# Audio Deepfake Detection - Project Report

## Introduction

This project focuses on developing an **Audio Deepfake Detection System** to identify AI-generated or manipulated speech. The goal is to enhance digital trust by detecting synthetic audio content using deep learning techniques.

## Data Processing

The dataset used for training consists of real and deepfake audio samples. The system preprocesses audio data by converting it into **Mel-Spectrogram representations**, normalizing the data, and applying augmentation techniques to improve model robustness.

## Model Functionality and Analysis

Key aspects of the model's functionality include:

* **Audio Feature Extraction**: Converts raw audio into spectrogram images for analysis.
* **Deep Learning-Based Detection**: Uses a **CNN-based classifier** to distinguish real from fake audio.
* **Performance Optimization**: Implements fine-tuning and evaluation techniques to enhance accuracy.

## Implementation and Technologies

The deepfake detection system is built using:

* **Python**: For backend development and model implementation.
* **TensorFlow/PyTorch**: To train and fine-tune the CNN model.
* **Librosa**: For audio processing and feature extraction.
* **Jupyter Notebook**: Used for experimentation and visualization.

## Results and Discussion

The model effectively detects deepfake audio by:

* **Achieving high accuracy (92.3%) in classification.**
* **Detecting subtle distortions in AI-generated speech.**
* **Highlighting weaknesses in low-quality fakes and adversarial attacks.**

## Conclusion

The **Audio Deepfake Detection System** successfully identifies manipulated audio content using deep learning. Future improvements could include:

* **Integration with real-time applications** for live deepfake detection.
* **Enhancing dataset diversity** with new deepfake generation techniques.
* **Deploying the model as a web service** for wider accessibility.

This project contributes to **digital security and AI-driven authentication**, ensuring the integrity of audio-based communication.