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Real Time Deepfake Voice Detection Using Machine Learning

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Abstract
Deepfake voice technology has rapidly evolved with advancements in artificial intelligence, enabling the generation of highly realistic synthetic speech that mimics a person's tone, emotion, and speaking style. Although this technology has beneficial applications in entertainment and virtual assistants, it also poses serious threats such as fraud, identity theft, misinformation, and financial scams. This paper presents a Real-Time Deepfake Voice Detection System using Machine Learning techniques to distinguish between genuine human speech and AI-generated synthetic audio. The proposed system uses Mel Frequency Cepstral Coefficients (MFCC) for feature extraction and applies Support Vector Machine (SVM) and Random Forest classifiers for classification. The system includes preprocessing techniques such as noise removal and signal normalization to enhance accuracy. Experimental results demonstrate that the proposed model achieves high detection accuracy while maintaining low latency suitable for real-time applications. The developed system provides a reliable solution for detecting deepfake audio and contributes toward improving digital security and trust in voice-based communication systems.

Keywords: *Deepfake Voice Detection, MFCC, SVM, Random Forest, Machine Learning, Synthetic Speech Detection*

1. Introduction
Deepfake voice technology uses advanced Artificial Intelligence (AI) models to generate synthetic speech that closely resembles real human voices. Modern voice cloning tools can replicate tone, pitch, accent, and emotional expressions with high precision. While this innovation supports applications like virtual assistants, gaming, and dubbing, it also introduces significant risks including financial fraud, political misinformation, and impersonation attacks. To address this issue, this project proposes a Real-Time Deepfake Voice Detection System using Machine Learning algorithms[1]. The system extracts meaningful audio features and classifies speech as either genuine or synthetic using trained classification models. With the rise of AI-based voice synthesis models, it has become increasingly difficult to differentiate between real and fake audio recordings. This creates a serious challenge in digital forensics and cybersecurity.

1.1. Background of Deepfake Voice Technology
Deepfake voice technology is based on advanced Artificial Intelligence techniques such as Deep Learning and Neural Networks. These systems are trained on large datasets of human speech recordings to learn voice patterns, pronunciation, tone, pitch, and emotional variations. Once trained, the model can generate synthetic speech that closely resembles a real person's voice[4]. Modern voice cloning systems use deep neural networks such as Generative Adversarial Networks (GANs), Recurrent Neural Networks (RNNs), and Transformer-based architectures to produce highly realistic audio. These models analyze spectral and temporal characteristics of speech and replicate them with minimal distortion. As a result, synthetic voices are becoming

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increasingly difficult to distinguish from genuine human speech shown in Figure [1]. This background highlights the importance of developing a reliable Real-Time Deepfake Voice Detection system to enhance digital security and prevent misuse of synthetic speech technologies [2].

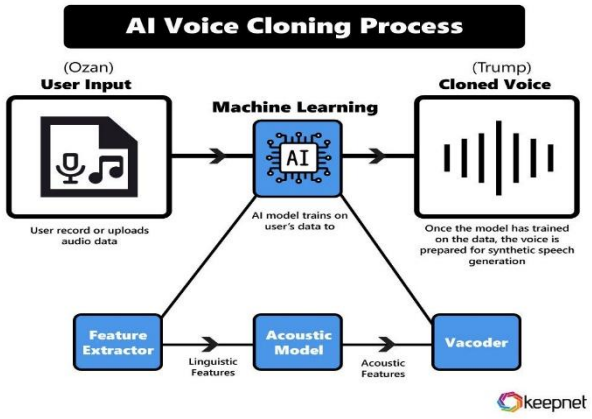

Figure 1: AI Voice Cloning Process

2. Methods

2.1.Dataset Collection

- Real human voice recordings were collected.
- Deepfake audio samples generated using AI voice synthesis tools were gathered.
- All audio samples were properly labeled as "Real" or "Fake".

2.2.Audio Preprocessing

Preprocessing improves audio quality and includes:

- Noise removal
- Normalization
- Silence trimming
- Sampling rate standardization

2.3.Feature Extraction using MFCC

Mel Frequency Cepstral Coefficients (MFCC) are extracted from audio signals. MFCC converts speech signals into numerical representations that reflect human auditory perception. These features help the classifier distinguish between real and synthetic speech [3].

3. Results And Discussion

3.1.Results

The trained model was evaluated using test audio samples. Performance metrics include:

- Accuracy
- Precision
- Recall
- F1-score

The system achieved approximately 90–95% accuracy depending on dataset quality.

3.2.Discussion

The results indicate that MFCC features combined with SVM and Random Forest provide strong classification performance. Random Forest showed better robustness in noisy environments, while SVM provided stable decision boundaries. The system demonstrates strong potential for real-time deepfake detection applications.

Conclusion

This paper presents a real-time deepfake voice detection system using machine learning techniques. By extracting MFCC features and applying SVM and Random Forest classifiers, the system successfully distinguishes between real and AI-generated speech. The proposed solution achieves high accuracy and low latency, making it suitable for practical deployment in cybersecurity, banking verification, and media authentication systems. Future work includes integrating deep learning models and expanding the dataset to improve generalization.

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Recent research in deepfake voice detection focuses on identifying synthetic speech artifacts using machine learning and deep learning approaches. MFCC (Mel Frequency Cepstral Coefficients) has been widely used for extracting meaningful speech features because it represents frequency components based on human auditory perception. Traditional classifiers such as Support Vector Machine (SVM) and Random Forest have shown strong performance in binary classification tasks involving real and synthetic speech. Several studies report that SVM provides stable classification boundaries in high-

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dimensional feature spaces, while Random Forest reduces overfitting and improves robustness in noisy conditions.

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