

# BeatMap Project Proposal

## Project Overview

The game BeatSaber is a Virtual Reality rhythm game where notes and obstacles are sent at the player in time to the beat of a song. There are a couple dozen songs available with the base game, but most of the songs that are available are created by BeatSaber community by hand with third party tools. Though there are many excellently mapped songs available, there are also songs that are not available because no one has mapped them, or that are available but are not mapped accurately.

This project is to utilize machine learning to create a program that will create a readable and accurate (accuracy referring to note blocks correctly being placed on the beat) mapping of a song as output when it is fed a song file as input. This is an interesting problem because instead of a normal translation type algorithm (e.g. English to Japanese), this is a translation from song waveforms into notes and obstacles which includes both regression and categorization problems.

## Data

Data for this problem is available on the Beat Saber Community website (bsaber.com) and from beatsaver.com, both of these through their API.

Beatsaver will give the songs themselves, their mappings, their metadata (i.e. beats per minute, song title, etc), the number of times they have been upvoted and the number of times they have been downvoted. Everything except the upvote and downvote numbers is stored in a zip file upon download. After extraction the songs are stored in a .ogg format, and the mappings and metadata are stored in a JSON format.

Bsaber.com will give the mean opinion score of the community reviews for that song in JSON format.

## Project Approach

The basic approach for this project is as follows:

1. Download metadata about all songs currently hosted on the BeatSaber Community sites (focusing on oldest first) and store the metadata in a local database
2. Download the songs and their mappings
3. Convert the songs into their waveform formats
4. Break the mappings and the song waveforms into smaller portions and feed them (along with the ratings) to a deep learning algorithm
  - a. The machine learning algorithm will be supervised (as there is both input and output in the data).

- b. The machine learning will have portions of both regression (for note timing which is floating point) and classification (for note type, and note placement which have only a few possible values)
5. Test program output against input and refactor as needed

### **Computational Resources Needed**

1. Processing Power - Unknown at this time
2. Storage - Minimum of 56GB of memory (based on an estimate of ~4MB per song while the song is archived and a current count of 14,109 songs available on BeatSaver). Keeping the .wav version of the song will increase this approximately eightfold, but .wav files for this project can be treated as an intermediate file and cleaned up after use

### **Final Deliverable**

The deliverable for this project is a web API that will automatically output a BeatSaber song mapping when fed a song as input.

A stretch goal for this project is to also allow existing mappings and songs to be fed to the program and allow the program to provide feedback about areas of the mapping that seem inaccurate or that do not follow the same style as other mappings with high mean opinion score.