Distinguishing a Frog Species through a Mobile Application

Jae Hyuk Oh, John Jay College ; Dr. Hunter Johnson, John Jay College

Abstract

This is a student centered research in which the research is designed to support many biologists and scientists in terms of distinguishing and finding new frog species through the use of their unique voice spectrum. The main goal of this research is to come up with Android based smartphone/mobile application that recognizes and distinguishes frog species using their unique voice calls through the devices' built in microphone.

Introduction

Scientists and biologists are often interested in finding new living species due to their benefits in medical, health, food and conservation. It is always a tough task to find something new without help of technology. This research is only targeting frogs as our research subject because of their unique voice callings. As an addition to their unique voice callings, a new frog species of frog was found recently on Staten Island on the basis of its frog songs [1]. If this research is successfully done, this mobile application can be used on other living species as well.

In this research, we are applying MSAS (Multi-stage average spectrum) method [2] as our main method to classify different frog species. There are other well-known classifiers including kNN, DTW, SEAV,SVM and MSAS[1] but we've chosen MSAS due to its high spectrum accuracy level of frog's unique spectrum.

Methods

1) Program and develop an Android application under Android Studio that can record a frog sound (using smart phone's built-in microphone) using Java programming language.

2) Download training data for classifiers (sample frog sounds to be used as a comparison purpose).

3) Setting up an ADB(Android Debugging Bridge) under a Linux environment to support a stable connection between a mobile device and a computer.

4) Implement a Python script that can extract/perform MSAS (Multi Stage Average Spectrum) on the training data and recorded sound file. At this stage, a Python audio module like Yaafe[3] will be used to aid implementation of MSAS and distinguishing a frog specie.

Results

Graphical User Interface of Frog Classifier/Recorder Application:
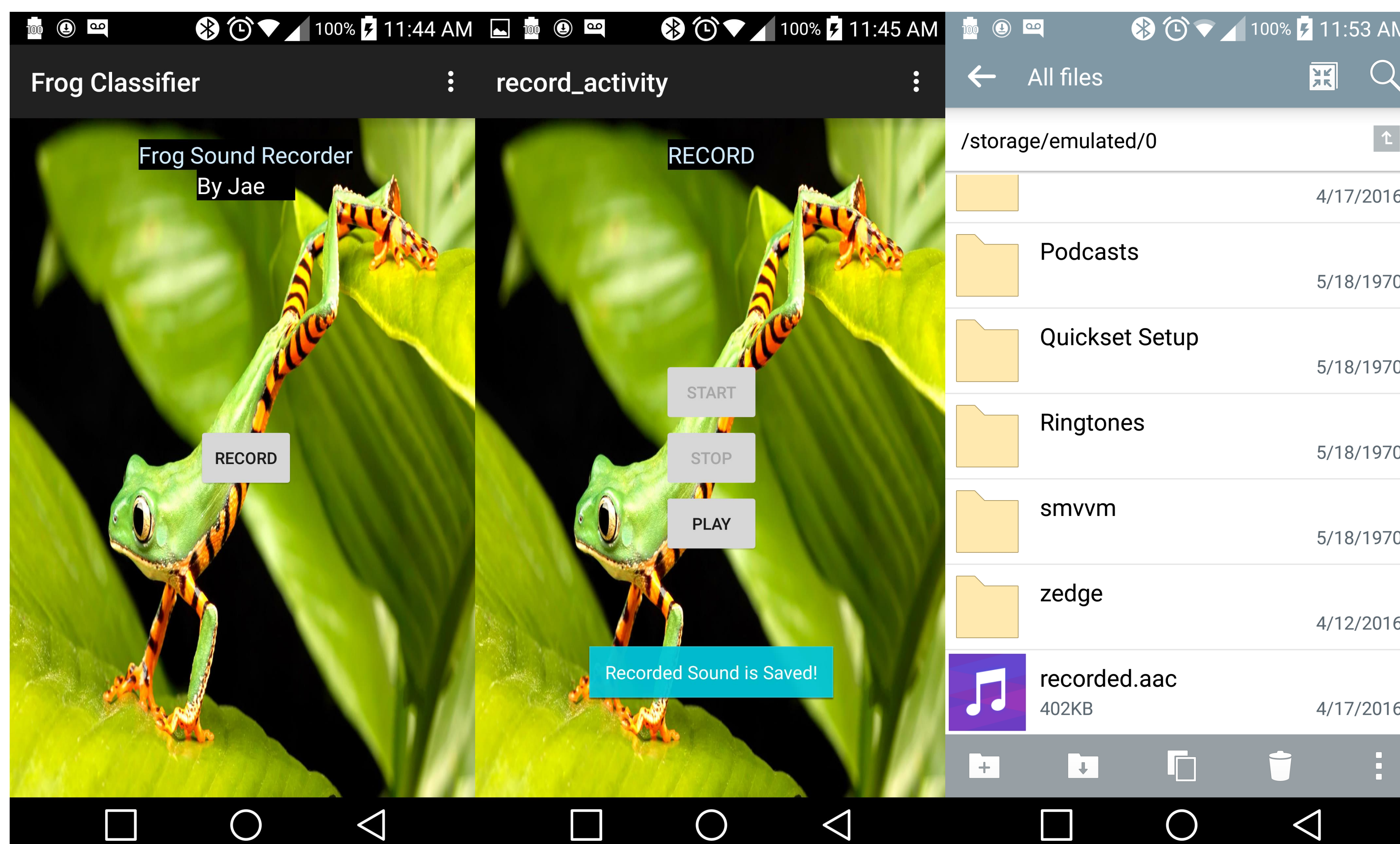
- If a user press "RECORD" button, it will direct a user to "RECORD" screen.
- When "START" button is pressed, the application will start to record a sound.
- When "STOP" button is pressed, the application will notify a user by saying "Recorded Sound is Saved!".
- A user can play recorded sound using "PLAY" button or permanently access through an internal storage.

Android Debugging Bridge(ADB):

- The device (LG G3) is connected to a Linux environment via USB and ADB.
- At this point, "recorded.aac" file will be linked with a Python script file via a Linux command.
- A Python script will take "recorded.aac" as an input to process further MSAS algorithm.

Conclusions

During the process of developing a recording application under Android Studio, I have encountered some major issues in terms of sound encoding. The procedure of analyzing such a sound like a frog is very delicate and sensitive meaning a sound file must not contain any other noises but frog itself. Maintaining a clarity of sound recording procedure was tough. Picking a right sound encoding codec is very important.

Most of our training data were in .mp3 and .wav format. The audio quality of training data were very clear since they were recorded under perfect environment (noise cancellation, high-spec machines and etc.) Expecting those quality from a hand-handled device seemed almost impossible. The best thing that I could do as a developer was to experiment with various codec. I have applied Advanced Audio Coding (.aac) codec as my choice since it is a rival to .mp3. Meanwhile, we are still under development of a Python script.

References

[1] This frog's unique call led to its surprising discovery in New York City. http://www.dailydot.com/news/new-frog-species-discovered-new-york-city/. Accessed: 2015-1-9.

[2] Wen-Ping Chen, Song-Shyong Chen, Chun-Cheng Lin, Ya-Zhung Chen, and Wen-Chih Lin. Automatic recognition of frog calls using a multi-stage average spectrum. Computer & Mathematics with Applications, 64(5):1270-1281, 2012.

[3] Telecom Paristech/AAO Team. Yaafe-audio feature extraction. http://www.yaafe.sourceforge.net. Accessed:2016-4-16.

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