

Team: Ensemble Methods - Funmbi Jaiyeola, Sai Korivi, Carlos Taveras



Pitch Perfect aims to address the the high cost and exclusivity of singing lessons taught by an instructor by democratizing high-quality singing lessons to users across the world, from the comfort of their home.



- Signal Processing
- Software Systems



Requirements

- Audio:
 - 90% pitch detection accuracy
 - 95% timing accuracy
- Posture:
 - 95% alignment of perfect posture (some motion is acceptable)
- User Interface:
 - Max lag time of 200 milliseconds between singing and UI display for real-time feedback
 - Lyrics for user to follow along with
 - Access to storage space that contains all recorded files of practices/exercises
 - Songs and exercises that differentiate good and bad singing
 - Visual data to show progress over time
 - Intuitive user interaction

User Interface

- Real-Time Visual Feedback:
 - Pitch accuracy
 - Good Posture
 - o On-beat Tempo
- Representation of Analytics and Progress of User
 - Data visualization of improvement
 - Patterns





- Latency
 - Our product must provide users with real-time pitch and timing feedback, thus we are constrained in time allowed for voice processing

- Metric Choices
 - Our metrics must prove to be reliable indicators of good singing performance

- Metric Extraction and Comparison
 - Our product must be able to extract metrics from a song from which we will use as a template to evaluate users' performances

Posture Analysis

- A person can not stay still without some motion
 - Makes posture detection slightly difficult
 - Latency between video capture becomes an issue
- Accounting for trivial motion such as:
 - Bobbing of the head
 - Swaying of hips
- Accounting for the presence of microphone
 - Microphone stand
 - Holding microphone



Solution Approach

- Hardware:
 - Microphone
 - External Camera
- Software:
 - Web Application using Django Framework
 - WebAudio API for audio visualizations
 - \circ User data and recordings storage on database
 - Cloud Deployment: AWS
 - OpenCV for posture detection
 - SciPy for voice processing
- Music Theory
 - Monophonic music (no instrumentals)
 - Links to simple breathing exercise

Solution Approach



Testing, Verification, and Metrics

- Real-Time Visual Feedback:
 - Human Eye -> Analyze metrics are met from what is done
 - Metric: Feedback Delay < 200 ms
- Pitch and Timing Accuracy:
 - Test our pitch and timing detection algorithms against known pure tones
- Posture Detection:
 - Use existing photos of good & bad posture
 - Test using videos of members of the group
 - Test on non-human objects
- Storage
 - Location check (on database to user)
 - Accessibility with user credentials

Tasks & Division of Labor

Carlos	Funmbi	Sai
Pitch and Rhythm Detection	Posture Detection	Real-time Visual Feedback
Song Feature Extraction	Cloud Deployment	Audio Visualization
Performance Data Analytics	Database Management	Django Views/Models/URLS

Schedule

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Schedule

