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Project Report: ECHO

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Introduction

ECHO is an audio based surveillance system built on android OS. It can detect gunshot from environment audio and generate a location based notification using GPS to some relevant authority. It helps in automation of crime reporting and reduces the information delivery time by reporting to nearest authority.

Problem statement

For the purpose of information forensic and security it's hard to use CCTV and other means for detection of unusual behavior. When an illegal activity happens, it takes time for information to reach nearest authorities and for them to know exactly kind of activity has happened. There is also a considerable cost linked with increasing police officials on roads and with growing size of cities, we will require equally growing budget for security forces to provide protection and safety.

Implementation

Before starting the implementation, we gathered large amount of data to train and test our system for which we collected around 6 hours of audio data. It contained both gunshot audio files and non-gunshot audio files.

The next step was to extract suitable features from the audios and store them in a CSV file format. Mfcc features were extracted using librosa library in python. These features were selected because they are most widely used in speech recognition as they remove any background noise from audios and separate out only linguistic content. Features of all audios were modified to same shape and stored in a csv file.

The feature vectors were split into testing (80%) and training data (20%). Training data was used to train Support vector machines with linear kernel and the best hyper parameters were chosen using gridsearch.

The trained model was exported to java. Real time environment sounds were recorded as wav files and they were broken into 4 sec frame audio files. The trained model was then used to test the real time audio.

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Results

The model trained on Support vector machine gives 98% accuracy on test data and the system detects gunshot happened on incident of Benazir assassination.

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In [38]: print "Accuracy on test set is : ",round(clf.score(X_test,y_test),2)*100 ,"%"
         Accuracy on test set is :  98.0 %
```

Conclusion

ECHO is a real time gunshot detection system that detects a gunshot with high accuracy.