as physical computing and design aspects, in actually creating the physical form of this instrument, which I have decided to call “The Dopplebänger”, as a working title. Overall I aim to create a user-friendly sample based musical device that is part smart Instrument, part research/identifying tool.

Sound identifying apps such as Shazam and Soundhound have popularized music recognition software in the recent years, with Shazam being one of the most downloaded apps of all time, and so there is a lot of research and libraries that deal with this idea and the implementation of sound analysis, however what separates this project from other tools is the focus on using this software in an live, creative context rather than for a commercial identification or playlist creating application.

This Project will draw from previous studies on sample based sound analysis but and these will influence the design and other interesting implementations of this instrument such as the “ measure of the similarity of the “global timbre” of music titles, based on the audio signal”[1]. This take on sound analysis proposed by Jean-Julien Aucouturier & Francois Pachet could mean that if the entirety of a song was uploaded and the closest sample would in be able to capture the overall feel of the track itself, it would be curious to see which sounds best embodies a certain genre or type of music.

This project also presents a moral/legal issue I would like to explore in the write up of my project, of where we draw the line between drawing inspiration and stealing. This idea of reproducing the most similar sound without stealing directly begs the question is it any better or perhaps worse than sampling the sound itself, in that it will just be a knock off?

A more technical problem I aim to address is that even with noise reduction algorithms and robust frature extraction methods “in [a] real mobile environment… shows about 65% of average retrieving success rate”[2], and the belief of some that when considering feature extraction and mining processes that the accuracy is capped due to a semantic gap. This brings into question the usefulness and reliability of live sampling, and weather or not the sampled sound is an accurate representation what we actually hear.

I plan on using an Arduino Uno to prototype and build the interface for this instrument, which builds on the physical computing module I am currently taking and since Arduino is also compatible with python I will be able to utilise ACRcloud file scan tools available on github as a means of analyzing a large database of samples, however, I will also have to code a large portion of the software myself.

I feel this project finds a good balance with my background in music whilst still being technical enough in terms of the computing aspects to be graded as final project for this BSc degree, with room either side for evaluation and discussion.

[1] Jean-Julien Aucouturier & Francois Pachet (2002) *Music Similarity Measures: What’s the use?*

# [2] Xue Li, Osmar R. Zaiane, Zhanhuai Li (2006, p.283) *Advanced Data Mining and Applications*