# AlgoRhythms:

## Interactive Fitness with Music-Driven Exercises

Oregon State University Cascades


# ABSTRACT

The AlgoRhythms mobile application generates a fun and interactive workout based on user-selected music. Using machine learning, we analyzed music and extracted data about its composition to build interactive workout visualizations in a mobile application. The application connects to a robust backend infrastructure that includes a Django API for passing data to the application, a PostgreSQL database for storing data, and an Nginx web server, all hosted on Amazon Web Services.


# OVERVIEW

The four main components of the application are a RESTful Django API (RDAPI), a PostgreSQL database, a Flutter mobile application, and a Beat-Detection-and-Segmentation Algorithm (BDSA). The capstone project focused on developing a mobile application, database, RDAPI, and deploying this system to AWS while integrating the BDSA.

# IMPLEMENTATION

The AlgoRhythms Senior Capstone project consists of:

1. Flutter Mobile Application
2. RESTful Django API (RDAPI)
3. PostgreSQL Database

The database and the API are hosted on an AWS Lightsail instance with an Nginx web server to help interface between the RDAPI and the Flutter Mobile Application.

## BEAT DETECTION AND SEGMENTATION ALGORITHM INTEGRATION

The BDSA operates on an AWS Lightsail instance, processing song files to output musical segments. The algorithm transfers the workout timings to the database to be retrieved by the mobile application. By analyzing the segments and beats of each song, our application generates workout visualizations that align with the rhythm and intensity of each track and individual segment.

## POSTGRESQL DATABASE

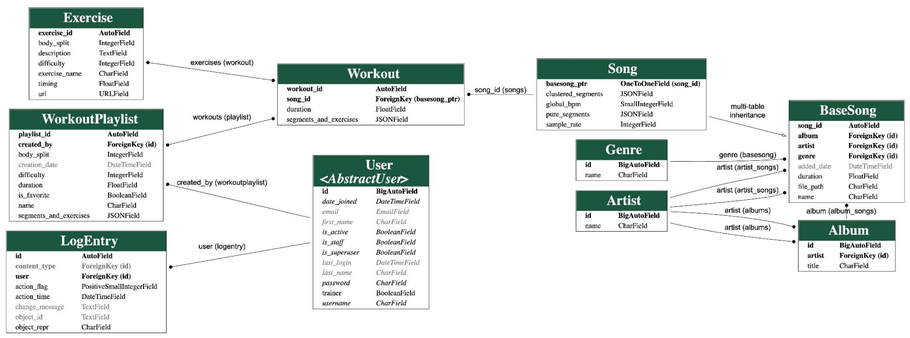


**Figure 1**: Database schema

Our team chose a relational database because of the many-to-many and one-to-one relationships present throughout the system, making PostgreSQL a preferable choice over a document-based database. Model management is handled by Django's built-in Object-Relational Mapping, allowing for simple and efficient database management.

## DJANGO RESTFUL API

The Django RESTful API populates the mobile application with data by serving JSON-formatted responses. Taking advantage of Django's robust model-view-controller architecture, it queries the PostgreSQL database, formats the query results, and sends them as a response to the mobile application. API authentication is handled by Oauth2 and a JSON-Web-Token system that allows for a stateless API, which increases the application's scalability for future development plans.

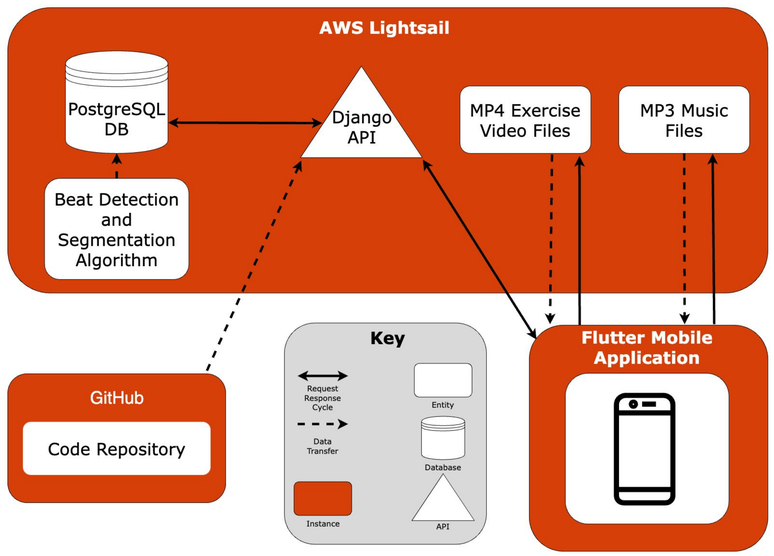


**Figure 2:** AlgoRhythms block diagram

## FLUTTER MOBILE APPLICATION

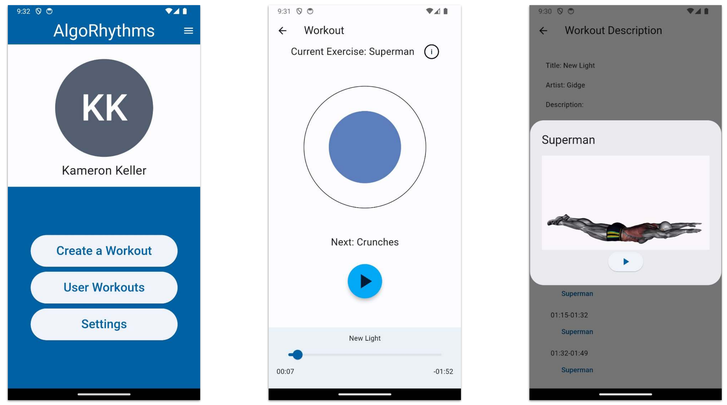


**Figure 3**: Screenshots of the mobile application

Built with the Dart programming language and the cross-platform Flutter framework, the mobile app includes these key features:

- Secure login
- Customizable song selection
- Adjustable workout difficulty and body split
- Workout reuse for easy planning
- Video demonstrations and exercise guidance

# FUTURE WORK

Currently, the AlgoRhythms application establishes a solid foundation with its mobile application, backend infrastructure, and connection to the BDSA. The next steps for this project involve refining the BDSA, gathering data on workout quality from user testing, and enhancing application visualizations and user experience. New features and UI/UX designs could then be tested and iterated upon based on user feedback and experiences.



Dalton Shults


Kameron Keller


Matthew O'Malley-Nichols


Patrick Donnelly

soundbendor lab