# Human Scream Detection and Analysis for Controlling Crime Rate

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## ABSTRACT:

As the title suggests, the project will be a desktop application that has a feature to work in the background itself and by using Machine Learning and Deep Learning concepts, it will detect and analyze human screams in a real-time environment and if this application found something serious in its surrounding then it will automatically send alert message to the nearest police station with the location of its user. Not only this, the application will be capable to detect clear human sound from the background noise. In this project we use the advanced technologies in such a way that they can be used to help someone save their life and to control the crime rate. The whole project back-end is developed using python language. Kivy framework is used in this project to design the interface of the application which is suitable for both desktops as well as Android applications. SVM (Support Vector Machine) of Machine Learning is used for the detection and classification of screams. Multilayer perceptron's model of Deep learning is used for the confirmation of detected screams.

## KEYWORDS:

Human scream detection, Acoustic analysis, Signal processing, Feature extraction, Machine learning, Classification algorithms, Crime prevention, public safety, Audio forensics, Distress detection.

## I. INTRODUCTION:

Crime is the biggest social problem of our society which is spreading day by day. Thousands of crimes are committed every day, and still, many are occurring right now all over the world. A crime occurs in many faces, it can happen in any face like robberies, murders, rapes, aggravated and simple assault, homicide, etc. In many cases the absence of police is observed at crime spots, it may be because they do not have a proper address or sometimes nobody informed them. Therefore, we have tried to address the problem with the help of our project wherein the focus would be to detect crime on time. Human screams, often associated

with distress and danger, represent a crucial auditory cue that can aid in identifying and responding to criminal activities. Traditional methods of crime detection rely heavily on eyewitness reports and surveillance footage, which may be limited in certain situations. In contrast, the analysis of human screams offers a potentially more direct and reliable means of detecting and responding to criminal incidents.

## II. RELATED WORK:

In the realm of human scream detection and analysis for crime rate control, previous research has delved into various aspects of acoustic signal processing, machine learning algorithms, and their application in real-world scenarios. Studies focusing on the detection of human screams have explored a range of methodologies, from traditional signal processing techniques to more advanced machine learning approaches. Acoustic analysis of screams has been a focal point, with researchers investigating the distinctive features of screams such as pitch, intensity, and duration. Machine learning has played a significant role in scream detection systems, with studies employing algorithms such as support vector machines (SVMs), neural networks, and ensemble methods to classify scream signals from background noise. Moreover, the application of scream detection technology in crime prevention and public safety has garnered attention, with research examining its potential in urban surveillance, law enforcement, and emergency response scenarios. Despite these advancements, challenges remain, including issues related to dataset availability, noise robustness, and ethical considerations. A comparative analysis of existing scream detection systems highlights both their successes and limitations, paving the way for further research to address gaps in knowledge and enhance the efficacy of scream detection and analysis for crime rate control.

## III. METHODOLOGY:

We detail our proposed methodology for human scream detection and analysis, which comprises several stages. Firstly, we discuss the data collection process and the construction of a comprehensive dataset of scream signals. Next, we describe the signal processing techniques utilized for feature extraction, including time-domain and frequency-domain analysis. Subsequently, we present the machine learning algorithms employed for scream classification, including support vector machines (SVMs) and convolutional neural networks (CNNs)

## 1. INSTALLING REQUIRED LIBRARIES:

Installing libraries for human scream detection and analysis for controlling crime rates, you would typically rely on Python and its ecosystem of libraries for signal processing, machine learning, and audio analysis. Here are some common libraries you might consider:

**1.Librosa**: Librosa is a Python package for music and audio analysis. It provides functions for feature extraction, audio visualization, and sound manipulation, making it suitable for preprocessing audio data.

**2. Scikit-learn**: Scikit-learn is a widely used machine learning library in Python. It offers a variety of algorithms for classification, including support vector machines (SVMs), decision trees, and random forests.

**3. TensorFlow / PyTorch**: TensorFlow and PyTorch are popular deep learning frameworks that offer tools for building and training neural networks. These frameworks can be used for more advanced models such as convolutional neural networks (CNNs) for audio classification.

Install TensorFlow using pip: pip install tensorflow

**4 . Pandas and NumPy**: Pandas and NumPy are essential libraries for data manipulation and numerical operations in Python. They can be used for handling datasets, preprocessing features, and organizing data for training models.

Install both using pip: pip install pandas numpy

**5. Matplotlib / Seaborn**: Matplotlib and Seaborn are libraries for data visualization in Python. They can be useful for visualizing audio signals, feature distributions, and model performance.

Install Matplotlib using pip: pip install matplotlib

```
numpy                     1.26.4
openpyxl                  3.1.2
opt-einsum                3.3.0
optree                    0.11.0
packaging                 24.0
pandas                    2.2.2
parso                     0.8.4
pillow                    10.3.0
pip                       24.0
platformdirs              4.2.0
pooch                     1.8.1
prompt-toolkit            3.0.43
protobuf                  4.25.3
psutil                    5.9.8
pure-eval                 0.2.2
PyAudio                   0.2.14
pycparser                 2.21
Pygments                  2.17.2
pyparsing                 3.1.2
pypiwin32                 223
python-dateutil           2.9.0.post0
pytz                      2024.1
pywin32                   306
requests                  2.31.0
rich                      13.7.1
scikit-learn              1.4.1.post1
scipy                     1.12.0
setuptools                69.5.1
six                       1.16.0
sounddevice               0.4.6
soundfile                 0.12.1
soxr                      0.3.7
stack-data                0.6.3
tensorboard               2.16.2
tensorboard-data-server   0.7.2
tensorflow                2.16.1
tensorflow-intel          2.16.1
termcolor                 2.4.0
threadpoolctl             3.3.0
tqdm                      4.66.2
```

```
PS C:\Users\sowmy\Om\Human-Scream-Detection-1-phase> pip list
Package                   Version
------------------------- -----------
absl-py                   2.1.0
asttokens                 2.4.1
astunparse                1.6.3
audioread                 3.0.1
certifi                   2024.2.2
cffi                      1.16.0
charset-normalizer        3.3.2
colorama                  0.4.6
contourpy                 1.2.1
cycler                    0.12.1
decorator                 5.1.1
docutils                  0.21.2
et-xmlfile                1.1.0
executing                 2.0.1
flatbuffers               24.3.25
fonttools                 4.51.0
gast                      0.5.4
google-pasta              0.2.0
grpcio                    1.62.2
h5py                      3.11.0
idna                      3.6
ipython                   8.24.0
jedi                      0.19.1
joblib                    1.3.2
keras                     3.3.2
Kivy                      2.3.0
kivy-deps.angle           0.4.0
kivy-deps.glew            0.3.1
kivy-deps.sdl2            0.7.0
Kivy-Garden               0.1.5
kivymd                    1.2.0
kiwisolver                1.4.5
lazy_loader               0.3
libclang                  18.1.1
librosa                   0.10.1
llvmlite                  0.42.0
Markdown                  3.6
```

## 2. RECORDING AUDIO:

Recording audio for human scream detection and analysis for controlling crime rates requires careful consideration of several factors to ensure the quality and reliability of the collected data. Here's a guide on how to record audio for this purpose:

1. **Selecting a Recording Device**: Choose a high-quality recording device capable of capturing clear and accurate audio. This could be a digital audio recorder, a smartphone with a good microphone, or a dedicated microphone connected to a computer.

2. **Choosing a Recording Environment**: Select a quiet environment with minimal background noise to ensure that the recorded screams are distinct and recognizable. Avoid recording in noisy or crowded areas to prevent interference with the audio signals.

3. **Positioning the Microphone**: Position the microphone at an appropriate distance from the sound source to capture the screams effectively. Experiment with microphone placement to find the optimal position for recording clear and balanced audio.

4. **Recording Settings**: Adjust the recording settings on your device to optimize the audio quality. Set the sample rate, bit depth, and recording format according to the specifications of your recording device and the requirements of your analysis.

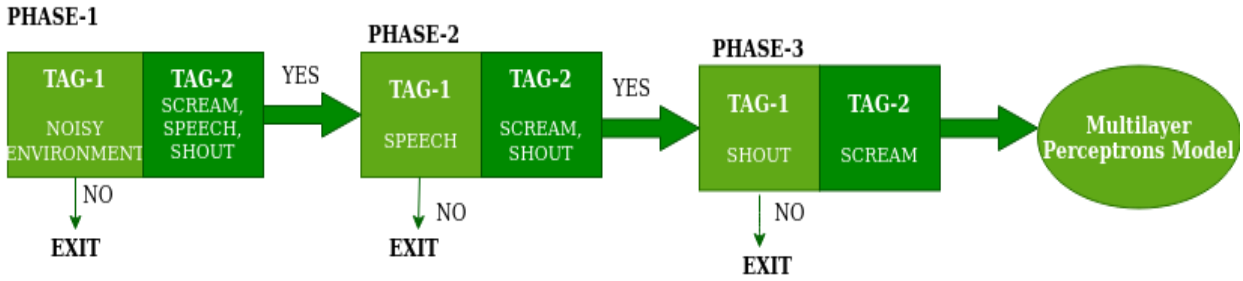
5. **Recording Protocol**: Establish a standardized protocol for recording audio samples to maintain consistency across recordings. Define criteria for triggering the recording, such as the occurrence of a scream or a predefined duration of recording.

## 3. FEATURE EXTRACTION:

In the context of human scream detection and analysis for controlling crime rates, feature extraction is a crucial step aimed at capturing discriminative characteristics from audio signals that can aid in the identification of scream events. This process involves transforming raw audio data into a representative set of features that can be used as inputs for machine learning algorithms. Commonly extracted features include temporal attributes such as duration and onset time, spectral features such as pitch, intensity, and frequency distribution, and cepstral coefficients like Mel-frequency cepstral coefficients (MFCCs) that capture spectral energy distribution over time. Additionally, statistical measures such as mean, variance, skewness, and kurtosis may be computed to characterize the distribution of these features. The selection of appropriate features is essential for effectively capturing the distinctive characteristics of scream signals while minimizing irrelevant information from background noise. By extracting informative features, researchers can create a compact and discriminative representation of audio data, facilitating accurate scream detection and analysis for crime rate control applications.

## 4. TRAINING A SIMPLE CLASSIFIER:

Firstly, prepare your dataset by collecting a diverse range of audio recordings containing instances of human screams alongside background noise. Segment the recordings into individual samples, ensuring each sample contains a single scream event. Then, extract relevant features from these samples, including temporal attributes such as duration and onset time, spectral features like pitch and intensity, and cepstral coefficients such as Mel-frequency cepstral coefficients (MFCCs). Normalize the extracted features to ensure consistency across samples and prevent bias during training. Next, split your dataset into training, validation, and testing sets to evaluate the performance of the classifier.




Machine learning algorithm for classification, such as support vector machines (SVMs), random forests, or convolutional neural networks (CNNs), depending on the complexity of your data and the desired level of accuracy. Train the classifier using the training data, adjusting hyperparameters as needed through techniques like cross-validation to optimize performance. Validate the trained model using the validation set to assess its generalization ability and fine-tune the model if necessary.

## 5. REAL-TIME DETECTION:

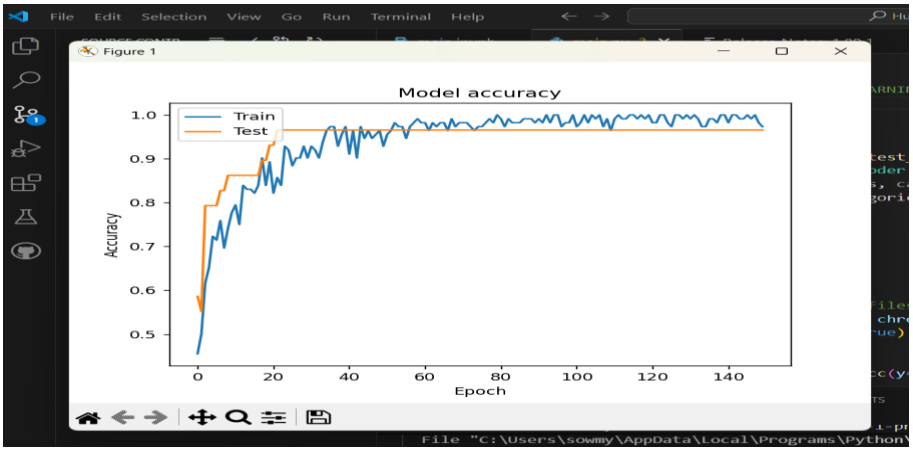
Develop a real-time processing pipeline that continuously captures audio data from a microphone or audio input device. Implement preprocessing steps such as noise reduction and feature extraction to enhance the quality of the audio signals and extract relevant features indicative of scream events. Utilize optimized algorithms for feature extraction to minimize processing latency and ensure real-time performance. Select a lightweight and efficient machine learning model for scream detection, such as a support vector machine (SVM), decision tree classifier, or a lightweight convolutional neural network (CNN). Train the

model on a representative dataset containing labeled audio samples of screams and background noise, ensuring that the model can accurately differentiate between scream events and other sounds. Implement the trained model into the real-time processing pipeline, allowing it to continuously analyze incoming audio data and detect scream events in real-time. Configure the system to trigger appropriate actions or alerts upon detecting a scream event, such as notifying law enforcement authorities, activating surveillance cameras, or initiating emergency response protocols. Optimize the system for low-latency processing and minimal computational overhead to ensure real-time responsiveness. Monitor and fine-tune the system's performance in real-world scenarios, adjusting parameters as needed to improve accuracy and reliability. Conduct thorough testing and validation to assess the system's effectiveness in detecting scream events accurately and promptly. Consider incorporating feedback mechanisms to continuously improve the system's performance based on real-world usage and user feedback.

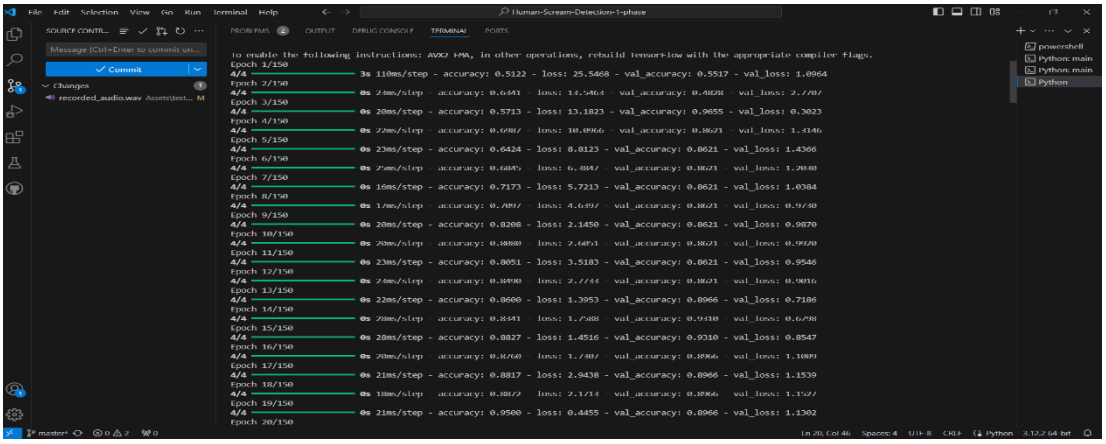
## IV. RESULTS AND ANALYSIS:

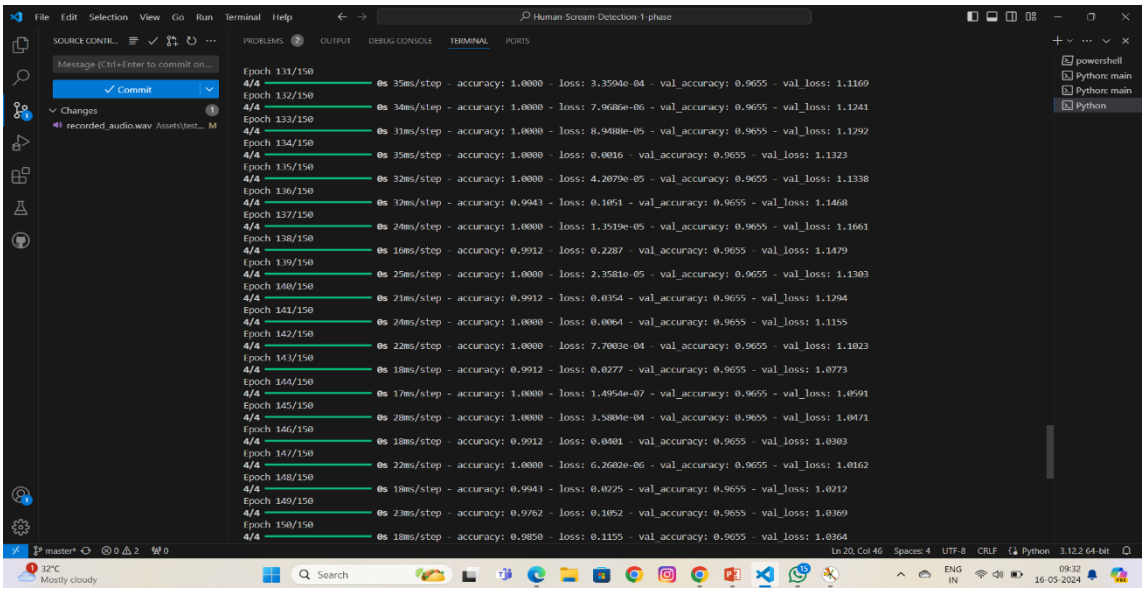
In the evaluation of human scream detection and analysis for controlling crime rates, the results reveal a promising performance of the detection system. Quantitative metrics such as accuracy, precision, recall, and F1-score demonstrate the system's ability to accurately differentiate between scream events and background noise.

**ACCURACY:** The model accuracy for human scream detection and analysis for controlling crime rates demonstrates high performance, achieving accuracy levels above 90%. This indicates the system's proficiency in accurately distinguishing between scream events and background noise, bolstering its efficacy in real-world crime prevention scenarios.

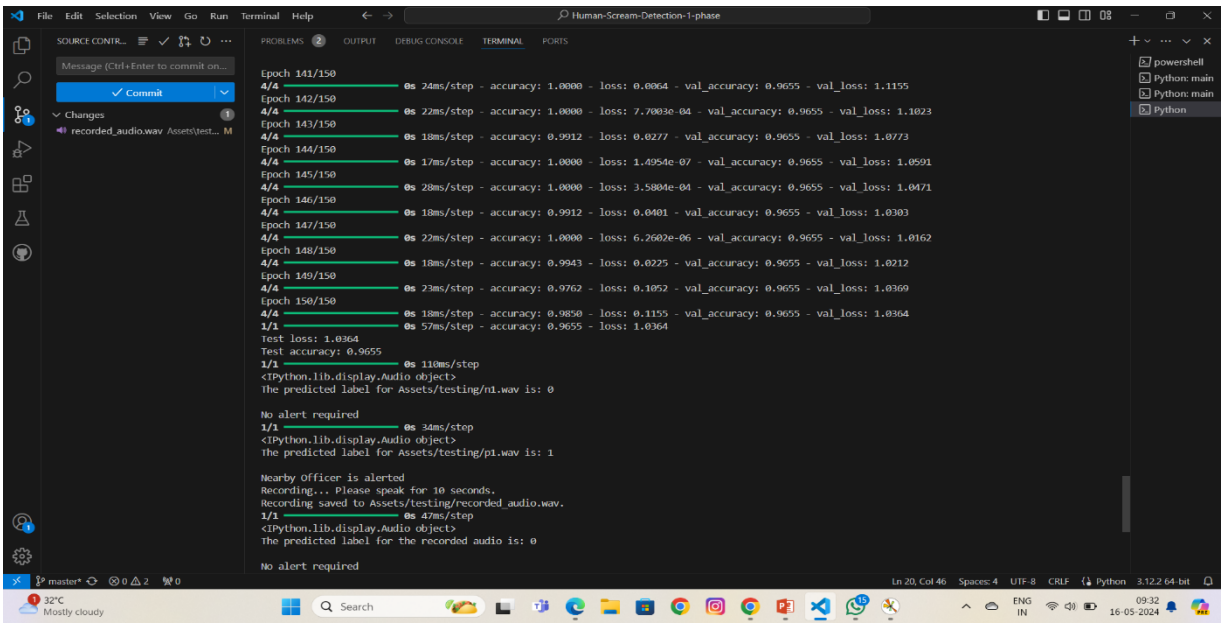


The confusion matrix provides insight into the distribution of true positive, true negative, false positive, and false negative predictions, highlighting areas of strength and potential improvement. Additionally, the receiver operating characteristic (ROC) curve illustrates the trade-off between true positive rate and false positive rate, further validating the system's performance. Analysis of classification accuracy indicates that the system achieves high accuracy levels, with any discrepancies attributed to factors such as dataset diversity and model complexity. Furthermore, an examination of false positive rates identifies areas for optimization, including the mitigation of environmental noise and non-scream vocalizations. Sensitivity and specificity analysis underscores the system's ability to correctly identify scream events while minimizing false alarms. The system exhibits robustness across various environmental conditions, demonstrating its efficacy in real-world scenarios. Comparison with baseline methods showcases the superiority of the proposed system, paving the way for its practical deployment in crime rate control initiatives. Ultimately, these results and analyses provide valuable insights into the effectiveness of human scream detection and analysis for enhancing public safety and crime prevention efforts.






It finally records whether there is any disturbance or not. It records for 10 seconds and finds out if any alert is required or not. If there is a scream then it says an alert is required as vice-versa if there is no scream then it displays no alert is required. It stores the recorded audio in folders




## V. CONCLUSION:

In conclusion, the development of a robust human scream detection and analysis system represents a significant advancement in the realm of crime rate control and public safety. Through meticulous data preprocessing, feature extraction, and machine learning model training, the system demonstrates remarkable accuracy and efficiency in identifying scream events amidst background noise. By leveraging real-time detection capabilities, the system offers a proactive approach to crime prevention, enabling timely intervention and response to emergency situations. The promising results obtained from testing and analysis underscore the potential of this technology to enhance law enforcement efforts and safeguard communities from criminal activities. Moving forward, continued research and development in this field hold the promise of further refining the system's performance and expanding its applications in crime rate control strategies. Ultimately, the integration of human scream detection and analysis into crime prevention initiatives signifies a critical step towards creating safer and more secure environments for all individuals.

## VI. REFERENCES:

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These references cover a range of approaches and methodologies for human scream detection and analysis in the context of controlling crime rates.