

SocialSafety



Social Distancing & Cough Detection App

Made with  by Team NoVAR

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Project Idea and Implementation

Goal: To provide **Real-Time Social Distancing Metrics** along with **Cough Detection**, to keep people safe during this pandemic.

Implementation:

- Proximity to people is detected using the number of nearby devices in an Android app (Android Studio & Java) using Bluetooth
- Cough Detection using ML algorithm trained using Google Audioset

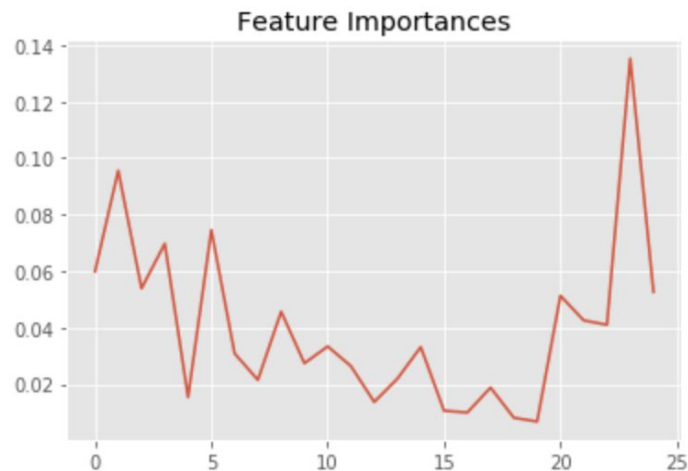
Cough Detection Features

- MFCC
- Power Spectral Density
 - The measure of signal's power content versus frequency
- Spectral Centroid
 - Indicates where the center of mass of the spectrum can be found
- Spectral Flux
 - The measure of how quickly the power spectrum of a signal is changing
- Spectral Rolloff
 - Frequency below which a specified percentage of the total spectral energy, e.g. 85%, lies
- Spectral Flatness
 - The ratio of the geometric mean to the arithmetic mean of a power spectrum

Feature Importances

Top 3 most important features:

1. MFCCs 0.67
2. Spectral rolloff 0.135
3. Spectral flatness 0.052

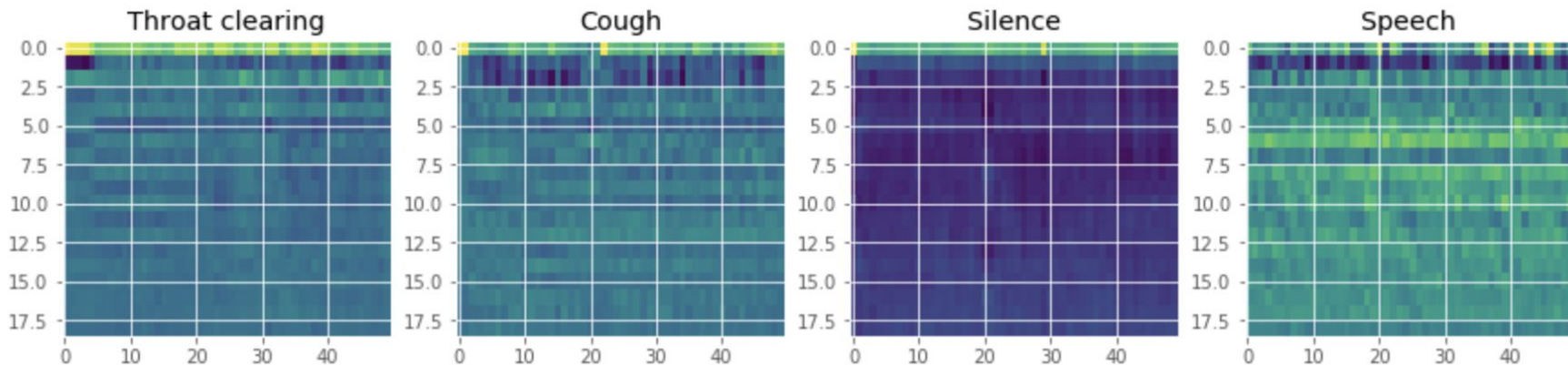


Features:

MFCCs : 0 - 19
Power Spectral Density : 20
Spectral centroid : 21
Spectral flux : 22
Spectral rolloff : 23
Spectral flatness : 24

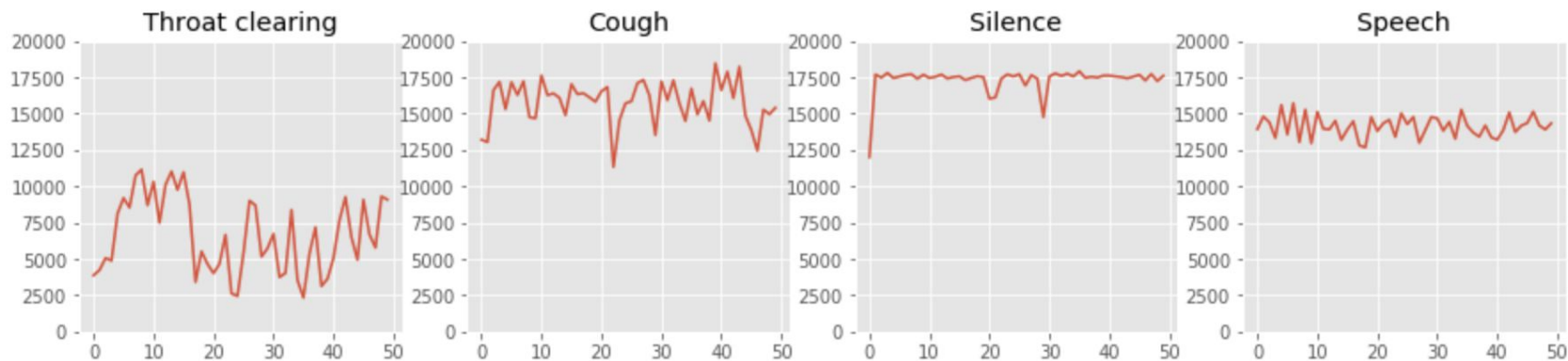
MFCCs

MFCCs are a representation of the power spectrum of a sound. The MFCC algorithm mimics the function of the cochlea of the human ear. This makes it an excellent feature for speech recognition



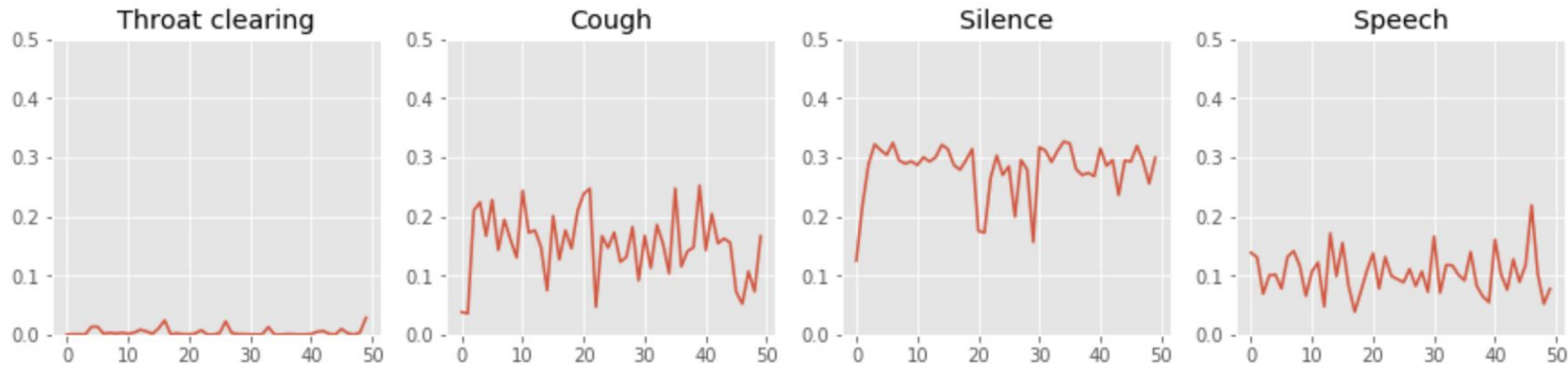
Spectral Rolloff

This is the frequency below which a certain percentage of the total spectral energy is present.



Spectral Flatness

Spectral flatness provides a way to quantify how tone-like a sound is Vs how noise-like it is.



Cough Detection performance

Random Forest classifier

Average Accuracy: 0.961

Precision: 0.938

Recall: 0.973

Decision tree classifier

Average Accuracy: 0.736

Precision: 0.7

Recall: 0.63

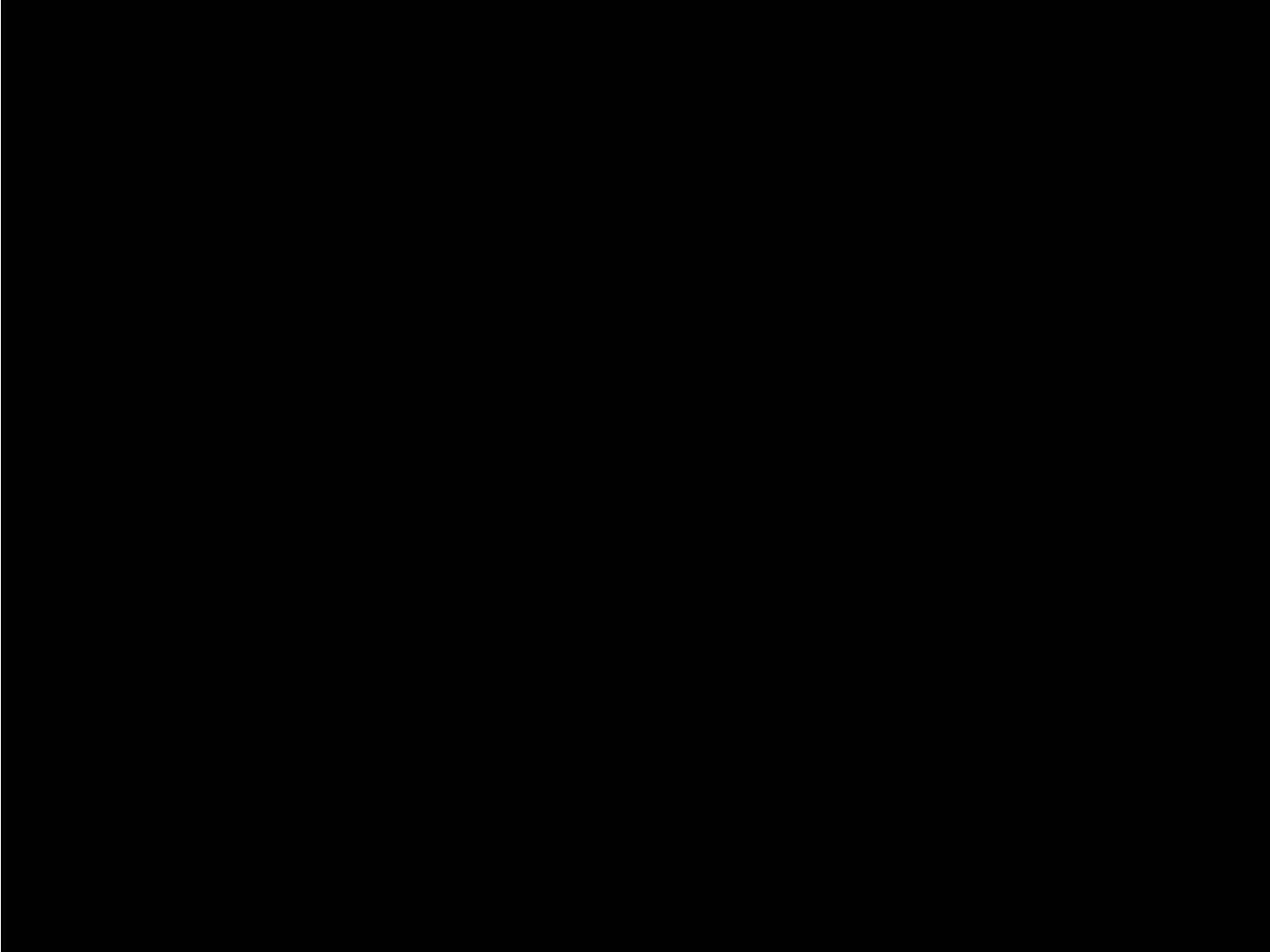
```
Fold 9 : Training Random Forest classifier over 1649 points...
Evaluating classifier over 183 points...
[[46  0  0  0]
 [ 0 18  0  0]
 [ 1  0 99  0]
 [ 0  0  6 13]]
Precision = [1.          1.          0.99         0.68421053]
Recall = [0.9787234  1.          0.94285714  1.          ]
The average accuracy is 0.9617872416250892
The average precision is [0.99494949 0.99090909 0.99412525 0.7723745 ]
The average recall is [0.98765639 0.97166667 0.94470718 0.99116541]
```

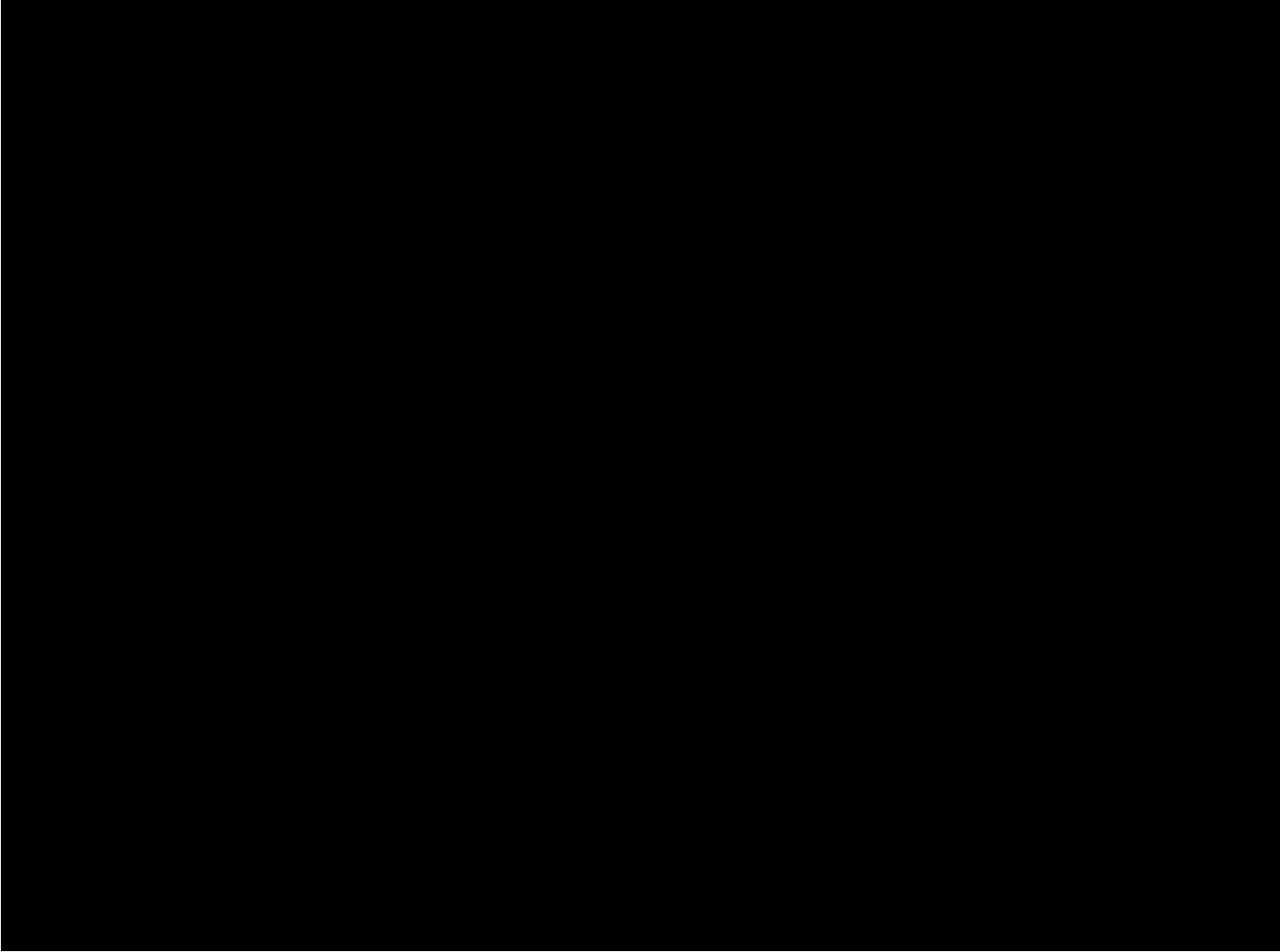
```
Evaluating classifier over 183 points...
[[ 24  0  0  0]
 [  1  7  0  0]
 [  9  0 112  0]
 [  0  0  30  0]]
Precision = [1.          0.875         0.92561983  0.          ]
Recall = [0.70588235 1.          0.78873239 0.          ]
The average accuracy is 0.7964391779520075
The average precision is [0.9873153  0.94090013 0.91472756 0.          ]
The average recall is [0.80860708 0.94034341 0.77782781 0.          ]
Training decision tree classifier on entire dataset...
```


Demo Time!

Social Distancing Metrics -

Cough Detection -





Thank you & Stay Safe!

Questions?

Special Thanks to:

- FluSense: A Contactless Syndromic Surveillance Platform for Influenza-Like Illness in Hospital Waiting Areas by Al Hossain, Forsad and Lover, Andrew A. and Corey, George A. and Reich, Nicholas G. and Rahman, Tauhidur
<https://github.com/Forsad/FluSense-data>
- Librosa <https://librosa.github.io/librosa> LibROSA is a python package for music and audio analysis.
- Professor Deepak Ganesan and the teaching staff for helping us learn the concepts that enabled us to complete this project successfully.