MCECS

Computer Science
Portland State University

Maseeh College of Engineering and Computer Science
CS 510: Music, Sound, and Computers Proposal

Academic Year:	Spring 2023
Project Title:	AWERALLUSION AUDIO-VISUALIZATION PLAYER
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MCECS Gitlab Repo:	https://gitlab.cecs.pdx.edu/cgula/awerallusion

Date	***Milestone***
April 23, 2023	Informal Project Approval
April 26, 2023	Submit Project Proposal
June 12, 2023	Submit Final Project and Report

Last updated: April 26, 2023

Introduction. Whether occurring from an acquired brain injury or developmental adaptation, synesthetic experiences imbue otherwise ordinary stimuli with uniquely perceptual phenomenon. Chromesthesia is the cross-sensory modality between audition and vision resulting in the synesthete seeing sound with color. While not synesthetes, many people commonly associate music with perceptual experiences such as colors and emotions. In 1997, a popular media player Winamp was released that played a plethora of live visual graphics which synchronized to the music.

Objective. The overall objective of creating Awerallusion is to develop a graphical integration between different sounds and music. Awerallusion will mimic chromesthesia and provide a visual cue for people who are just learning about the physics of sound by representing components of sound, such as frequency and pitch, in correlation with color and shapes.

Relevance. Machine learning utilizes a myriad of algorithms to learn about associations between data points. Integrating sound and computers occur by both producing sounds from a computer or using existing sounds or music and introducing them into a machine learning algorithm to analyze.

Motivation. Learning with visual expression helps me understand applied content better. As a student new to the world of learning about the physics of sound and the convergence of sound and computers, I had attempted to find resources that could provide a visual representation of different sound waves. As someone interested in studying unique cognitive processes in both the human brain and artificial intelligence research, I have found chromesthesia to be a fascinating area of study that bridges my motivations. By exploring the cross-sensory modality between audition and vision, chromesthesia offers the potential by using machine learning to replicate these processes.

Methods. In an effort to study the empirical comparison of sound and color, I am going to create datasets based on the following criteria:

Visual Associations:

- Violet - 400-440 nm Highest frequency
- Indigo - 440-490 nm
- Blue - 440 - 490 nm
- Green - 490 - 570 nm
- Yellow - 570 - 585 nm
- Orange - 585 - 620 nm
- Red - 780 nm
- Circles
- Triangles
- Squares
- Small
- Large

Sound Attributes:

- Frequency
- Amplitude
- Duration
- Timbre

The algorithm that will be used for the project is an extended decision tree algorithm: a multi-output random forest. Due to the nature of multiple variables that I intend on using within the dataset, I will use a multi-output random forest. Random forests are also useful to prevent overfit data that a single decision tree can cause. The output with be a graphic model with color, shapes, and sizes of the analyzed input and another output to include the physics representation of the soundwave.

Concerns. Some concerns are that integrating a dataset with this many variables could be difficult with a simple machine learning algorithm and I may not be able to produce the different graphical variations that I intend to implement. Also, I had a difficult time finding data online to use, so I will have to create my own, which should be relatively easy, but an extra step.

Resources. The various components that will be itemized are the python programming language, including python libraries such as pygame and turtle. VSCode and a Gitlab Repository will be used tomanage code. LaTex will be used in Overleaf to integrate the written findings of my results.

References.

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[2] Hawley, Scott H. "Synthesis of Musical Instrument Sounds: Physics-Based Modeling or Machine Learning?" *Acoustics Today*, vol. 16, no. 1, 2020, p. 20, https://doi.org/10.1121/at.2020.16.1.20. Accessed 23 Apr. 2023.

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