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REAL TIME SCREAM SURVEILLANCE: PUBLIC SAFETY THROUGH AUDIO-BASED CRIME DETECTION USING MACHINE LEARNING

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ABSTRACT

The rise in global crime rates, particularly affecting women, has created an urgent need for innovative safety solutions. This study presents a Human Scream Detection and Analysis System using machine learning and deep learning techniques to identify human screams from background noise through acoustic analysis. The proposed system aims to enhance public safety and emergency response by enabling real-time scream recognition. It also addresses ethical concerns such as privacy and potential misuse, ensuring responsible implementation of the technology.

KEYWORDS: Human Scream Detection, Machine Learning, Acoustic Analysis, Public Safety, Ethical Considerations.

INTRODUCTION

Human scream detection is an important area of research as screams indicate fear, pain, or distress. Detecting such sounds helps improve safety and emergency response in areas like healthcare, security, and surveillance. The Yin algorithm, based on pitch detection, is effective in identifying high-pitched sounds such as screams even in noisy environments. By analyzing pitch variations in real time, it can separate scream-like sounds from background noise. Developing a robust scream detection system using the Yin algorithm can enhance

public safety, provide faster responses during emergencies, and support smart monitoring systems.

3. Problem Statement

In real-world environments, accurately detecting human screams is crucial for safety and quick emergency response. Existing audio detection systems struggle to differentiate genuine distress sounds from background noise, often causing false alerts or missed detections. The challenge is to develop a robust and noise-resistant scream detection system that works effectively in various acoustic conditions. Using advanced signal processing methods like the Yin algorithm, the system should accurately recognize high-pitched distress sounds in real time while filtering out irrelevant noise. It must also be adaptable and easy to integrate into existing safety systems such as smart homes, public surveillance, and healthcare monitoring, enabling faster and more reliable emergency responses.

4. Research Gap

Most existing audio recognition systems focus on general sounds or speech and are not optimized for detecting human screams. They often fail in noisy or crowded environments and lack real-time adaptability. Limited research addresses the unique acoustic features of screams, such as sudden pitch and high intensity. There is a need for a robust, noise-resistant, and real-time scream detection system for practical applications in safety, security, and healthcare**.**

5. System Architecture

The Human Scream Detection System captures real-time audio from microphones in environments like smart homes, public areas, or healthcare facilities. The preprocessing module removes background noise and normalizes the signal. Key audio features such as pitch and intensity are extracted using the Yin algorithm. The scream detection module analyses these features to classify sounds as screams or non-screams. On detection, the decision and alert module sends real-time notifications to security personnel or caregivers. The system can be integrated with smart home automation, healthcare monitoring, or public surveillance to enable fast and reliable emergency responses.

6. Methodology

The scream detection system starts with data collection of screams and background noises from various environments. Preprocessing removes noise, filters irrelevant frequencies, and

normalizes the audio. Feature extraction identifies key characteristics like pitch, energy, and spectral properties, with the Yin algorithm used for accurate pitch detection. Thresholding and decision logic classify sounds as screams or non-screams, while dynamic thresholds reduce false alarms. The system can send SOS alerts via Twilio, and batch processing ensures real-time detection. Visualization of pitch and confidence helps monitor and improve system performance.

7. Applications

The scream detection system can enhance public safety by alerting authorities in case of emergencies. In smart homes, it can detect distress and notify family members or security services. In healthcare facilities, the system helps monitor patients and respond to urgent situations. Public surveillance systems can use it to detect incidents in crowded areas. It can also be integrated into emergency response systems for faster intervention during accidents or crimes.

8. Case Studies

This case study explores a real-time scream detection system using the Yin algorithm for accurate pitch detection. Audio data is preprocessed, features like pitch and intensity are extracted, and thresholding logic identifies screams. Alerts can be sent via SMS, making it useful for smart homes, healthcare, and public safety. The study highlights challenges like noise handling and real-time processing for effective deployment.

9. Evaluation and Results

The human scream detection system using the Yin algorithm was tested in various environments and showed high accuracy in distinguishing screams from background noise. Real-time processing and threshold-based decision logic ensured prompt detection with minimal false alarms. Visualization of pitch and confidence helped monitor performance and fine-tune the system. Overall, the system is effective, reliable, and adaptable, demonstrating practical applications in smart homes, healthcare monitoring, and public safety by improving emergency response and enhancing overall security.

10. Future Scope

The scream detection system can be enhanced by integrating **machine learning** for better adaptability to new sounds and environments. **Context-aware algorithms** can allow the system to adjust to varying noise levels automatically. Incorporating **multi-sensor fusion**

with cameras or wearable devices can improve detection accuracy. **Edge computing** can enable faster real-time processing with lower latency. Additionally, **privacy-preserving techniques** can ensure secure handling of audio data, and expanding to **cross-domain applications** like smart cities or personal safety devices can broaden its impact.

11. CONCLUSION

The human scream detection system using the Yin algorithm provides an effective and reliable method for detecting distress signals in real time. Its modular design—from data collection and preprocessing to feature extraction and alert generation—ensures accuracy and adaptability. The system has practical applications in smart homes, healthcare monitoring, and public safety, helping improve emergency response and overall security. By integrating advanced audio processing techniques, it offers a robust solution for timely detection and intervention in critical situations.

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