Synthetic Instrument Generation

Evolving Instruments Using Artificial Intelligence

Our project uses additive synthesis in order to produce instruments partial by partial. Instruments are synthesized client-side eliminating the need for cloud storage.



Figure 1: Additive synthesis of a sine wave at 1 and 4 Hz.

- Crowdsourced voting approach to leverage user interaction and take advantage of humans subjective ability to identify what sounds they like best.
- Evolution of generations of instruments produced by our genetic algorithm that are paired together to create offspring.
- Evaluation using a series of fitness functions and metrics designed to analyze frequency and amplitude.
- Front end fetches sounds after each vote and runs the genetic algorithm once a voting threshold is met.

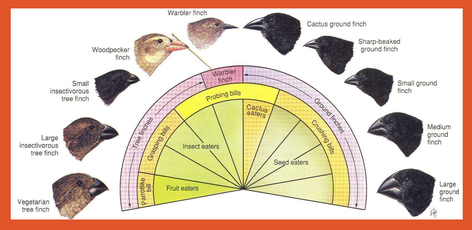


Figure 2: Illustration of Darwin's finches.

Oregon State University



What is a Genetic Algorithm?

A genetic algorithm (GA) is a problem-solving approach inspired by the process of natural selection and evolution. It uses a population represented as chromosomes, which are subject to various genetic operations such as selection, crossover, and mutation. Through successive generations, the algorithm iteratively evolves and improves the population based on their fitness.

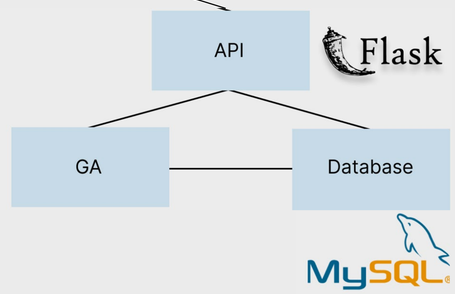


Figure 3: Interaction between the UI, API, and the GA.

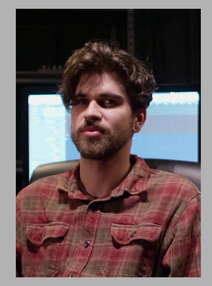
Outcomes

- Developed a web application using React that visually represents the pairs of different sounds that user can hear and vote on.
- Synthesizes sounds using the Tone library in Javascript which allows creating instruments solely using a compact JSON representation.
- Developed a sequential model for experiments running the genetic algorithm which generates the instrument synthesis based off user inputs and audio analysis.

Future Developments

- Increasing diversity in synthesized sounds through different audio effects (distortion, chorusing, convolution, and reverberation).
- Migrating to a non sequential model, where instruments could crossover into other generations or move to different islands.
- Transitioning the entire web application to AWS services to allow for a more streamlined development pipeline.

Acknowledgements



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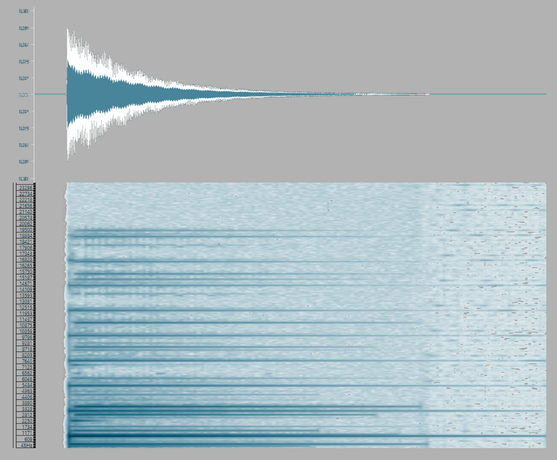

Figure 4: Waveform and spectrogram of a synthetic instrument generated by our approach.

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