DEEPFAKE DETECTION USING MULTIMODAL ANALYSIS | PROJECT PROPOSAL |

CSE299.5
Spring 2025
Group : 2

Atique Shahrier Chaklader
2132882642
Md.Waliul Sakib
2212570042
Samin Yeasar Badhon
2212208042

INTRODUCTION

- **What are Deepfakes?**
  - **AI-generated synthetic media (video, audio) that can deceive viewers.**
- **Problem Statement:**
  - **Deepfakes threaten security, privacy, and public trust.**
  - **Current systems focus on single modalities and are vulnerable to advanced techniques.**
- **Key Challenge:**
  - **Need for a robust multimodal system to detect deepfakes reliably.**

PROJECT OBJECTIVE

Goal

Develop a Python-based deepfake detection system using multimodal analysis.

Core Features

Visual Analysis: Detect artifacts in video frames.
Audio Analysis: Identify synthetic voice and lip-sync mismatches.
Temporal Analysis: Analyze motion and frame consistency.
Multimodal Fusion: Combine all modalities for better accuracy.
User-Friendly Interface: App for video analysis and detailed reports.

CURRENT SIMILAR PROJECTS

-Existing Solutions:

- Microsoft Video Authenticator: Focuses on visual artifacts.

https://www.microsoft.com/en-us/videoauthenticator

- Deepware.ai: Uses AI to detect deepfakes but lacks multimodal fusion.

https://deepware.ai/

- Deeptrace: Analyzes deepfakes but is not open-source.

https://www.deeptracelabs.com/

-Limitations:

- Most systems focus on single modalities (visual or audio).
- Lack of explainability and robustness against adversarial attacks.

METHODOLGY

Step 1: Preprocessing and Training Models:

- **Visual Analysis: Train CNN (e.g., MobileNet) on DFDC and Celeb-DF datasets.**
- **Audio Analysis: Use Librosa for spectrogram generation**

and train CNN for voice artifact detection.

- **Temporal Analysis: Train RNN or Transformer on sequences of video frames.**
- **Multimodal Fusion: Combine outputs using late fusion or attention mechanisms.**

Step 2: Deployment:

- **Backend: Flask API for processing.**
- **Frontend: User-friendly GUI (Tkinter for desktop or Flask for web).**

DATASETS

Datasets to be Used:

DeepFake Detection Challenge Dataset (DFDC): High-quality real and fake videos.

- **https://ai.facebook.com/datasets/dfdc/**

FakeAVCeleb Dataset: Audio-visual deepfake examples.

- **https://github.com/DashanGao/FakeAVCeleb**

Celeb-DF: High-quality facial deepfake videos.

- **https://github.com/yuezunli/celeb-deepfakeforensics**

VoxCeleb: Audio dataset for voice analysis.

- **https://www.robots.ox.ac.uk/~vgg/data/voxceleb/**

OpenSLR: Speech datasets for synthetic voice detection.

- **https://openslr.org/**

TECHNOLOGIES AND TOOLS

Programming Languages

1. Python

Frameworks and Libraries

1. Deep Learning: PyTorch
2. Visual Analysis: Mediapipe
3. Audio Analysis: Librosa, Matplotlib
4. Multimodal Fusion: Scikit-learn
5. Deployment: Tkinter (desktop app)
6. Explainable AI: Grad-CAM

Free Resources

1. Cloud Training: Google Colab (Free Tier)
2. Deployment Hosting: Streamlit Cloud

REFERENCES AND LINKS

Existing Projects Using Datasets:

- **DFDC Dataset:**
  - Facebook's DeepFake Detection Challenge: https://ai.facebook.com/datasets/dfdc/
- **FakeAVCeleb Dataset:**
  - FakeAVCeleb GitHub Repository: https://github.com/DashanGao/FakeAVCeleb
- **Celeb-DF Dataset:**
  - Celeb-DF GitHub Repository: https://github.com/yuezunli/celeb-deepfakeforensics
- **VoxCeleb Dataset:**
  - VoxCeleb Official Website: https://www.robots.ox.ac.uk/~vgg/data/voxceleb/
- **OpenSLR Dataset:**
  - OpenSLR Official Website: https://openslr.org/

Datasets:

- **DFDC**: https://ai.facebook.com/datasets/dfdc/
- **FakeAVCeleb**: https://github.com/DashanGao/FakeAVCeleb
- **Celeb-DF**: https://github.com/yuezunli/celeb-deepfakeforensics
- **VoxCeleb**: https://www.robots.ox.ac.uk/~vgg/data/voxceleb/
- **OpenSLR**: https://openslr.org/

TIMELINE(TENTATIVE)

- **Project Milestones**
- **Week 1-2: Dataset collection and preprocessing.**
- **Week 3-5: Model training (visual, audio, temporal).**
- **Week 6: Multimodal fusion.**
- **Week 7: App development (backend, GUI).**
- **Week 8: Testing and deployment.**
- **Week 9: Final report and presentation.**

CONCLUSION

- **Key Takeaways:**
  - **-Deepfake detection requires a multimodal approach for robustness.**
  - **-This project combines free resources to develop a comprehensive solution.**
- **Expected Impact:**
  - **-Improved trust in digital media.**
  - **-Enhanced tools for journalists, law enforcement, and content moderators.**
- **Future Work:**
  - **-Incorporate more modalities (e.g., text analysis).**
  - **-Improve robustness against adversarial attacks.**

Q/A?