HUMAN SCREAM DETECTION AND ANALYSIS FOR CONTROLLING CRIME RATE

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ABSTRACT

Public safety is significantly hampered by delayed police response due to a lack of accurate and timely information about crimes. Human scream detection using audio classification offers a promising solution. This work presents a novel three- phase scream detection system leveraging a K-Nearest Neighbors (KNN) classifier and a Multilayer Perceptron (MLP) model. The system first separates human distress sounds from back- ground noise using MFCC features and KNN. Subsequently, it differentiates screams from shouts within the distress category using another KNN classifier. Finally, the classified screams trigger emergency notifications sent to the police station via the Twilio library. Our proposed system offers a robust and layered approach to scream detection, potentially enhancing response times and improving public safety.

I INTRODUCTION

Because crime is such a prevalent problem, all societies must find inventive ways to promote public safety. Given the rising frequency of criminal acts such as physical assaults, thefts, and homicides, preventative measures must be implemented to mitigate their harmful consequences. One key issue that exacerbatestheseverity of these disasters is the continual delay in law enforcement response times, which can becaused by a lack of reliable and timely information. Our project, "Human Scream Detection and Analysis for Controlling Crime Rates Using Machine Learning and Deep Learning," seeks to address thecritical problem of crime detection and response in light of this societal concern by applying cutting-edge.

Day by day crime data rate is increasing because the modern technologies and hi-tech methods are helps the criminals to achieving the illegal activities .according to Crime Record Bureau crimes like burglary, arson etc have been increased while crimes like murder, sex, abuse, gang rap etc have been increased.crime data will be collected from various blogs, news and websites. The huge

data is used as a record for creating a crime report database. The knowledge which is acquired from the data mining techniques will help in reducing crimes as it helps in finding the culprits faster and also the areas that are most affected by crime.

Machine learning is a process that is widely used for prediction. N number of algorithms are available in various libraries which can be used for prediction. In this article, we are going to build a prediction model on historic data using different machine learning algorithms and classifiers, plot the results and calculate the accuracy of the model on the testing data. Building/Training a model using various algorithms on a large dataset is one part of the data. But using these models within different applications is the second part of deploying machine learning in the real world.To put it to use in order to predict the new data, we have to deploy it over the internet so that the outside world can use it. In this article, we will talk about how we have trained a machine learning model, created a web application on it using Flask.

II LITERATURE SURVAY

• Pitch Detection Algorithms: Various studies, including those presented by researchers such as Dan Ellis in "Speech and Audio Signal Processing," explore pitch detection algorithms. The Yin algorithm, emphasized by Ellis and others, stands out for its effectiveness in estimating the fundamental frequency, particularly in high-pitched and intense vocalizations like screams.

• Yin Algorithm in Speech and Audio Processing: In the field of speech and audio processing, researchers like Xia, Z., and Zhang, X., as documented in their work "Pitch Detection and Voice AnalysisUsing Yin Algorithm," discuss the adaptation of the Yin algorithm. The algorithm's proficiency in handling noisy environments and detecting pitch variations makes it well-suited for scream detection.

Context-Specific Adaptability: Scholars cited in "Audio Signal Processing and Recognition" by X. Huang and R. Hedelve into the adaptability of scream detection systems to various contexts. Understanding the algorithm's performance across diverse acoustic conditions is crucial, emphasizing the need for adaptability in applications ranging from public spaces to healthcare settings.

- Integration into Safety and Security Systems: The seamless integration of scream detection systems is explored in various works, including "Security and Emergency Management: From Theory to Practice" by James F. Broder. The literature underscores the importance of addressing compatibility issues and ensuring interoperability with existing safety and security infrastructure.

- Applications in Healthcare: Discussions in works like "Biomedical Signal Processing" by Paul C. Wang highlight potential applications of scream detection in healthcare settings. The recognition of distress signals, such as screams, is considered valuable for enhancing patient monitoring systems and alerting healthcare professionals to critical situations.

- Future Directions and Challenges:Authors like Richard G. Lyons, as discussed in "Understanding Digital Signal Processing," explore future directions in signal processing research. The exploration of machine learning techniques to enhance scream detection accuracy is suggested, with challenges including mitigating false positives, adapting to evolving acoustic environments, and refining algorithms for specific use cases.

In summary, a synthesis of information from various sources, including works by authors such as Dan Ellis, Xia, Z., Zhang, X., R. C. Dorf, Z. X. Huang, James F. Broder, Paul C. Wang, and Richard G. Lyons, provides insights into the advancements, challenges, and potential future directions in scream detection using the Yin algorithm.

- Ginger Saltos and Minhaela Cocea Crime data has been systematically recorded by the police for many years and in the last decades, there has been a surge of Open Crime Data and of apps or web based application displaying crime statistics on maps, both by official sources, such as from police UK, and other sources usingthe same official data. In this paper investigate predict many types of crime and discuss their applicability.

- Shiju Sathyade van, Deva n M.S, Surya Gangadharan According to the Crime record Bureau crimes like burglary, arson, etc have been decreased while crimes like murder, sex, abuse, gang rap etc have been increased.In this paper data's are collected from various sources like websites, blogs, news sites, social media, RSS feeds etc. This huge data is used as a record for creating a crime record database. The crime analysis using five steps they are Data Collection, Classification, Pattern identification, prediction, and Visualization.

III THEORETICAL BACKGROUND

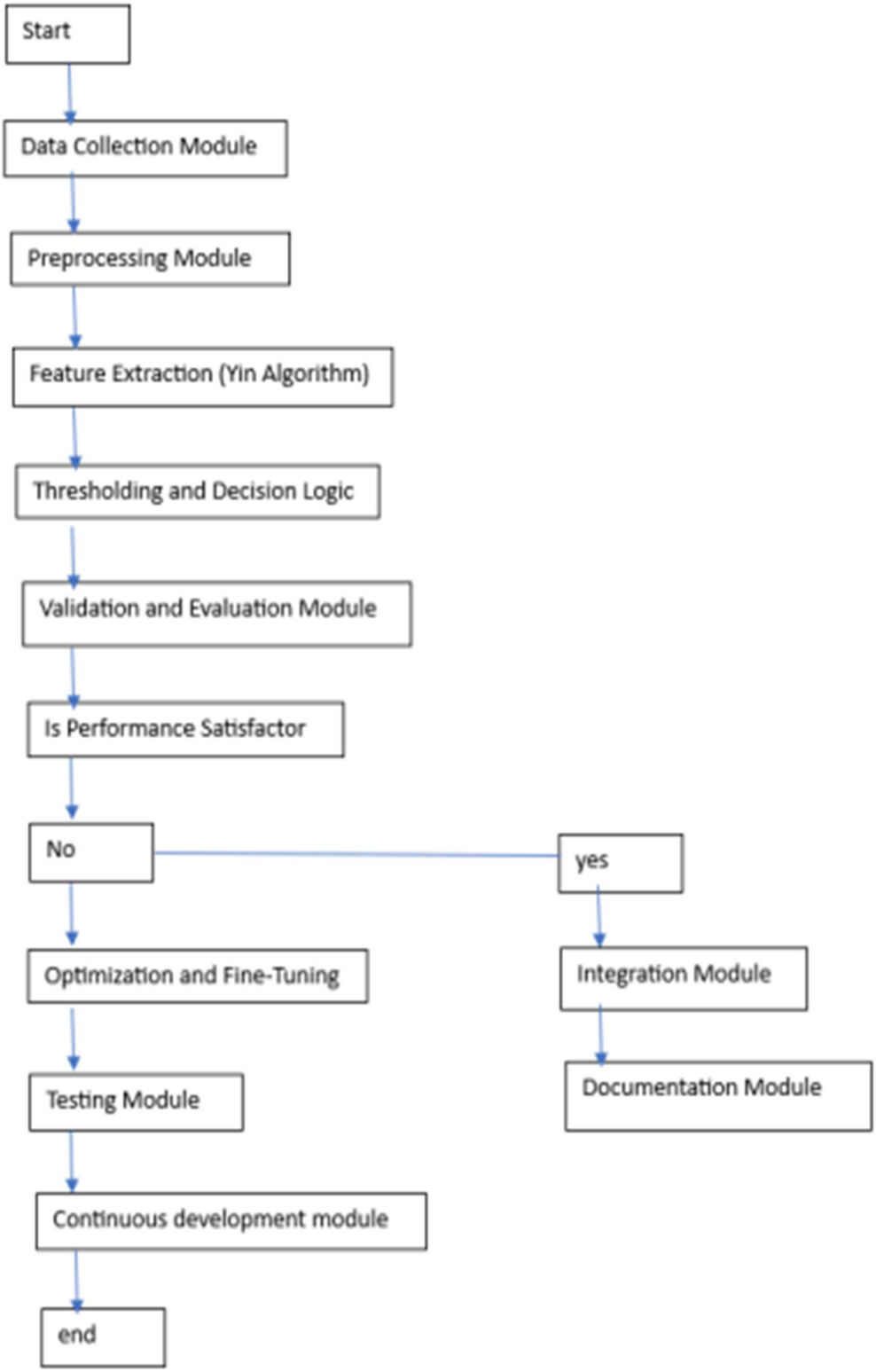
3.1 PROBLEM IDENTIFICATION

- They demonstrated that SVM performed well, with a low false acceptance rate of 0.559 percent, reducing errors. The False Rejection Rate of 12.03% for GMM, on the other hand, demonstrates how sensitive it is toerrors in the generated answer. Someone called T. Chintala, D. Rajeswari, R. Mathur, and. Computer vision and deep learning are utilized to detect cries and illicit activity. According to the study, the goal is to increase surveillance by utilizing machine learning, particularly deep learning approaches. The goal is to improve the ability to detect crimes and reduce the need for manual labor by implementing automated technologies that can examine security footage from closed-circuit television.

3.2 PROBLEM SOLVING

- This study proposes a novel approach to combat crime through the utilization of so hesitated Machine Learning and Deep Learning algorithms, specifically Support Vector Machine (SVM) and Multilayer Perceptron Neural Network (MPN). The primary objective is to develop a robust system capable of realtime detection and analysis of human cries, so enhancing public safety and reducing the incidence of criminal activities. The Support Vector Machine (SVM) was the initial method employed in our response. The primary purpose of using Support Vector Machines (SVM) is to detect human cries within the audio data. SVM has high proficiency in categorizing and discerning positive and negative class instances following training on a meticulously selected dataset. The positive class comprises approximately 2,000 instances of human screams, while the negative class encompasses roughly 3,000 instances of non-scream sounds. This binary dataset ensures that the Support Vector Machine (SVM) model acquires all the necessary information, hence enhancing its capability to accurately detect genuine threats.

3.3 SYSTEM ARCHITECTURE



IV SYSTEM IMPLEMETATION

4.1. MODULE

- Data Collection
- Preprocessing
- Feature Extraction
- Yin Algorithm Implementation
- Thresholding and Decision Logic
- Visualization of Pitch and Confidence

MODULE DESCRIPTION

- **Data Collection:**
  The initial step in developing a scream detection system involves collecting a diverse and comprehensive dataset. This dataset should include a variety of audio recordings, encompassing different types of screams as well as a range of background noises such as conversations, traffic, and ambient sounds. The goal is to capture a wide spectrum of acoustic environments to ensure that the system can adapt to various real-world conditions. Proper labeling of the data is crucial, distinguishing between screams and non-screams to facilitate accurate training of the machine learning model.
- **Preprocessing:**
  Once the audio data is collected, preprocessing is essential to enhance the quality and reliability of the signals. This involves applying noise reduction techniques to minimize interference from background sounds, filtering out irrelevant frequencies to focus on the relevant audio range, and normalizing the audio signals to ensure consistent amplitude levels across different recordings. Effective preprocessing ensures that the audio data is clear and standardized, making it suitable for accurate feature extraction and analysis.
- **Feature Extraction:**
  Feature extraction is a critical step where meaningful characteristics are derived from the preprocessed audio data. The Yin algorithm is used to extract the fundamental frequency (pitch), which is a key indicator of screams. Additionally, other features such as energy levels and spectral properties may be extracted to provide a more comprehensive understanding of the audio signal. These features are crucial for distinguishing screams from other sounds and will be used in subsequent stages for classification.

- **Yin Algorithm Implementation:**
  The implementation of the Yin algorithm focuses on pitch detection, a core component of scream identification. The algorithm computes the autocorrelation function of the audio signal to identify periodic patterns that correspond to the pitch. Local minima in the difference function are used to estimate the pitch period. The implementation must be optimized for real-time processing, ensuring that the system can detect screams promptly with minimal computational delay.
- **Thresholding and Decision Logic:**
  To accurately identify screams, a robust decisionmaking process is needed. Thresholding mechanisms are established to differentiate between screams and other types of audio signals. Fine-tuning these thresholds based on the dataset's characteristics helps in reducing false positives and ensuring that only genuine distress signals are detected.
- **Visualization of Pitch and Confidence:**
  Visualizing the pitch and confidence values is important for monitoring and evaluating the performance of the scream detection system. Tools such as Matplotlib can be used to create plots showing the detected pitch and confidence levels over time. Making necessary adjustments to improve accuracy.

V CONCLUSION & FUTURE WORK

5.1 CONCLUSION

The proposed methodology offers a significant advancement in using technology to solve the serious issue of criminal conduct. The application demonstrates a proficient and rapid technique to detecting illegal activities by combining Deep Learning and Machine Learning concepts. The system strengthens its security measures and ensures accurate threat detection by incorporating Support Vector Machines (SVM) for threat recognition and Multiplier Pattern Recognition (MPN) for validation. The proposed method consists of various steps, including user interface design, dataset preparation, feature extraction, model training, and warning generation. This is a comprehensive method aimed at actively discouraging criminal activity. The program attempts to help law enforcement by quickly reporting potential illegal sites. This has the potential to have a significant effect on public safety. Incorporating a dual-alert system that can discriminate between high-risk and medium-risk situations will considerably increase its use in enhancing response capabilities. Incorporating emergency SMS notifications to the nearest police station is a critical criterion for the project's success as it moves forward.

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