UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

ECE 420 Final Project Presentation

Electrical & Computer Engineering

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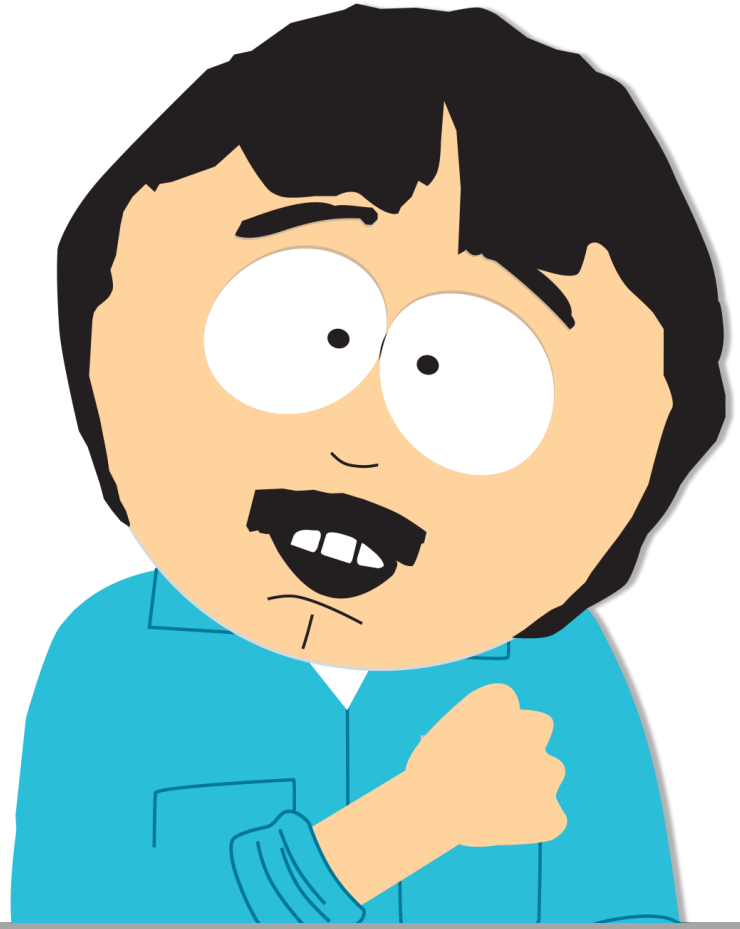
App Operation Overview

Purpose & Function

The Main functionality of our app is to provide auto-tune feature, which adjusts the pitch of the user's singing to a pre-processed or live-recorded soundtrack. Allowing users to enhance their vocal performance.
A key feature of the app is its ability to separate BGM and vocal components from any song captured via Android's integrated microphone. This method allows individual component of the song to be analyzed and manipulated.

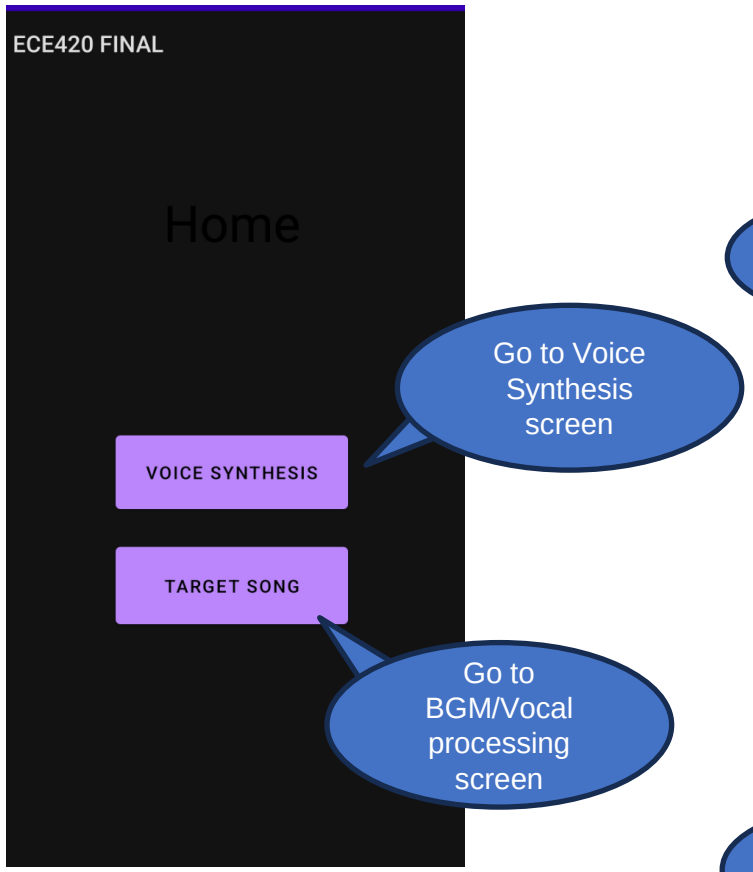


Algorithms Used

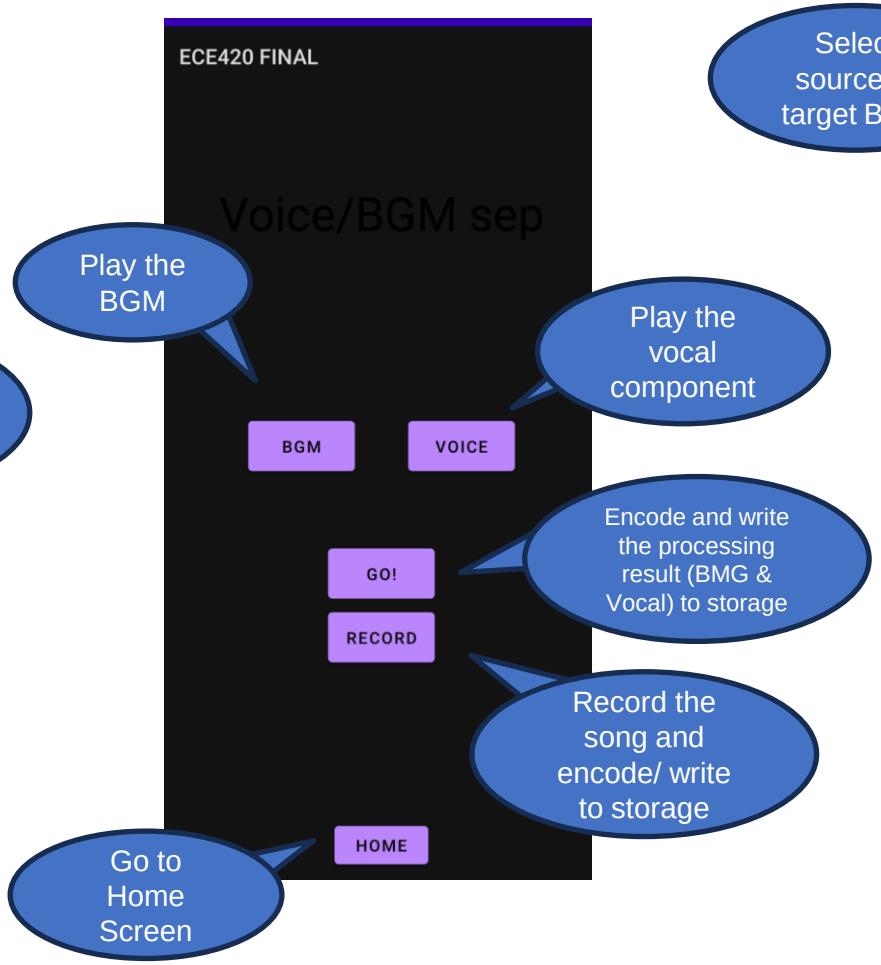
Repet for BGM/Vocal separation,
TD-PSOLA for Pitch Synthesis,
STFT/Autocorrelation for spectrum analysis.

User Interface

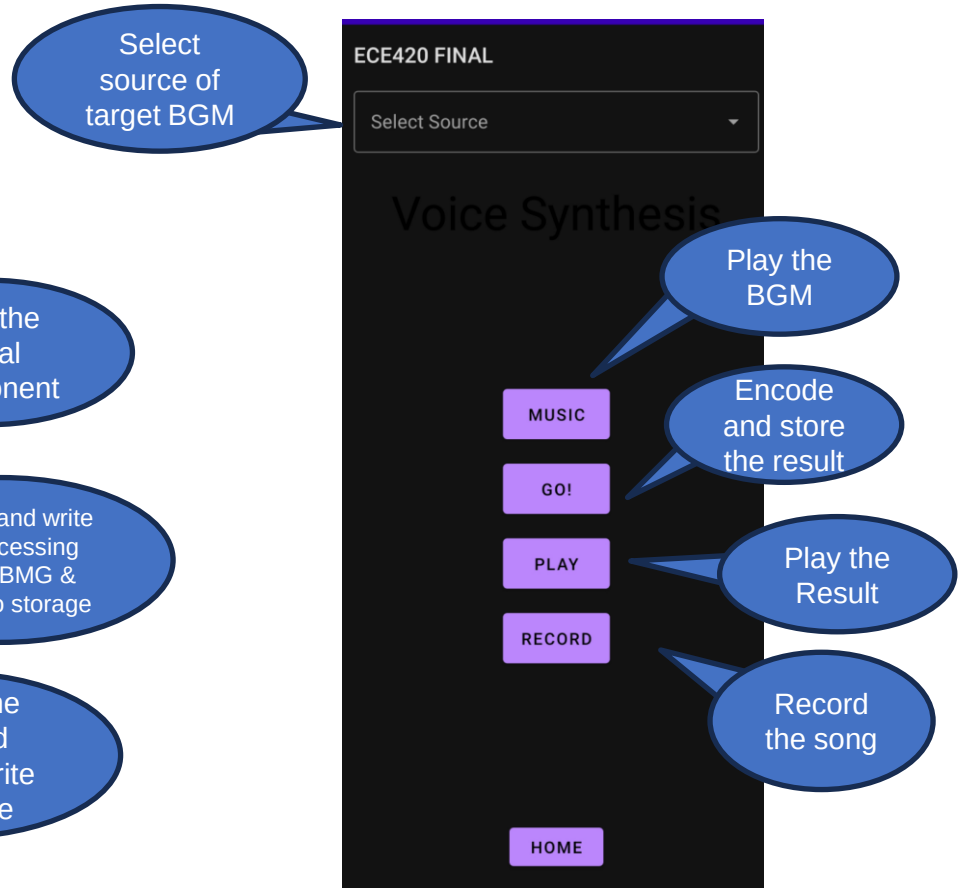
Home Screen



Target Song Screen

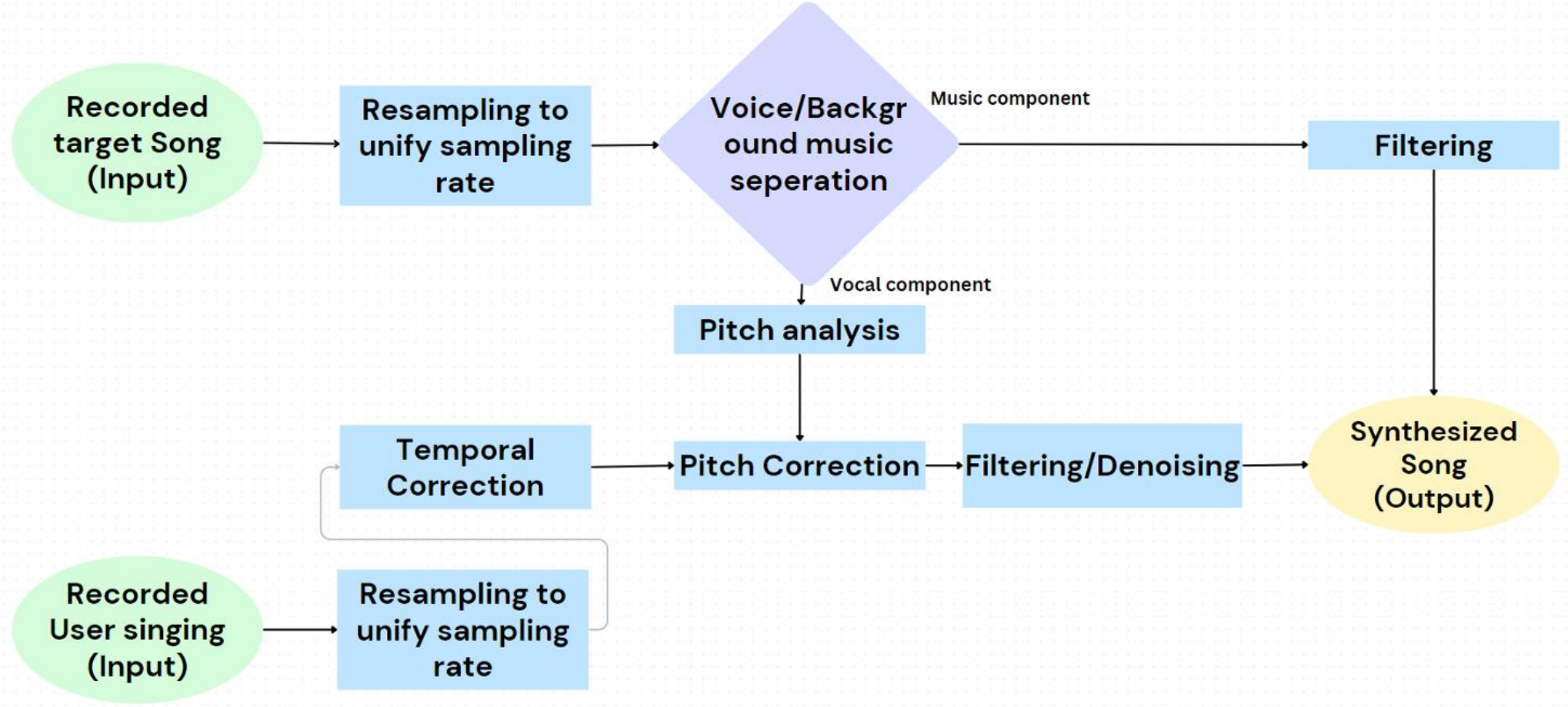


Voice Synthesis Screen



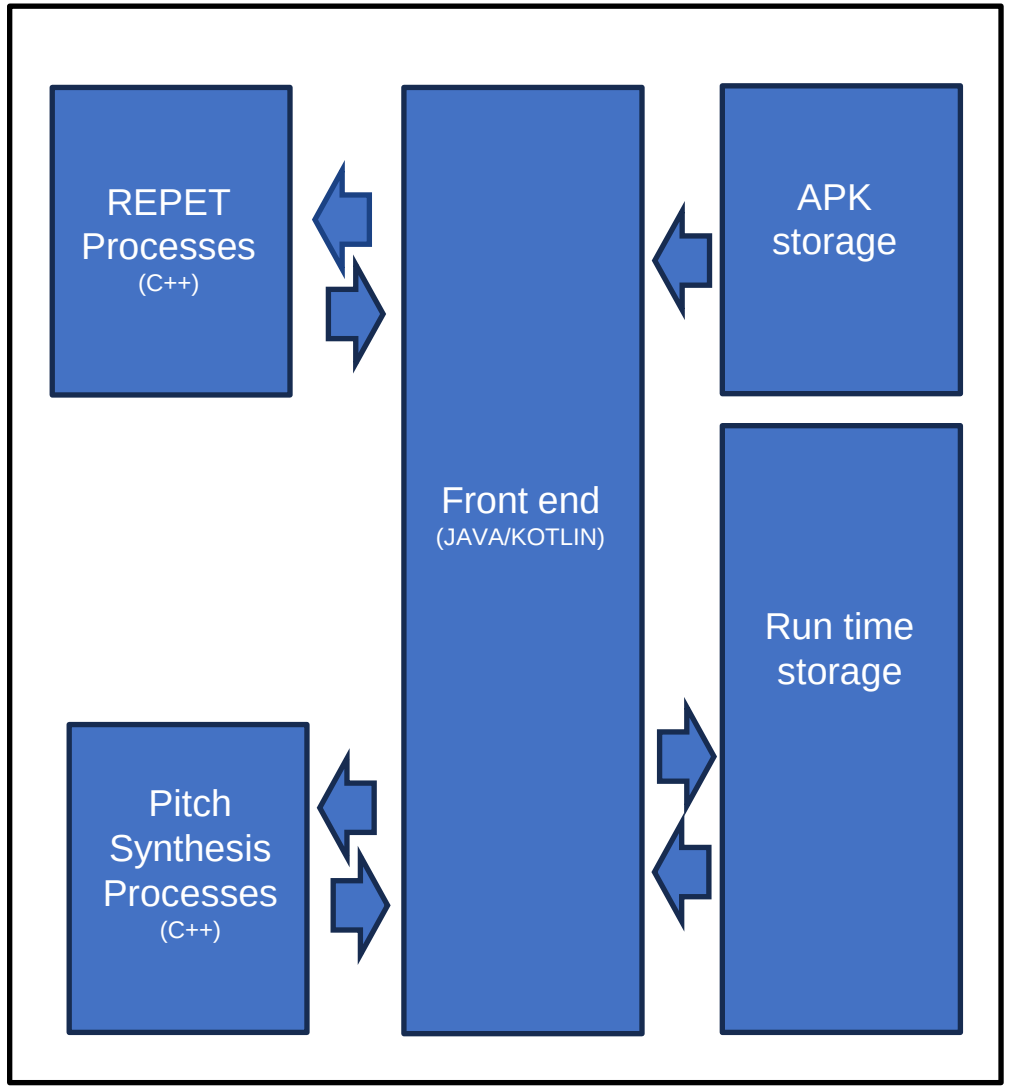
System Designs

System level algorithm



System Architecture

- **All audio data are stored in storage in stead of loaded in the memory**
- **The encoding and decoding of audio data is handled by ffmpeg in Java/Kotlin**
- **The Front end passes decoded audio data (int16 array) to the C++ Processing Frames**

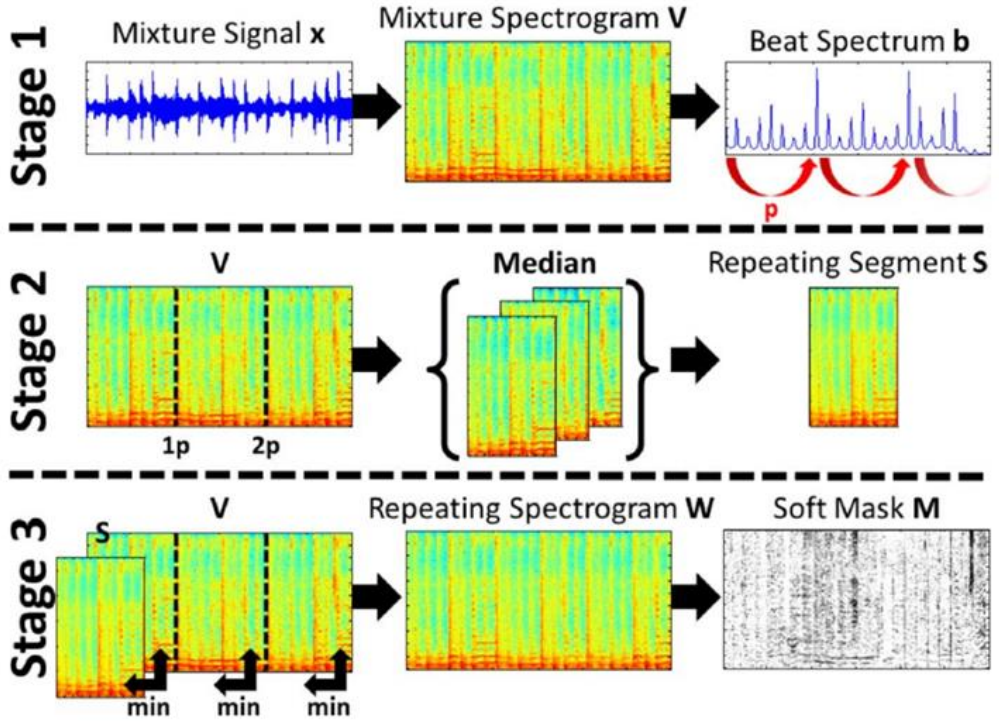


Algorithms

REpeating Pattern Extraction Technique (REPET)

- **Purpose of REPET: REPET is specifically designed to identify and extract repeating musical structures from a mixed audio signal.**

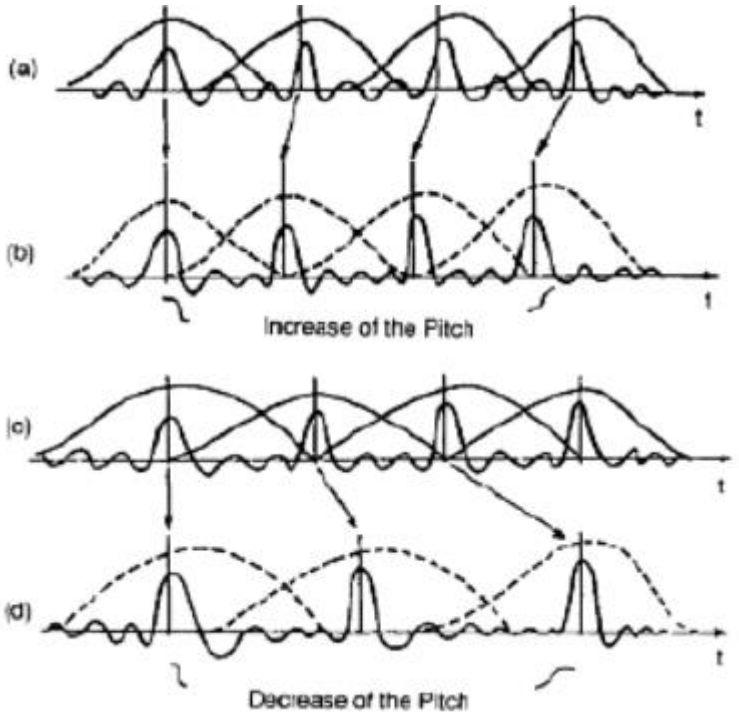
- **How It Works: The algorithm operates by exploiting the repetitive nature of the background music in most recorded songs. REPET identifies the repeating patterns by analyzing the audio signal's spectrogram and isolates the background track from non-repeating components like vocals.**



Pitch correction

- **Partition: the User singing and the vocal component will be partitioned to segments with 1024 samples of width**

- **Frequency analysis: Autocorrelation will be applied to each segment of vocal component to detect fundamental frequency and period**
- **Pitch Synthesis: Each segment of the user singing would be match with a segment from the vocal track. The segment will then be pitch changed to match the frequency of respective vocal track**



Results & FeedBack

Demo/ Q&A

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