

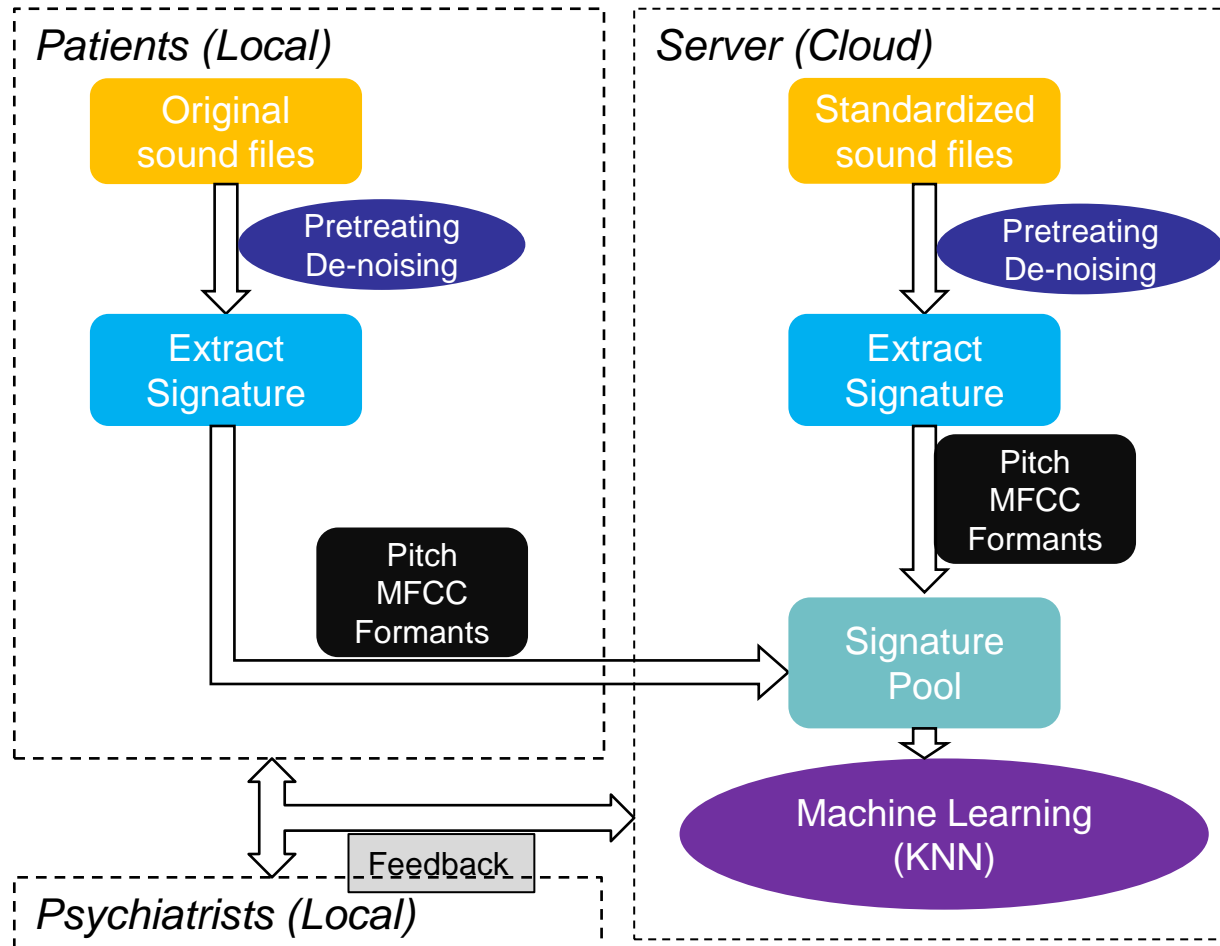
Mood Detect

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Team #2

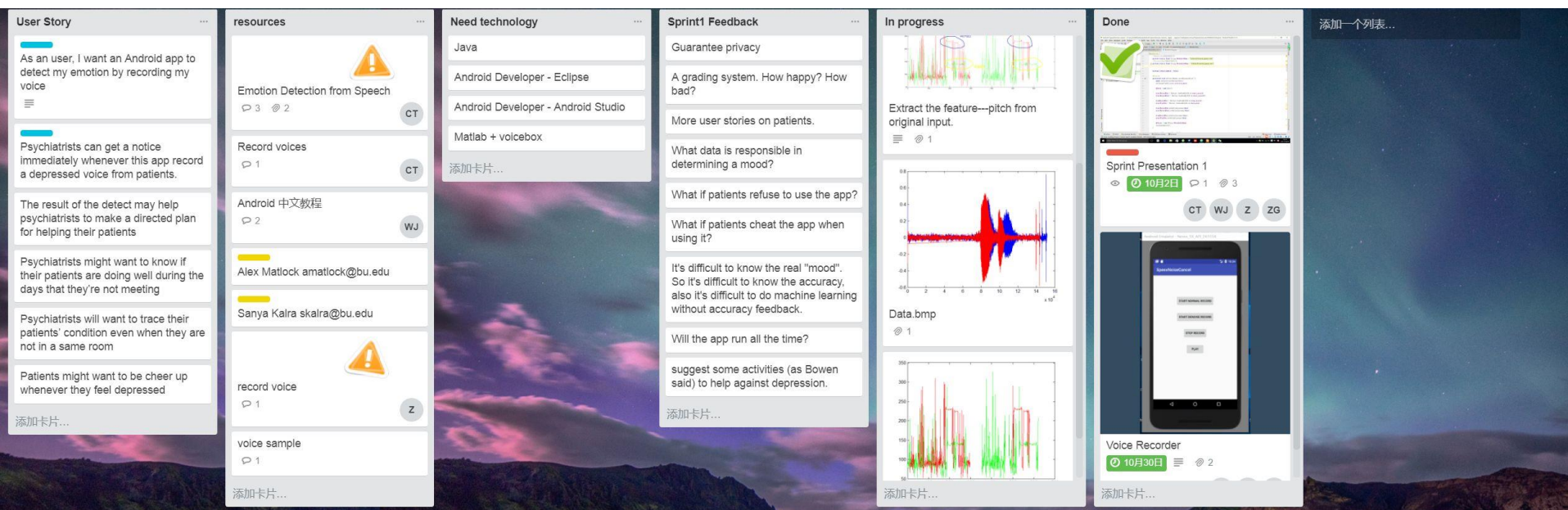
Github Link: <https://github.com/tungchihwei/EC601-Mood-Detect>

Trello Link: <https://trello.com/b/QZmTZ7UV/ec-601-final-project>

System Diagram



Trello Diagram



Accomplishments #1

□ Theoretical Background

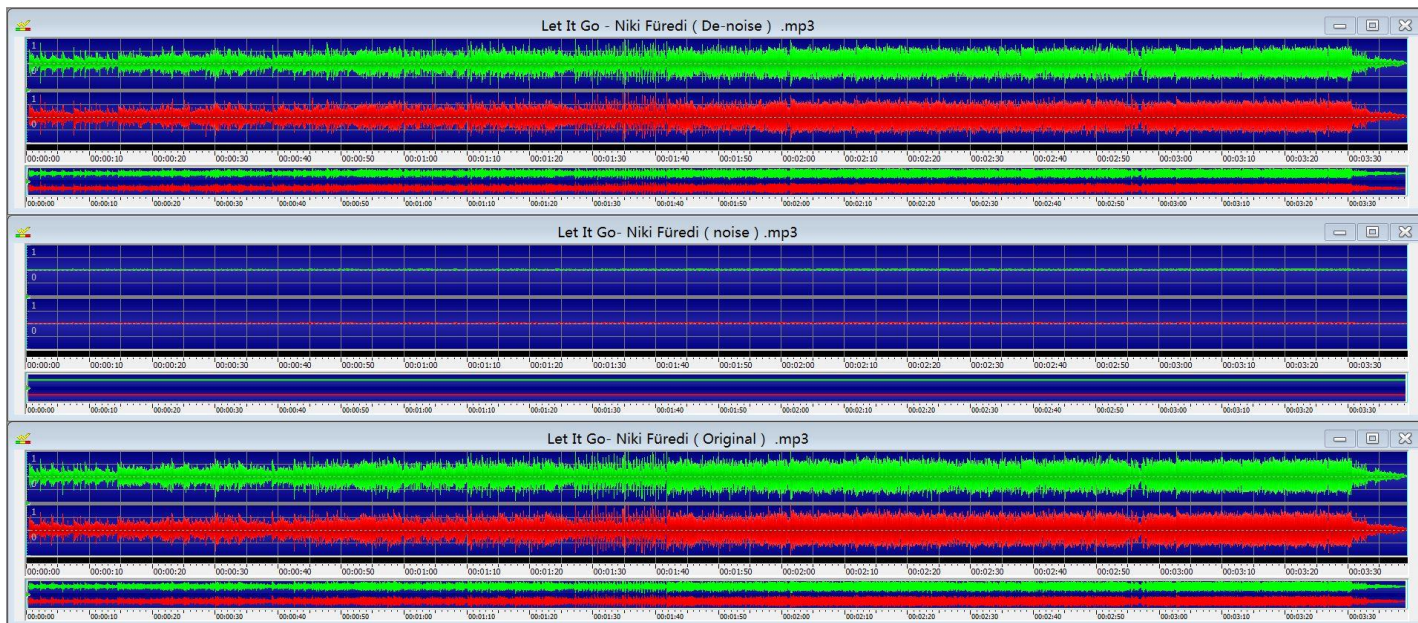
- ✓ *Pitch, Mel Frequency Cepstral Coefficients(MFCCs) and Formants* are extracted from human speech as features influence the recognition of emotions. [1][2][3]
- Pitch is extracted from the speech waveform using *RAPT algorithm* implemented in the *VOICEBOX* toolbox.[4]
- MFCC parameters are calculated by *STFT* and *DCT* algorithm.[5]
- Using *Linear Predictive Coding(LPC)* to model formants.[6]
- ✓ *K-Means Clustering* and *Support Vector Machines(SVM)* [7] are adopted to classify opposing emotions.

All Speakers						
Experiment	Features	Distance Measure	Centroid	Iterations	Recognition Accuracy	Variance
despair-elation	MFCC	L1 norm	UDC	100	75.76%	1.74%
happy-sadness	MFCC	L1 norm	UDC	1	77.91%	14.34%
interest-boredom	Pitch	L1 norm	UDC	100	71.21%	2.48%
shame-pride	MFCC	L1 norm	UDC	1	73.15%	3.23%
hot anger-elation	MFCC	L1 norm	UDC	1	69.70%	10.75%
cold anger-sadness	MFCC	L1 norm	UDC	1	75.66%	3.35%
Male Speakers						
Experiment	Features	Distance Measure	Centroid	Iterations	Recognition Accuracy	Variance
despair-elation	MFCC & Pitch	Correlation	UDC	1	87.80%	0.14%
happy-sadness	MFCC	L1 norm	UDC	1	88.80%	3.66%
interest-boredom	MFCC & Pitch	Cosine	Random	100	81.20%	6.36%
shame-pride	MFCC & Pitch	Correlation	UDC	1	74.24%	15.53%
hot anger-elation	MFCC	L1 norm	UDC	1	65.89%	14.95%
cold anger-sadness	MFCC	L1 norm	UDC	1	88.43%	9.78%
Female Speakers						
Experiment	Features	Distance Measure	Centroid	Iterations	Recognition Accuracy	Variance
despair-elation	MFCC	L1 norm	UDC	1	80.42%	9.66%
happy-sadness	MFCC	L1 norm	UDC	1	72.80%	15.24%
interest-boredom	MFCC	L1 norm	UDC	1	70.62%	18.06%
shame-pride	MFCC	L1 norm	UDC	1	81.18%	19.79%
hot anger-elation	MFCC	L1 norm	UDC	1	77.16%	4.37%
cold anger-sadness	MFCC	Correlation	UDC	1	72.04%	15.00%
<i>Table 2: Highest Recognition Accuracies using K-means Clustering</i>						

Accomplishments #2

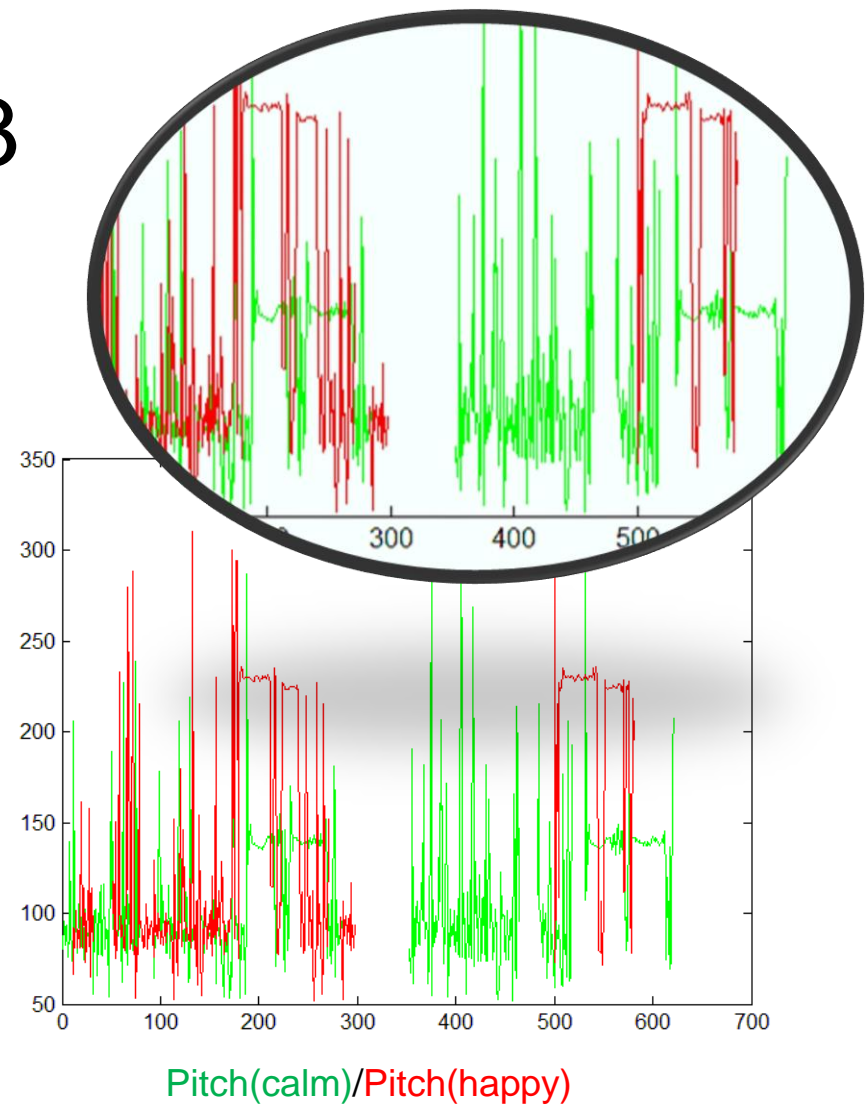
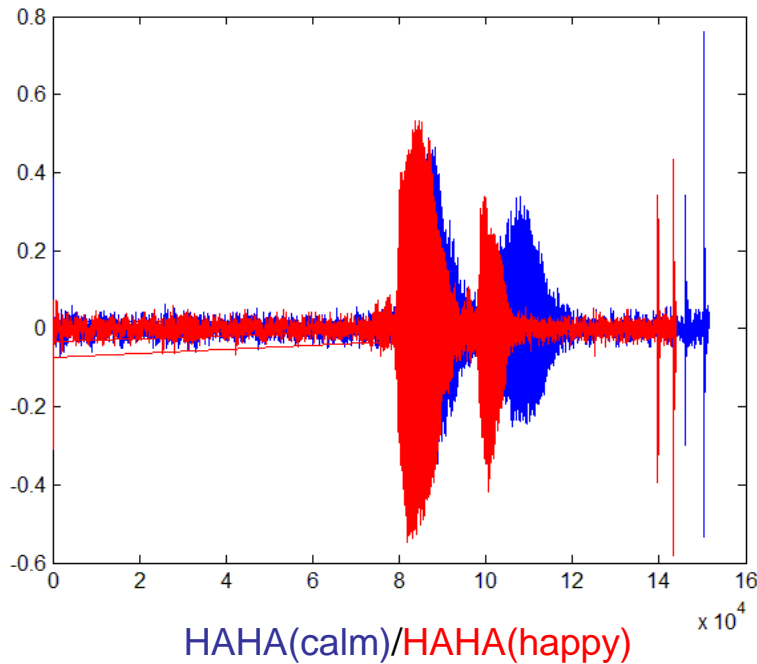
□ De-noise Recorder

- ✓ Build an demo to achieve voice recording
- ✓ Noise elimination



Accomplishments #3

□ Pitch Extraction



```

Pitch.m
1 % Copyright 2017 Zhonghao Guo gzh1994@bu.edu
2 % Pitch Extraction by Voicebox in MATLAB
3
4 clear all
5 clc
6 filename1 = 'd:/calm.wav';
7 filename2 = 'd:/happy.wav';
8 [Data1,Fs1]=wavread(filename1);
9 [Data2,Fs2]=wavread(filename2);
10 x1=[1:151423,1];
11 x2=[1:143807,1];
12 plot(x1,Data1,'g',x2,Data2,'r');
13 [fx1,tt1] = fxrapt(Data1,Fs1,'u',50);
14 [fx2,tt2] = fxrapt(Data2,Fs2,'u',50);
15 x3=[1:684,1];
16 x4=[1:649,1];
17 figure(2)
18 plot(x3,fx1,'g',x4,fx2,'r');
19
20 fx1_adjust = fx1(~isnan(fx1));
21 fx2_adjust = fx2(~isnan(fx2));
22 fx1_mean = mean(fx1_adjust);
23 fx2_mean = mean(fx2_adjust);
24 fx1_max = max(fx1_adjust);
25 fx2_max = max(fx2_adjust);
26 fx1_min = min(fx1_adjust);
27 fx2_min = min(fx2_adjust);
28 fx1_variance = fx1_max-fx1_min;
29 fx2_variance = fx2_max-fx2_min;
30 fx1_midian = median(fx1_adjust);
31 fx2_midian = median(fx2_adjust);
32
33 fx1_derivative = diff(fx1_adjust);
34 fx2_derivative = diff(fx2_adjust);
35
36 fx1_energy_avg = mean(Data1);
37 fx2_energy_avg = mean(Data2);
38 speaking_rate1 = length(fx1)/length(fx1_adjust);

```

➤ For the pitch vector and its derivative:

- *Mean*
- *Median*
- *Maximum*
- *Minimum*
- *Variance*

➤ Average energy of speech

➤ Speaking rate

- *Inverse of the average length of the voiced part of the utterance*

Hence, the pitch feature vector is 12-dimensional

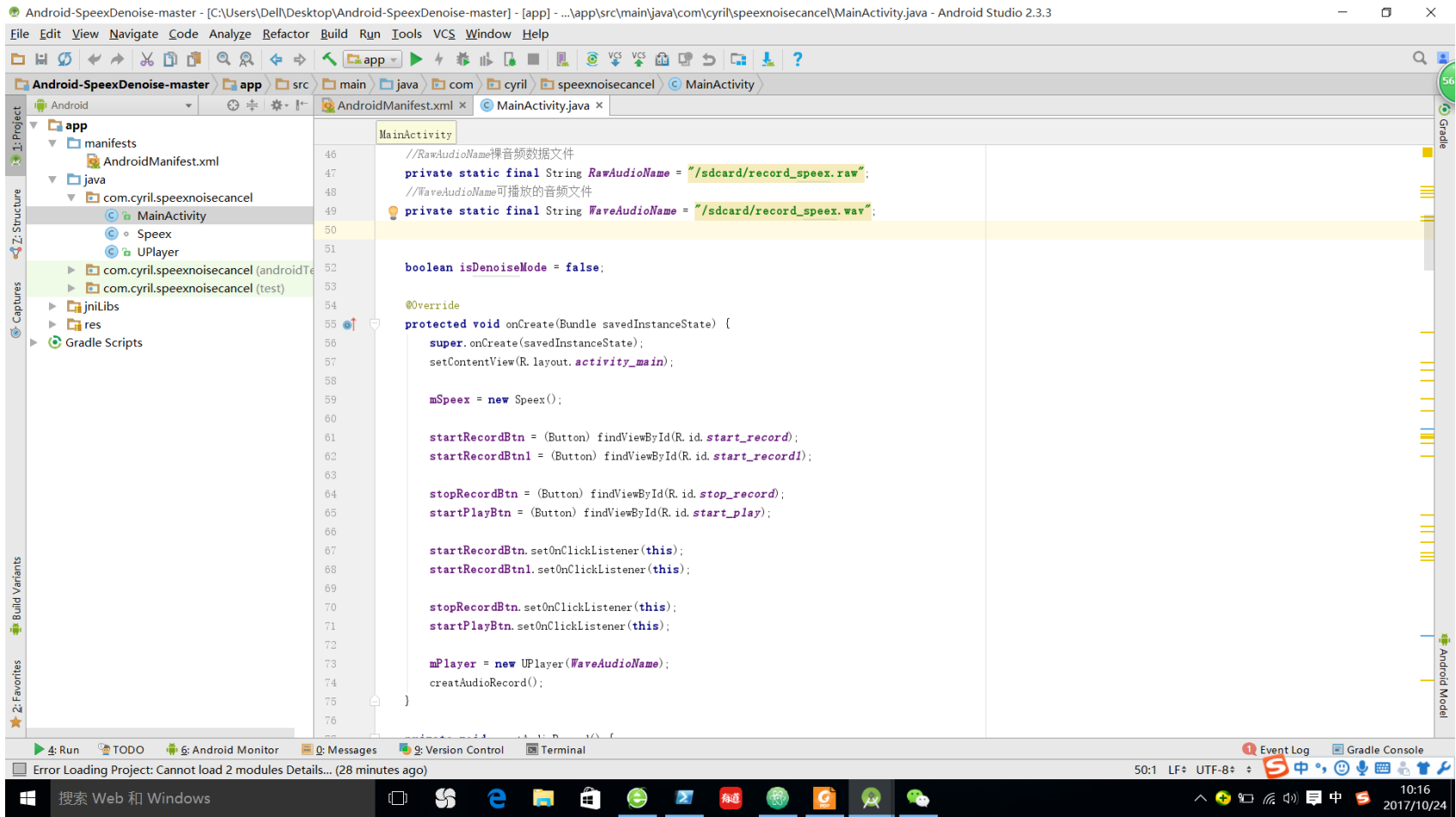
Accomplishments #4

□ Emotional Prosody Speech and Transcripts^[8]

[URL:https://catalog ldc.upenn.edu/LDC2002S28](https://catalog ldc.upenn.edu/LDC2002S28)

- The recordings consist of professional actors reading a series of semantically neutral utterances (dates and numbers) spanning fourteen distinct emotional categories.
- The content and emotion of each word and phrase is recorded in the matching transcript.

DEMO



Android-SpeechDenoise-master - [C:\Users\De\l\Desktop\Android-SpeechDenoise-master] - [app] - ...app\src\main\java\com\cyril\speexnoisecancel\MainActivity.java - Android Studio 2.3.3

```
File Edit View Navigate Code Analyze Refactor Build Run Tools VCS Window Help

Android-SpeechDenoise-master
  app
    manifests
      AndroidManifest.xml
    java
      com.cyril.speexnoisecancel
        MainActivity
        Speech
        UPlayer
      com.cyril.speexnoisecancel (androidTest)
      com.cyril.speexnoisecancel (test)
    jniLibs
    res
    Gradle Scripts

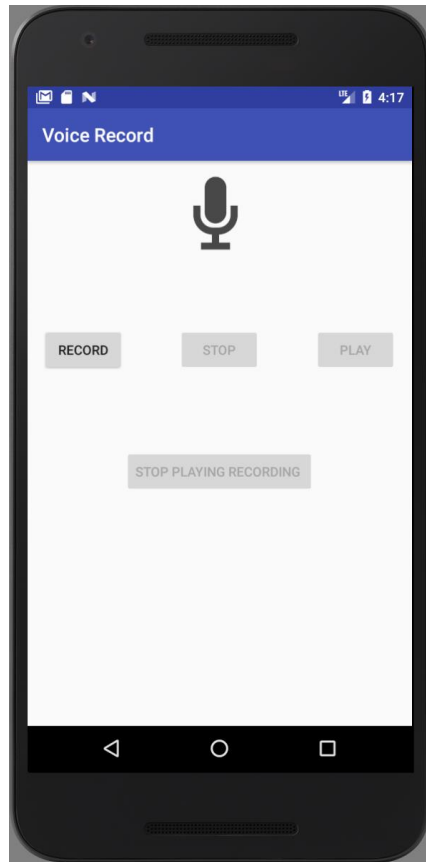
MainActivity
46 //RawAudioName裸音频数据文件
47 private static final String RawAudioName = "/sdcard/record_speex.raw";
48 //WaveAudioName可播放的音频文件
49 private static final String WaveAudioName = "/sdcard/record_speex.wav";
50
51
52 boolean isDenoiseMode = false;
53
54 @Override
55 protected void onCreate(Bundle savedInstanceState) {
56     super.onCreate(savedInstanceState);
57     setContentView(R.layout.activity_main);
58
59     mSpeex = new Speex();
60
61     startRecordBtn = (Button) findViewById(R.id.start_record);
62     startRecordBtn1 = (Button) findViewById(R.id.start_record1);
63
64     stopRecordBtn = (Button) findViewById(R.id.stop_record);
65     startPlayBtn = (Button) findViewById(R.id.start_play);
66
67     startRecordBtn.setOnClickListener(this);
68     startRecordBtn1.setOnClickListener(this);
69
70     stopRecordBtn.setOnClickListener(this);
71     startPlayBtn.setOnClickListener(this);
72
73     mPlayer = new UPlayer(WaveAudioName);
74     creatAudioRecord();
75 }
76
```

4: Run TODO Android Monitor Messages Version Control Terminal

Error Loading Project: Cannot load 2 modules Details... (28 minutes ago)

50:1 LF+ UTF-8 10:16 2017/10/24

DEMO



Normal Recorder



Denoise Recorder

Challenges

- User story——What if customers “cheat” the app when recording voice or even refuse to use it when feeling down?
- Privacy Issue——If monitoring constantly, will the app offense user’s privacy?
- Feedback Fraud——How to make sure the feedback from patients and psychiatrists are real? We may not get an objective training data set from subjective feedback.
- Technical Challenges——How to transplant the RAPT toolbox from MATLAB to JAVA?

Next Sprint Plan

- Extract signatures from original sound samples
- Create multi-dimensional feature vectors from signatures acquired
- Set up a dataspace to storage statistics
- Upload all feature files to dataspace for Machine Learning



Reference

- [1] Shah Hewlett, Emotion Detection From Speech, CS229, 2007.
- [2] Garima Vyas, Malay Kishore Dutta, Automatic Mood Detection of Indian music Using MFCCs and K-means Algorithm, 2014.
- [3] Sharifa Alghowinem, Roland Goecke, Michael Wagner, Julien Epps, Michael Breakspear, Gordon Parker, From Joyous to Clinically Depressed: Mood Detection Using Spontaneous Speech, 2012.
- [4] <http://www.ee.ic.ac.uk/hp/staff/dmb/voicebox/voicebox.html>
- [5] <http://www.ee.columbia.edu/~dpwe/resources/matlab/rastamat/>
- [6] L.R. Rabiner and B.H. Juang. “Fundamentals of Speech Recognition”, Upper Saddle River; NJ: Prentice-Hall, 1993
- [7] <http://ida.first.fraunhofer.de/~anton/software.html>
- [8] <https://catalog.ldc.upenn.edu/LDC2002S28>

THANK YOU