ARTEMIS: DISTRESS DETECTION FOR URBAN ENVIRONMENT

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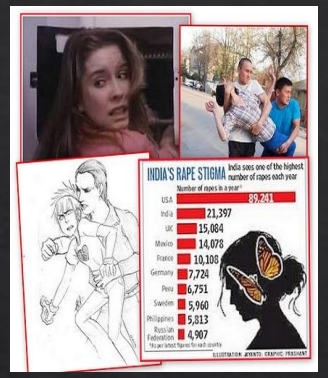
MOTIVATION



- Crime against Women Increasing day by day.

- More than 970 million Mobile Phone Users . 91% SmartPhone Users.
- Current Approaches require Voluntary Interaction.

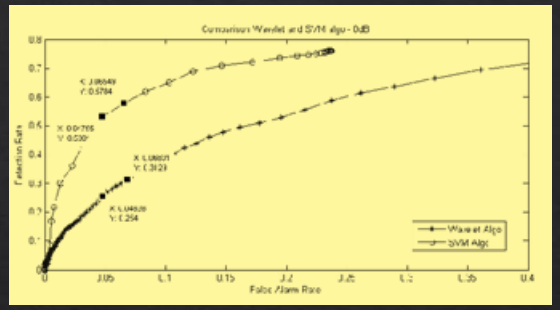
CONTRIBUTION

- We propose a two stage supervised learning framework using Support Vector Machines (SVMs)
- Proposed Framework provides improvement over prior work [1, 2].
- Extensive evaluation on data collected from varied environmental contexts
- An Smart Phone Application on the Android Platform.
- A Server Side Dashboard to Monitor Activity of participants, push updates and analyze data.

NUMBERS AND RESULTS

93.61% Accuracy

< 1.5% Error Rate



Improvement over Existing Methods

OBJECTIVES

- Detect distress using audio captured by smartphone microphones, available for analysis on a server/inform Authorities.
- Enable high detection rates and low false alarm rates from quiet to harsh environmental context.

NON-INTRUSIVE DISTRESS DETECTION

EVALUATION/DATA COLLECTION

- 16 Volunteers. 250 Hours of Data
- Real time evaluation
- Location Based Alarm Clustering

Fig 1. Data Collection

WORKING

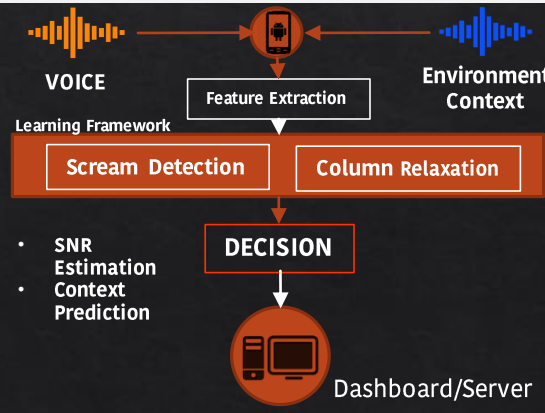


Fig 2. Flow

Features Used:
1. MFCC
2. Spectral Features
3. HOG

References:
[1] Weimin Huang, Tuan-Kiang Chiew, Haizhou Li, Tian Shiang Kok, and J. Biswas. Scream detection for home applications.
[2] Ntalampiras S., I. Potamitis, and N. Fakotakis. On acoustic surveillance of hazardous

Smartphone audio based Distress Detection

Automated Distress Detection on a smartphone using audio analysis techniques

- Anil Sharma, Sarthak Ahuja, Dr. Sanjit Kaul

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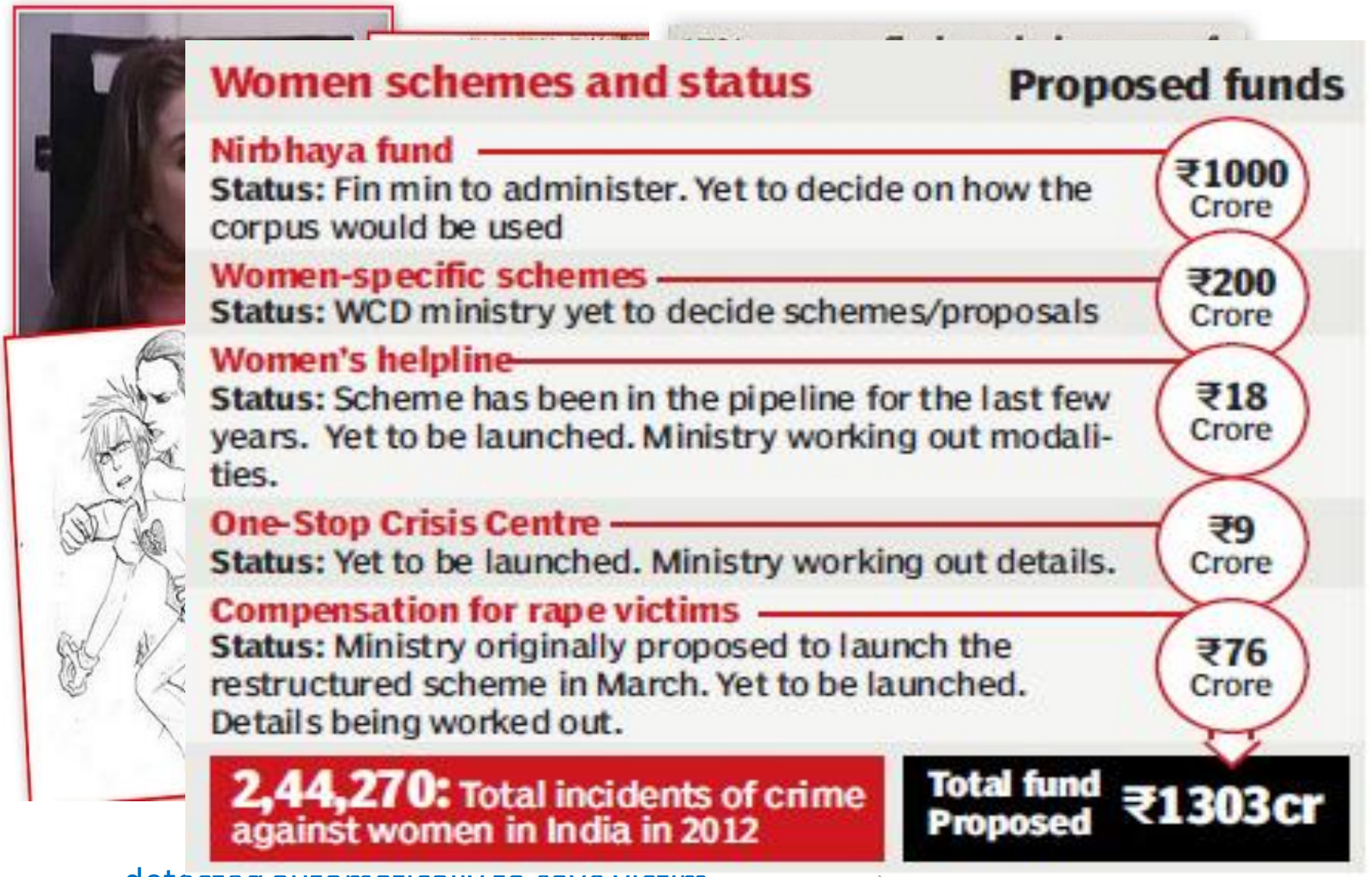
Problem statement



detected automatically to save victim

Images source: google

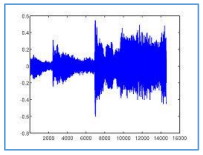
Available solutions

- A manual trigger on phone to raise an alarm
  - People panic very frequently
  - Generate too many false alarms
- Scream detection systems for restricted environment (home, metro etc.)
  - Have a limited number of environment sounds
- Emotion detection from audio
  - Have very low detection rate
  - Fear emotion can be seen in panic situations

A better solution

- Scream, sob can be detected using audio analysis techniques

- A smartphone is always available with a person



Goals

High confidence of distress

Early report of crime to Law enforcement

Fully automated system

Contd..

- Distress detection on smartphone requires analysis of many environment sounds were a phone goes

Traffic

Laugh and anger

Audio from TV

Crowd in public vehicle on road

party

Different kinds of people in a meeting

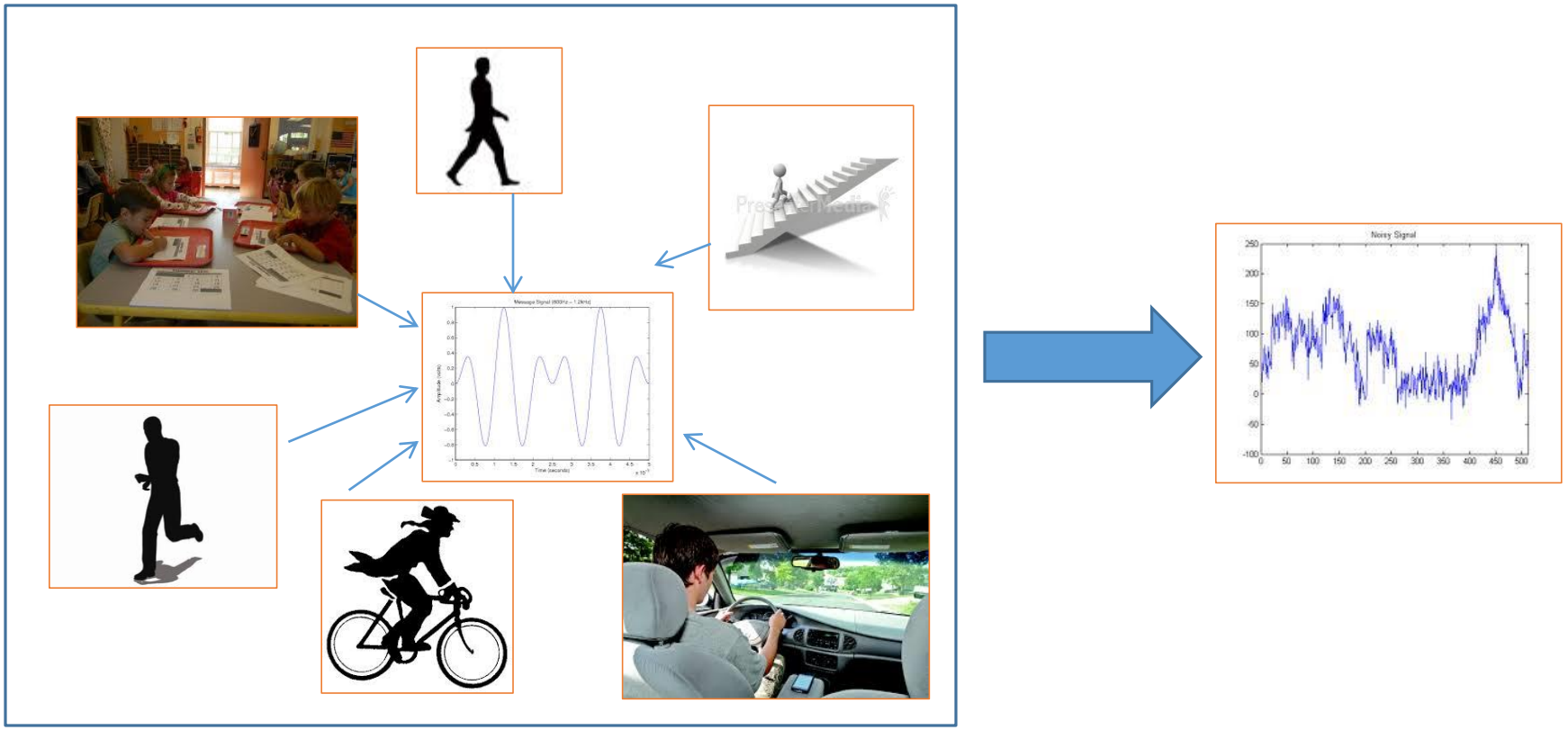
Cry of a child

Crowd in metro

Images source: google

Contd..

- Noisy signal is hard to classify into a known category



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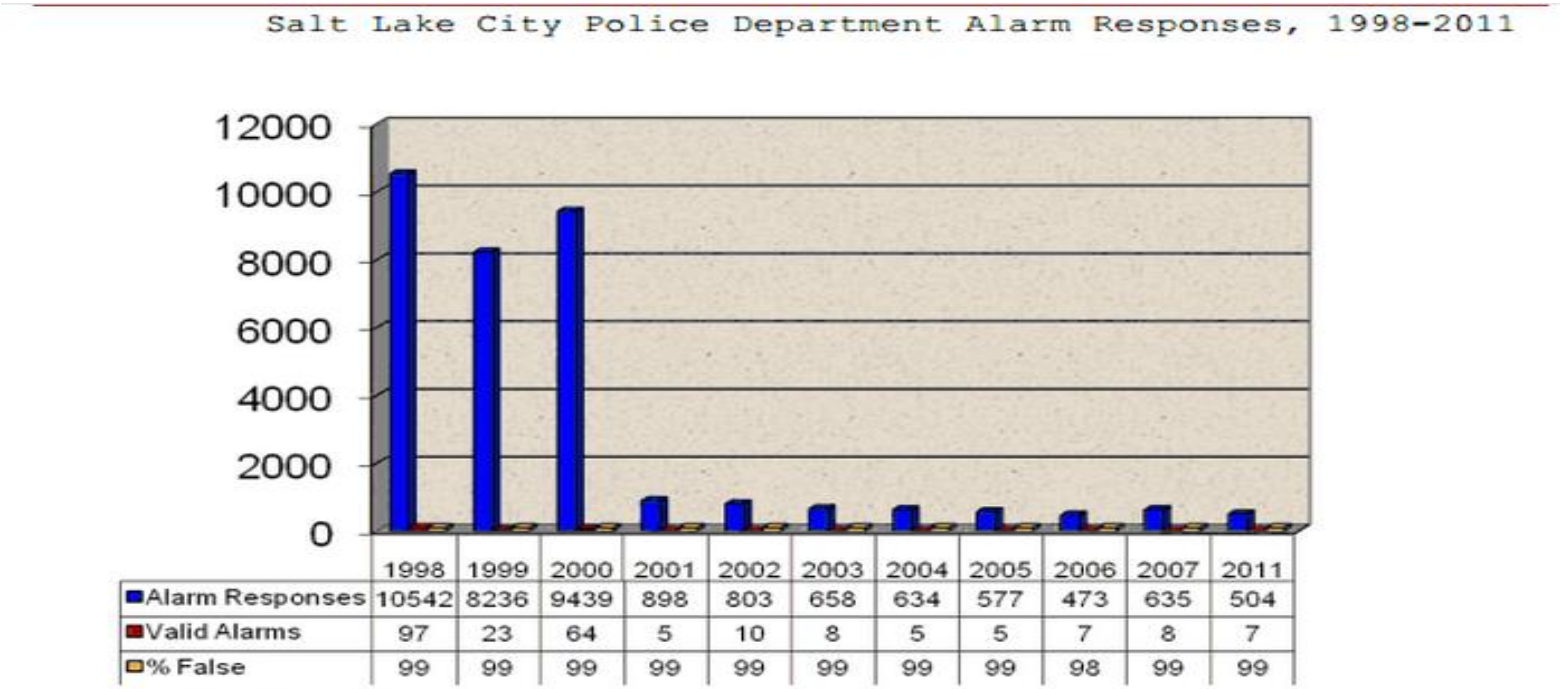
Research Challenges

- High Detection Rate (DR)
- Low False Alarm Rate (FAR)

- If 10 false alarms a day, 300 a month, 3600 a year and 1000 people are using the app then 3.6 million false alarms will be reported
  - Seems not feasible with so many FARs

Images source: google

Contd..



	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2011
Alarm Responses	10542	8236	9439	898	803	658	634	577	473	635	504
Valid Alarms	97	23	64	5	10	8	5	5	7	8	7
% False	99	99	99	99	99	99	99	99	98	99	99

Source: Salt Lake City police department, 2012.

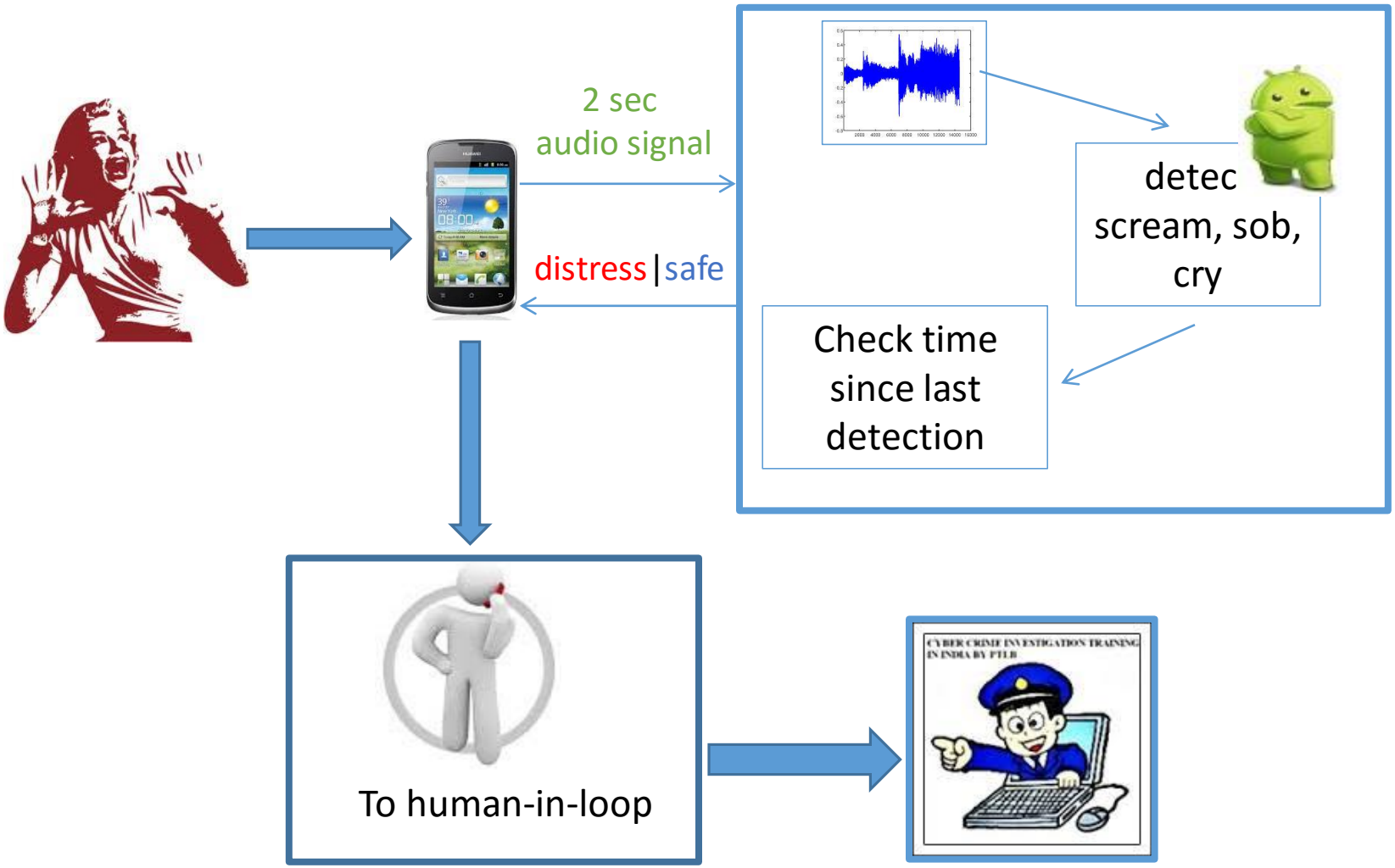
- Battery consumption for 24 X 7 automated system

Images source: google

Our contribution

- First to propose an entirely smartphone audio based 24 X 7 distress detection system
- A two stage framework for distress detection and false alarm rejection which has fairly less FAR
- Evaluation of feasibility to use friend-in-the-loop to further reduce the number of false alarms
- Extensive evaluation on many hours of volunteer data (278 hours, 16 volunteers).

Proposed architecture



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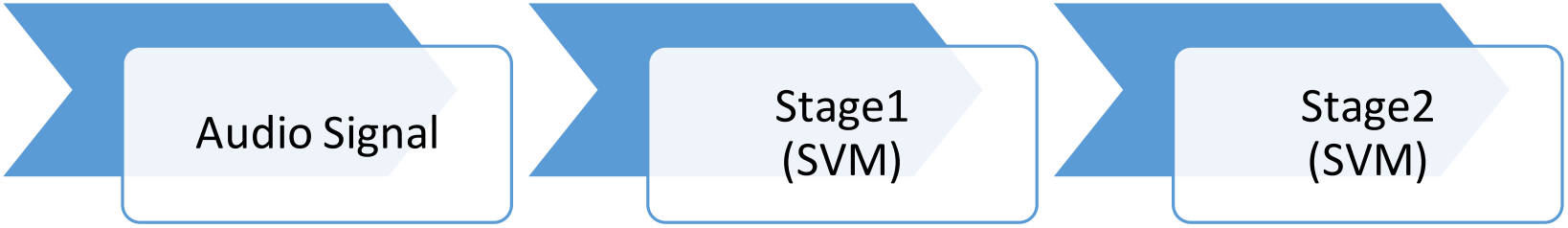
Two stage framework

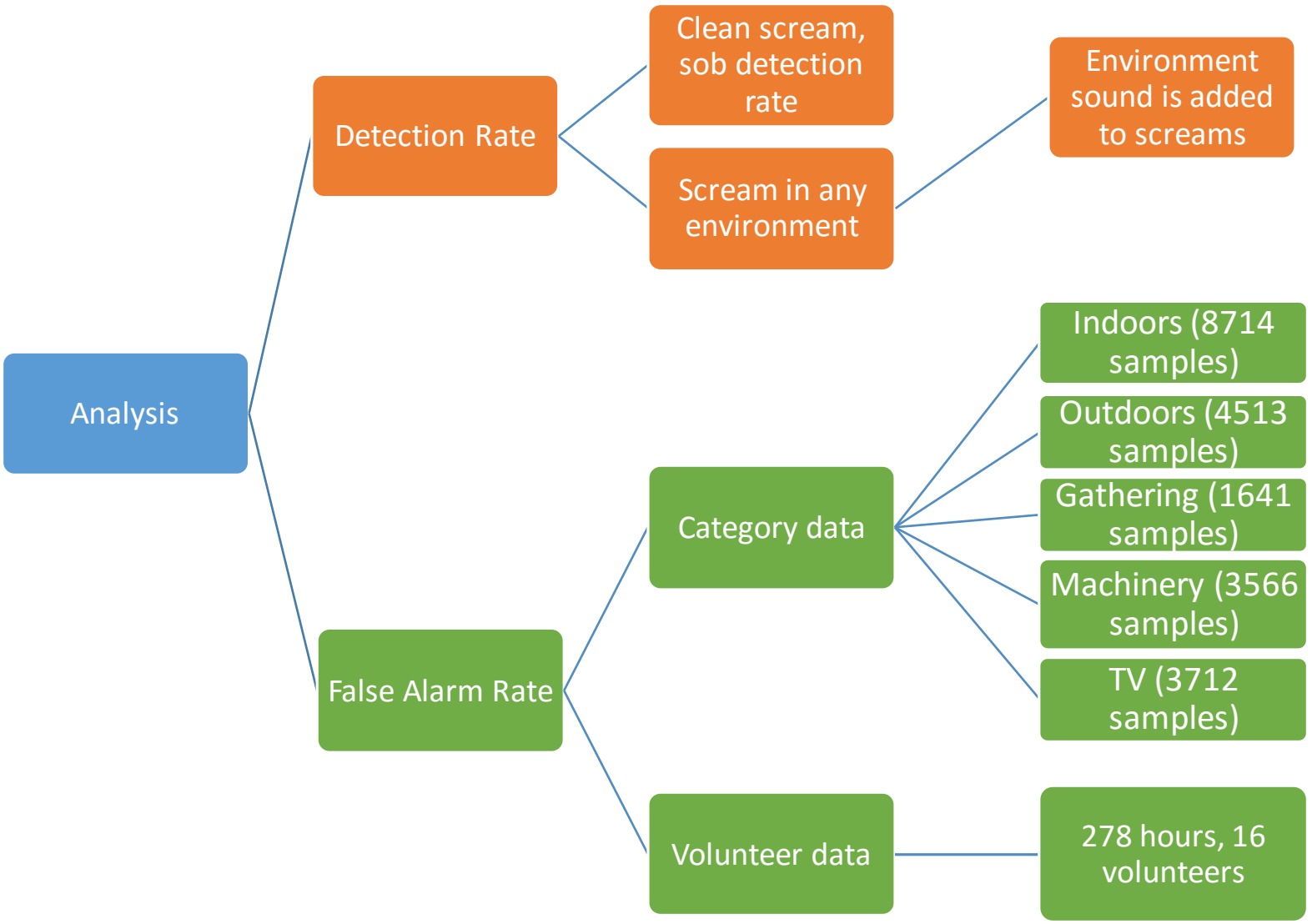


- 2 sec audio signal

- 2 class classification
- Filters out normal speech from the audio signal

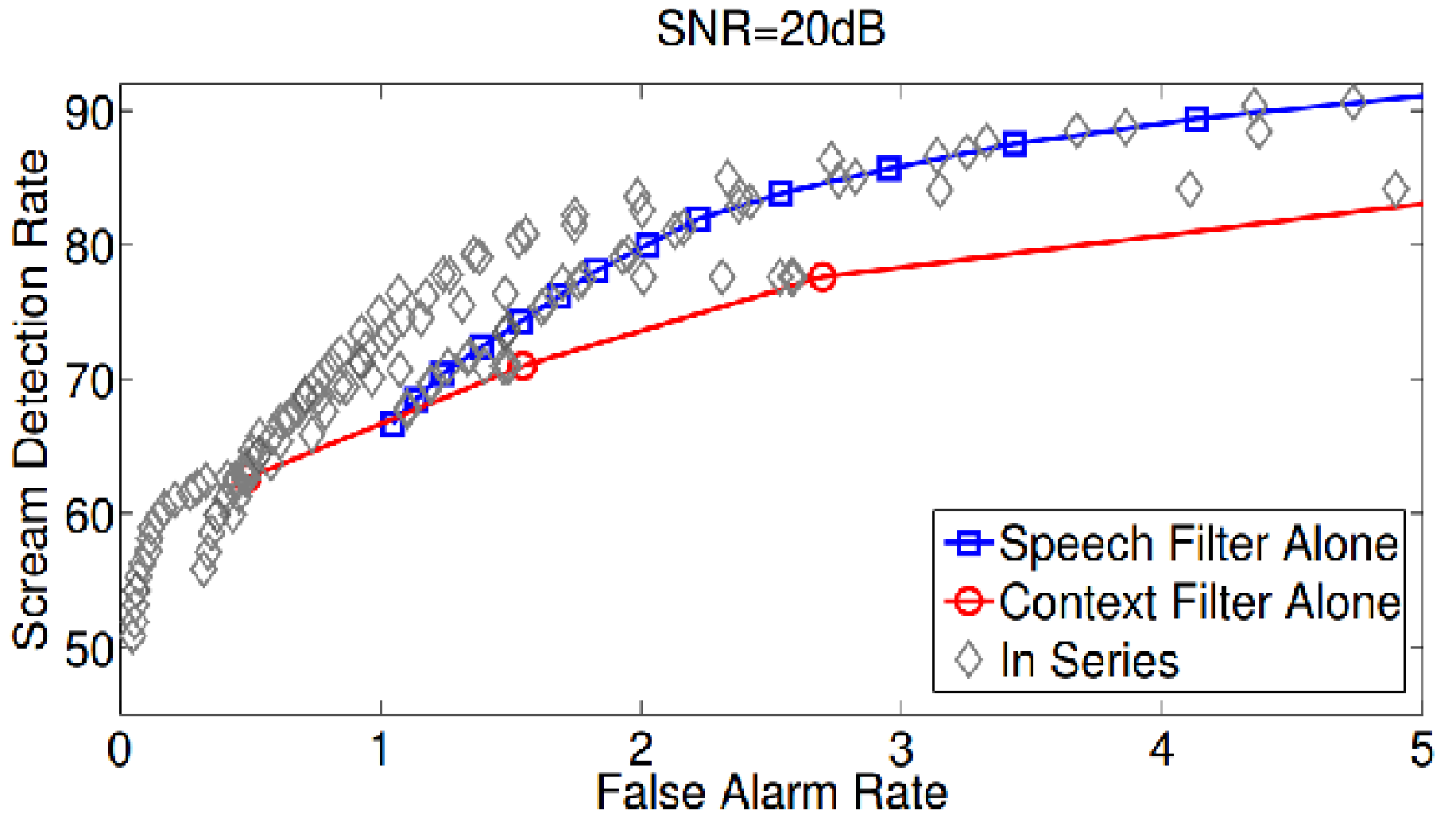
- 7 class classification
- Filters out environmental sound (context) from the audio signal

Analysis approach



Results

- Tradeoff curve for DR and FAR for 20dB SNR



Results contd..

- False alarm rate for volunteer data

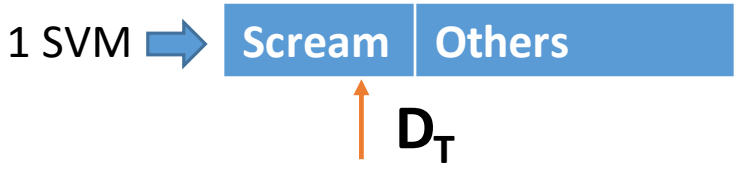
	False alarms sent to friends-in-loop		
Tot. Hours	No Timeout	30 min	60 min
57.28	304	20	18
39.10	55	3	3
19.27	466	8	7
18.49	25	3	3
18.33	7	2	2
13.51	1197	14	11
11.09	49	8	6
3.15	12	2	2
0.97	30	3	2
0.69	35	1	1

Importance of contributions?

- Distress detection is automated
- Early detection of distress is required to save victim from any harm
- Have high confidence of detection due to Human-in-The-loop.

Thanks

Scream Filter



Column Relaxation