ALZHEIMER'S DISEASE PREDICTION AND CLASSIFICATION

AP LAB

Presented by Group-15

OUR TEAM

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INTRODUCTION

- Alzheimer's disease is a progressive neurodegenerative disorder leading to memory loss.
- Early detection is crucial for timely intervention.
- Machine learning in Python can analyze medical data to assist in diagnosis.
- This project uses MRI scans, cognitive scores, and clinical data for detection.
- This research aims to harness the power of CNNs to develop a practical and accessible web-based system for the early detection of Alzheimer's disease using readily available MRI data

WHAT IS ALZHEIMER'S DISEASE?

- Alzheimer's disease is a neurological disorder that gradually diminishes memory and cognitive abilities.
- It impairs the ability to perform even simple tasks.
- People with Alzheimer's experience changes in behavior and personality.
- Over 6 million Americans, mostly aged 65 and older, are affected by Alzheimer's.
- The number of those affected exceeds the population of many large American cities.
- Family members and friends are also impacted by the disease.
- Symptoms of Alzheimer's, such as changes in thinking and behavior, are collectively called dementia.
- Alzheimer's is the most common cause of dementia among older adults.
- Alzheimer's disease is not a normal part of aging. It results from complex brain changes that start years before symptoms appear, leading to brain cell loss and disconnections.

OBJECTIVES OF DATASET ANALYSIS

- Thoroughly examine the data's inherent characteristics and distribution among different stages of Alzheimer's disease.
- Recognize potential class imbalances that could affect model training and require addressing.
- Visually analyze image data to identify key features and patterns that signify Alzheimer's progression.
- Use the insights from visual analysis to guide feature engineering and model creation.
- Lay the groundwork for developing a strong and impartial predictive model for early and accurate diagnosis.
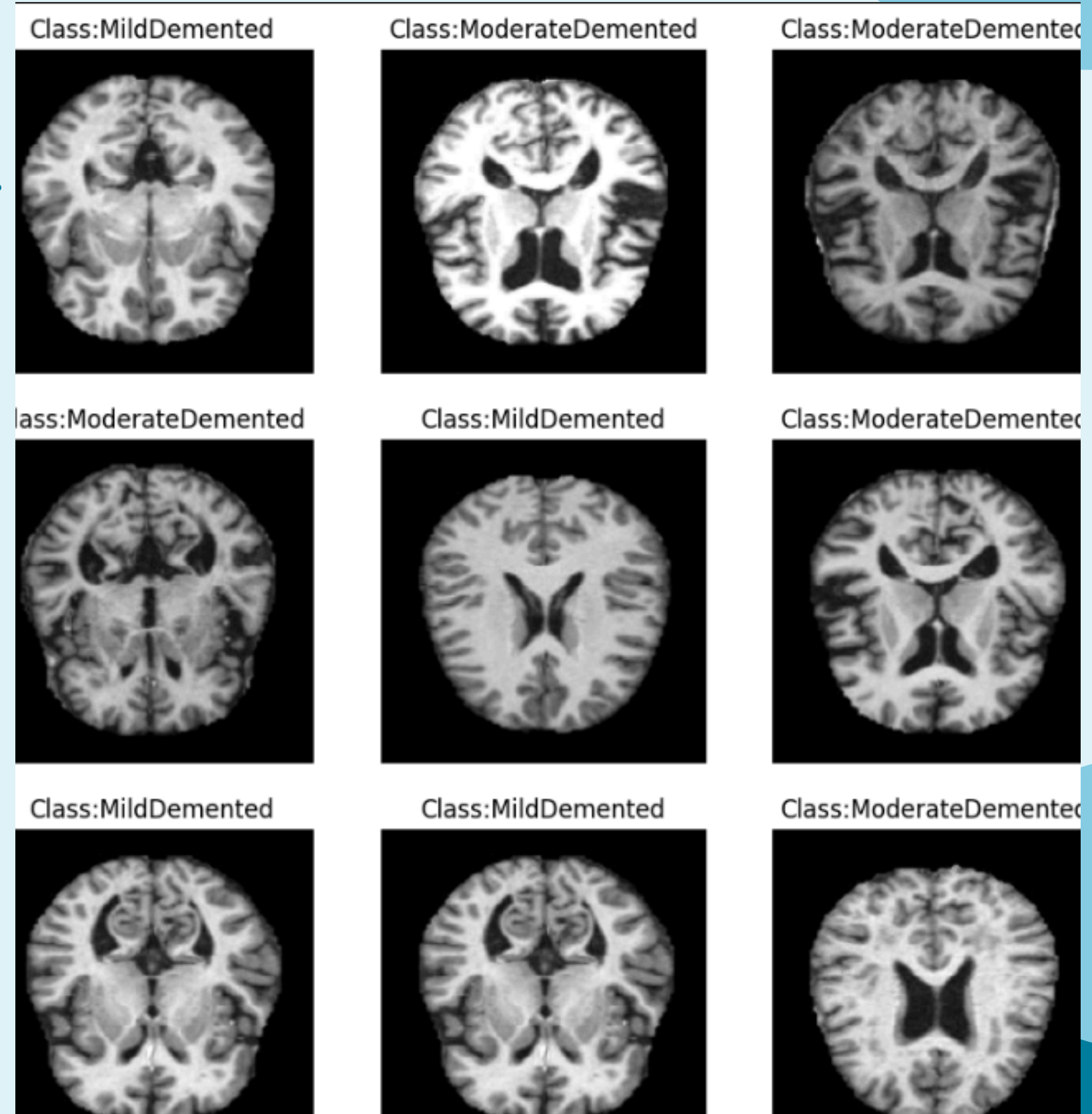
AI FOR ALZHEIMER'S DETECTION: A QUICK OVERVIEW

- Problem: Alzheimer's needs early detection.
- Solution: AI (Deep Learning) analyzes brain scans.
- How: CNNs classify disease stages.
- Data: Images are prepped & enhanced.
- Why: Understandable AI builds trust.
- Goal: Accurate & efficient diagnosis.
- Future: AI can improve detection & care.
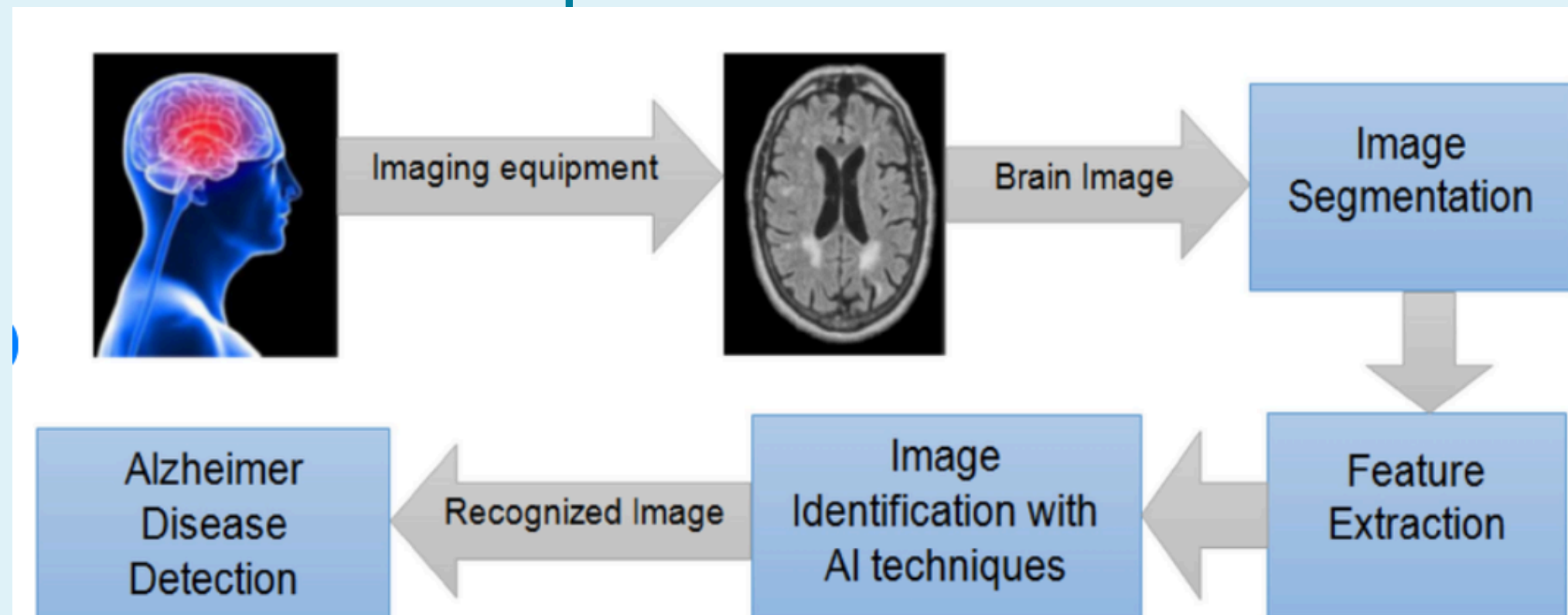
TECHNOLOGIES USED

- Python: Core programming language.

- TensorFlow/Keras: Deep learning framework.

- OpenCV & PIL : Image preprocessing.

- Streamlit : Web-based UI.

- MySQL : Database for patient records.

- FPDF : Automated report generation.

MODEL TRAINING & PREDICTION

- Uses a pre-trained deep learning model (my_model.h5).

- Classifies MRI scans into Mild, Moderate, Non-Demented, or Very Mild Demented stages.
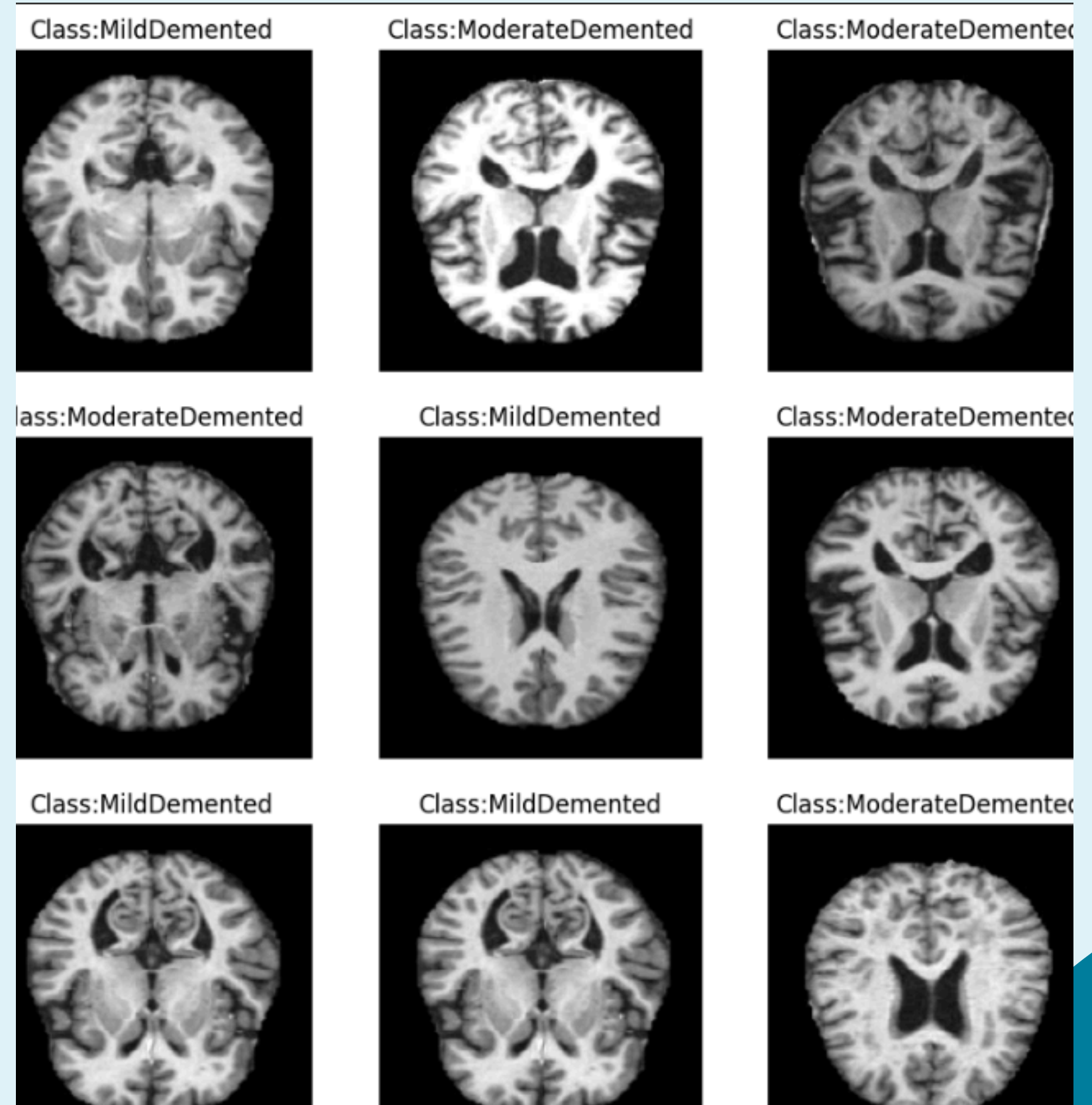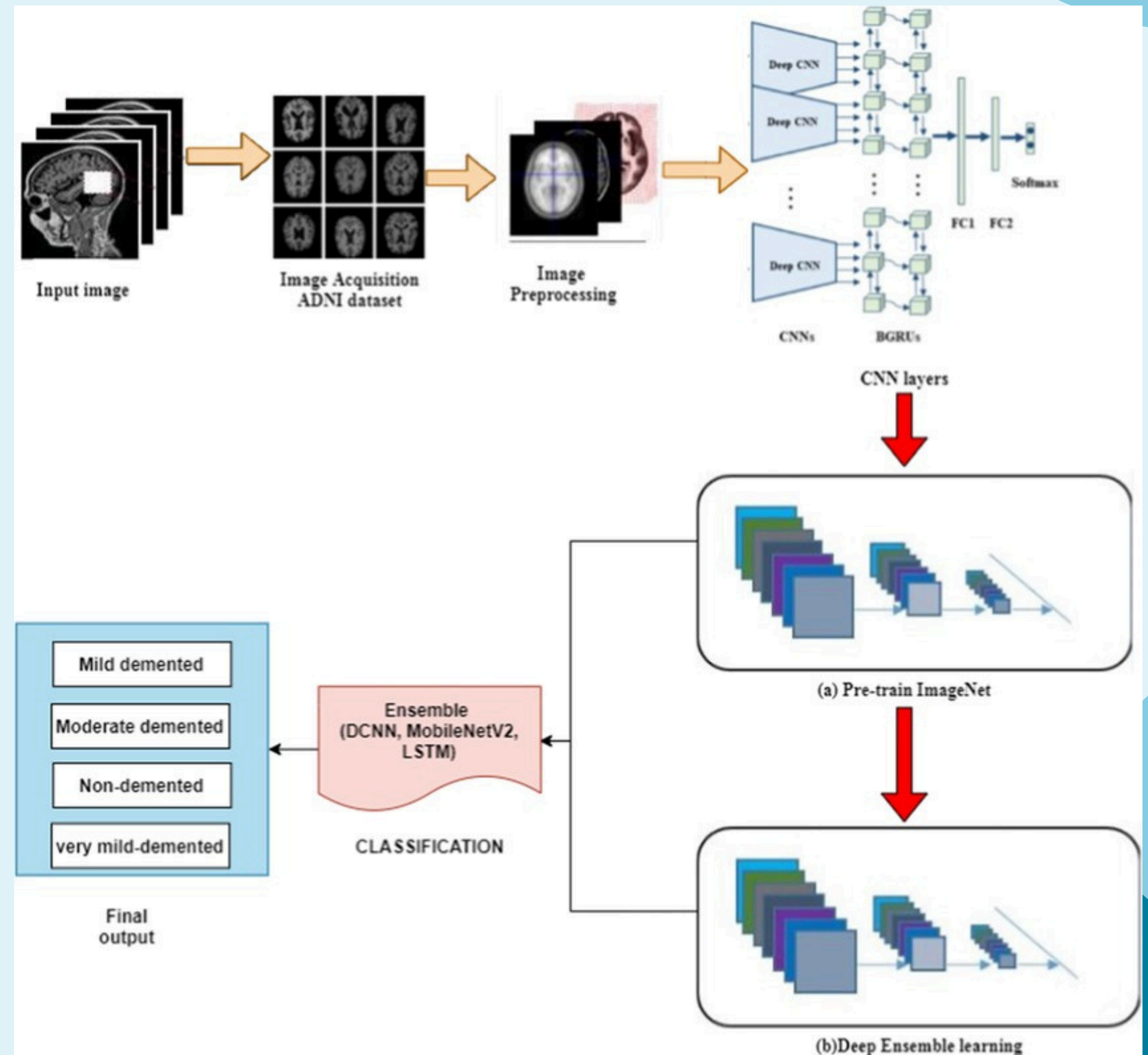
- Predictions are based on image features extracted using AI.

IMAGE PREPROCESSING

- Converts MRI images to RGB format.

- Resizes images to 176x176 pixels.

- Normalizes pixel values to improve prediction accuracy.

WEB APPLICATION DEVELOPMENT

- Built with Streamlit for a user-friendly experience.

- Allows users to upload MRI images for real-time analysis.

- Displays instant prediction results.
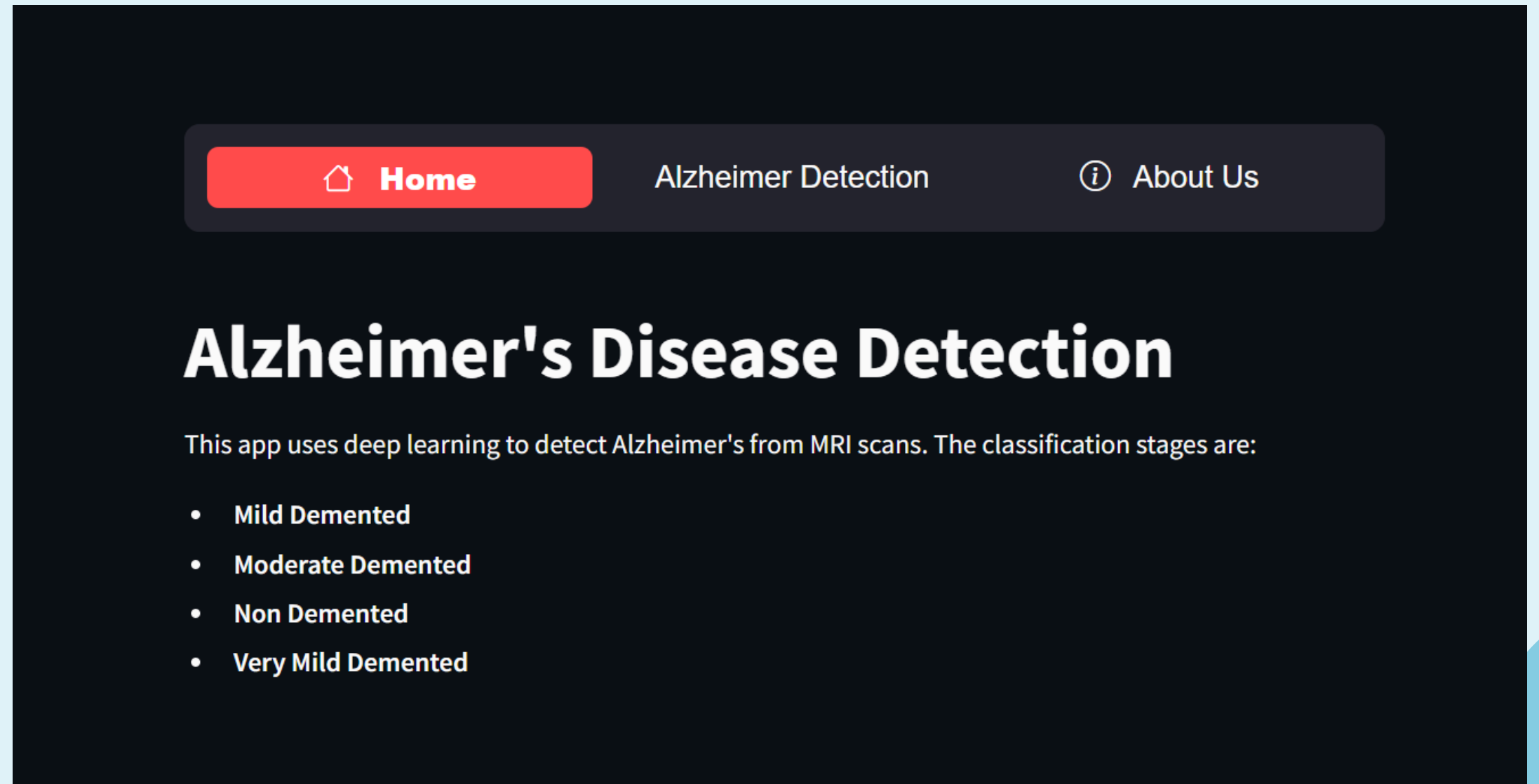
REPORT GENERATION

- Generates downloadable PDF reports for each diagnosis.
- Includes patient details and predicted Alzheimer's stage.
- Facilitates medical record-keeping and consultation.

Upload MRI Scan

Drag and drop file here
Limit 200MB per file • JPG, JPEG, PNG

Browse files

Submit

Export Report

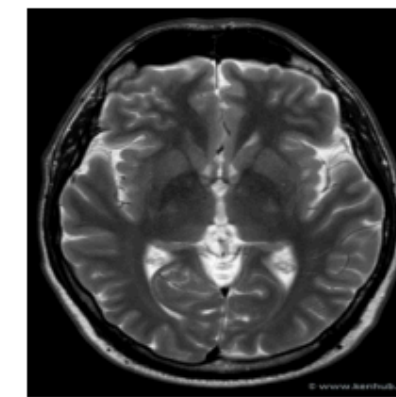Download Report

Alzheimer Detection Report
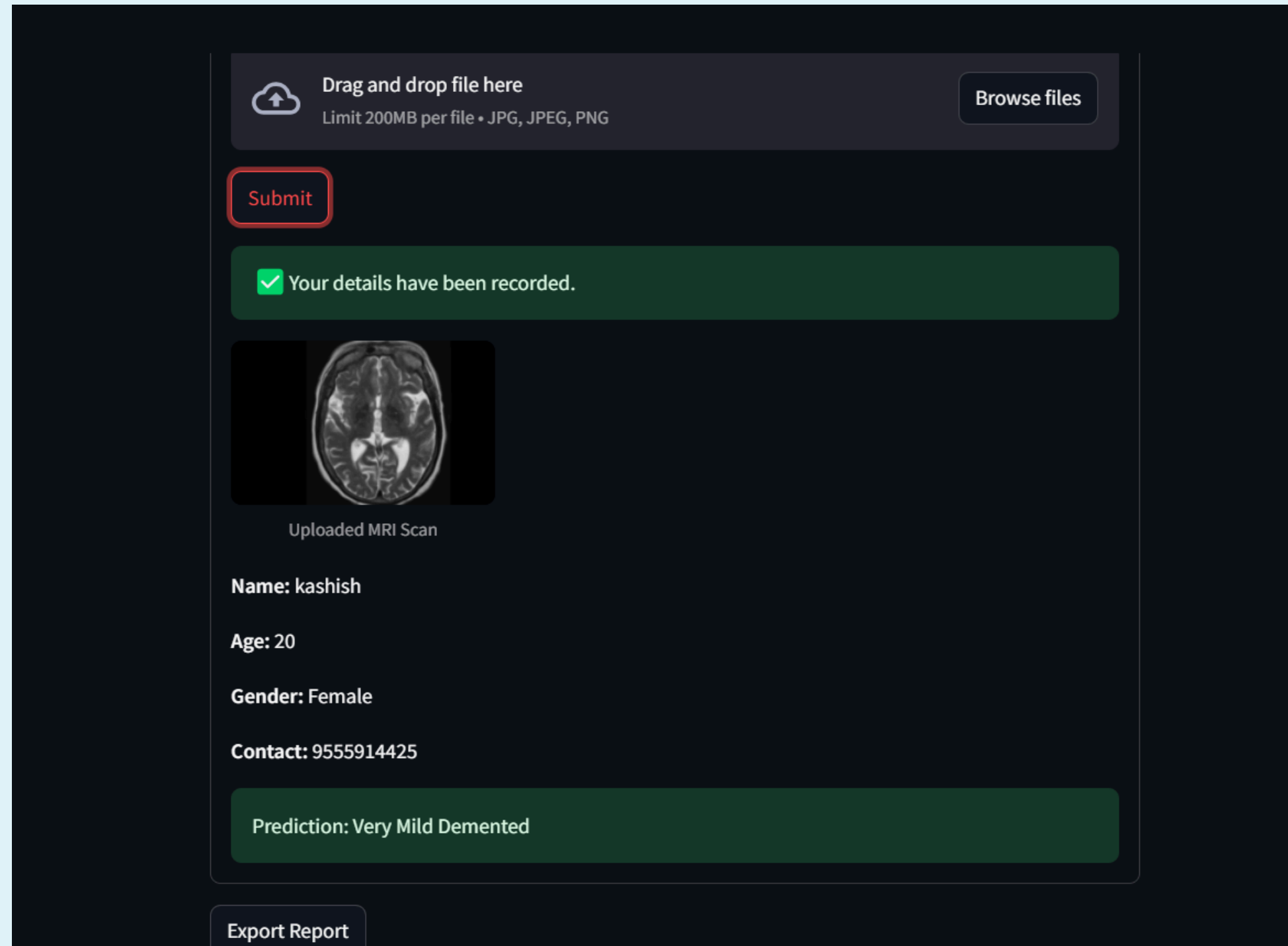
Name: naurav

Age: 23

Gender: Male

Contact: 1234567890
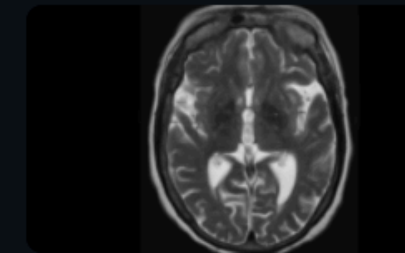
Prediction: Very Mild Demented

RESULTS

- Successfully classifies MRI scans into Alzheimer's stages.
- Provides an interactive web interface for easy usage.
- Secure database management for patient records.

FUTURE ENHANCEMENTS

- Model Optimization: Implement techniques like hyperparameter tuning and model ensembling to improve prediction accuracy.
- Data Augmentation Integration: Incorporate advanced data augmentation strategies within the data pipeline to increase dataset diversity and robustness.
- Explainable AI (XAI): Integrate interpretability methods (e.g., Grad-CAM) to provide insights into the model's decision-making process.
- Scalability Improvements: Optimize the data loading and preprocessing pipeline for handling larger datasets and faster training times.
- Automated Evaluation Metrics: Implement automated tracking and logging of various evaluation metrics during training and validation.
- API Development: Develop a RESTful API to easily integrate the trained model into other applications or systems.

USER INTERFACE

CASE STUDIES

- Mayo Clinic AI Trial: Achieved over 83% accuracy in early Alzheimer's detection using deep learning models.
- Google Health & Alzheimer's Research: AI models integrated with neuroimaging and cognitive assessments to refine risk prediction.
- IBM Watson & Biogen Collaboration: Applied AI-driven analysis of genetic and biomarker data for early detection and drug development.
- MIT Speech Processing Study: Used NLP techniques to analyze speech recordings, detecting early cognitive impairment with 87% accuracy.
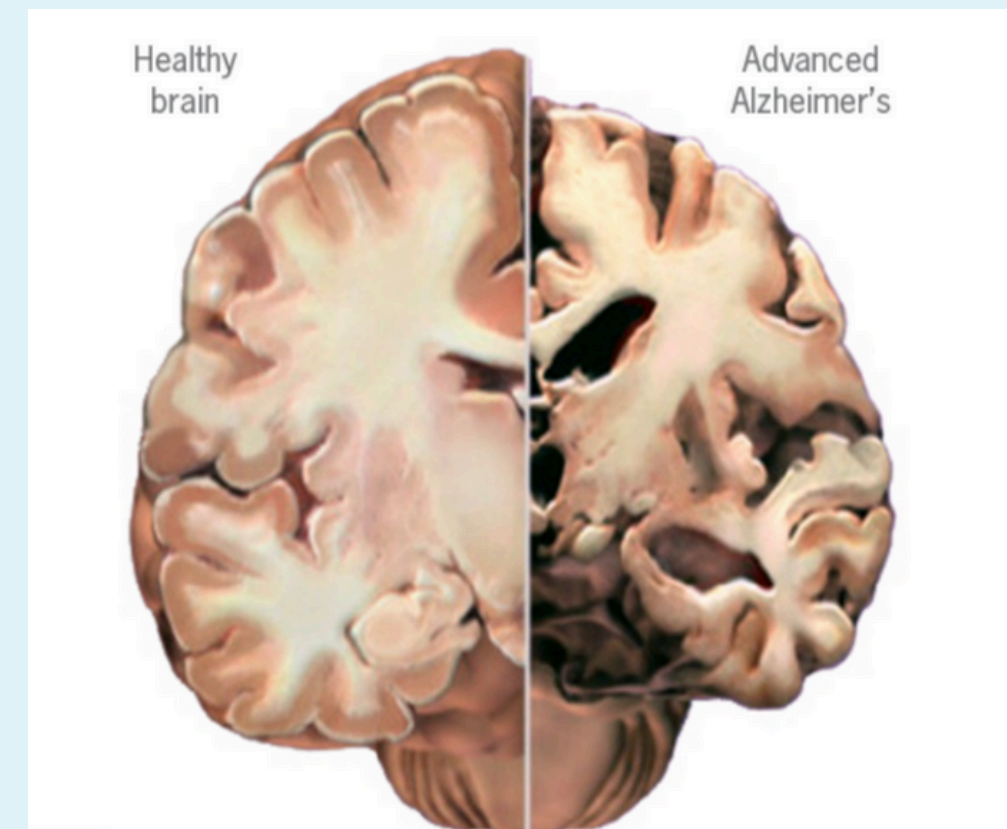
CHALLENGES AND ETHICAL CONSIDERATIONS

Here are four code-related challenges often encountered in Alzheimer's disease detection projects:

- Data Imbalance: Addressing the inherent class imbalance within medical image datasets, where certain disease stages may have significantly fewer samples.
- Model Complexity: Selecting and tuning appropriate deep learning architectures that can effectively learn complex patterns from medical images while avoiding overfitting.
- Data Preprocessing Pipeline: Developing a robust and efficient data preprocessing pipeline that handles variations in image quality, size, and format.
- Interpretability Limitations: Enhancing the interpretability of the model's predictions, as understanding the "why" behind a diagnosis is crucial in medical applications.

CONCLUSION & FUTURE SCOPE

- Successful creation of a web-based system for early Alzheimer's detection using deep learning on MRI data.
- Combines a trained CNN model with an intuitive Streamlit interface and a strong backend database.
- Serves as a practical, accessible tool to aid in the diagnostic process.
- Demonstrates the potential of deep learning in medical imaging for more accurate and timely diagnoses.

Future improvements will focus on exploring advanced CNN architectures like 3D CNNs to better utilize volumetric MRI data.

THANK YOU