

# Facial Recognition System Project

# Team project

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# Executive Summary

- 5 key milestones of the project
- Data collection & preprocessing (LFW dataset)
- Model development (FaceNet with transfer learning)
- Deployment (Streamlit on Hugging Face)
- MLOps implementation (MLflow, Kubeflow)
- Performance analysis

# Project Overview

- Problem: Challenges in facial recognition (varying lighting, poses, demographic bias)
- Solution: End-to-end production-ready system
- Application domains: Identity verification, access control, security

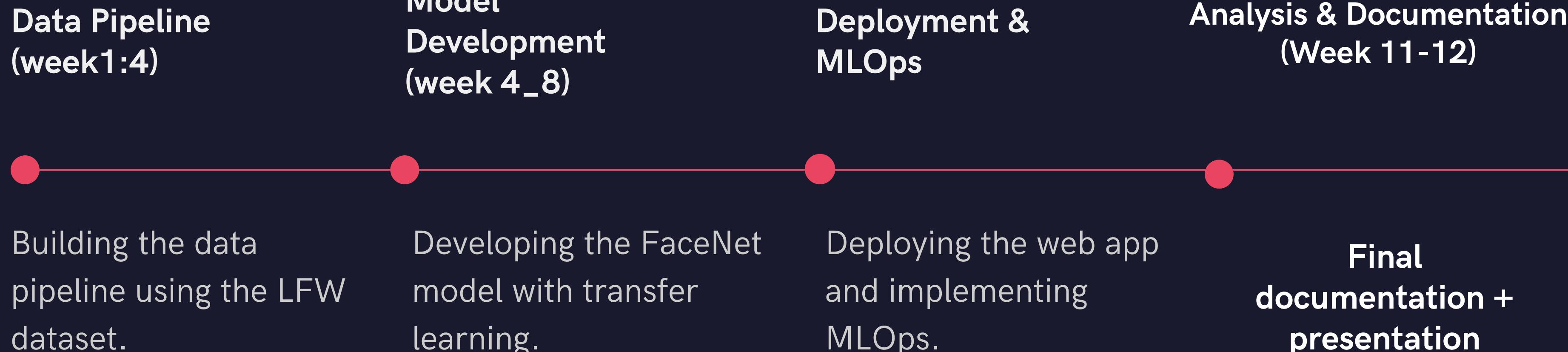
# Project Objectives

## Achieving High Accuracy and Efficiency

- Achieve high accuracy (>80%) on LFW dataset
- Implement comprehensive MLOps practices
- Build production-ready web application
- Optimize performance for real-time inference
- Ensure fairness across demographic groups

# Project Timeline

**Data Pipeline**  
**(week 1-4)**



Building the data pipeline using the LFW dataset.

**Model Development**  
**(week 4-8)**

Developing the FaceNet model with transfer learning.

**Deployment & MLOps**

Deploying the web app and implementing MLOps.

**Analysis & Documentation**  
**(Week 11-12)**

Final documentation + presentation

# Team Roles

## Allocation of Resources and Responsibilities

Our project relies on a **dedicated team** utilizing GPU resources for training, along with MLflow for tracking and Kubeflow for orchestration, ensuring efficient workflow management.



# Deep Learning Architectures

- FaceNet: 23M parameters, 128D embeddings, **99.63% accuracy**
- VGGFace2: 25M parameters, 2048D embeddings
- ArcFace: 65M parameters, 512D embeddings
- MobileFaceNet: 1M parameters (**lightweight**)

Architecture	Parameters	Embedding Size
FaceNet	23M	128
VGGFace2 (ResNet-50)	25M	2048
ArcFace (ResNet-100)	65M	512
MobileFaceNet	1M	128

# System Design Overview

01

## Presentation Layer

User interfaces facilitate interaction and display results seamlessly.

02

## Application Layer

Core logic processes requests and manages data flow efficiently.

03

## ML Layer

Machine learning models perform tasks such as face recognition.

# Face Verification Flow

The face verification process ensures accurate matching through a systematic approach, enhancing security and user experience.



# Testing and Metrics

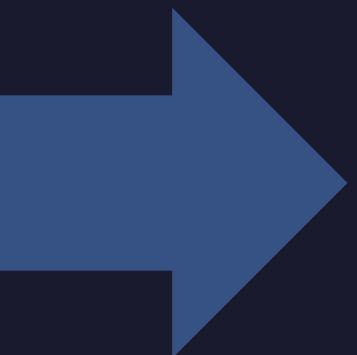
## Ensuring Quality and Reliable Performance

**Comprehensive testing improved accuracy from 70% to 80% after transfer learning, achieving over 99% uptime and maintaining inference times under 500 milliseconds for efficiency.**



# Accuracy

70



80

Pre-trained FaceNet  
accuracy

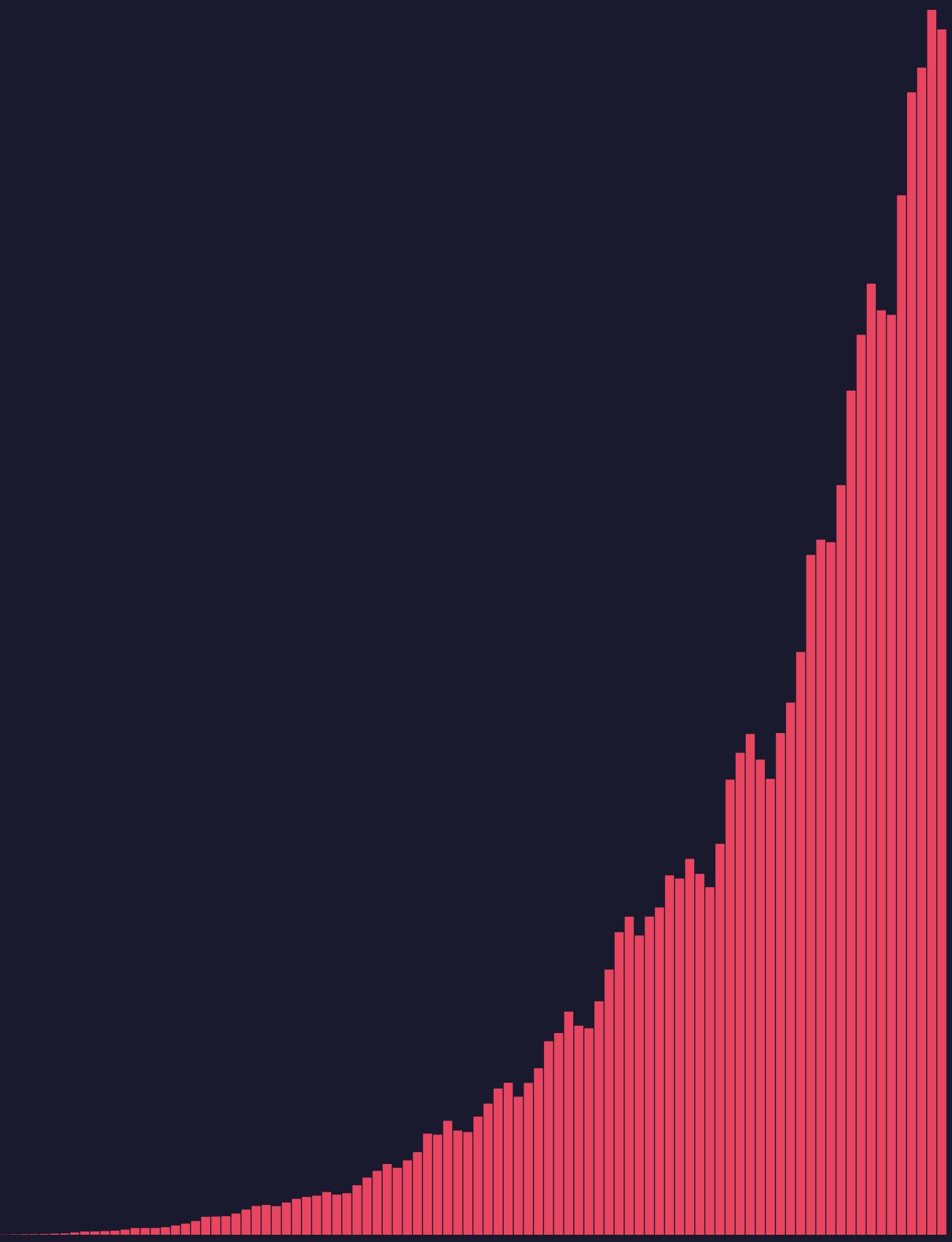
Fine-tuned FaceNet  
accuracy

# Key Performance Statistics

80% Recognition  
Accuracy

**<500 ms**

Inference time for real-time processing



# Ethical Considerations in Facial Recognition Systems



## Bias Mitigation

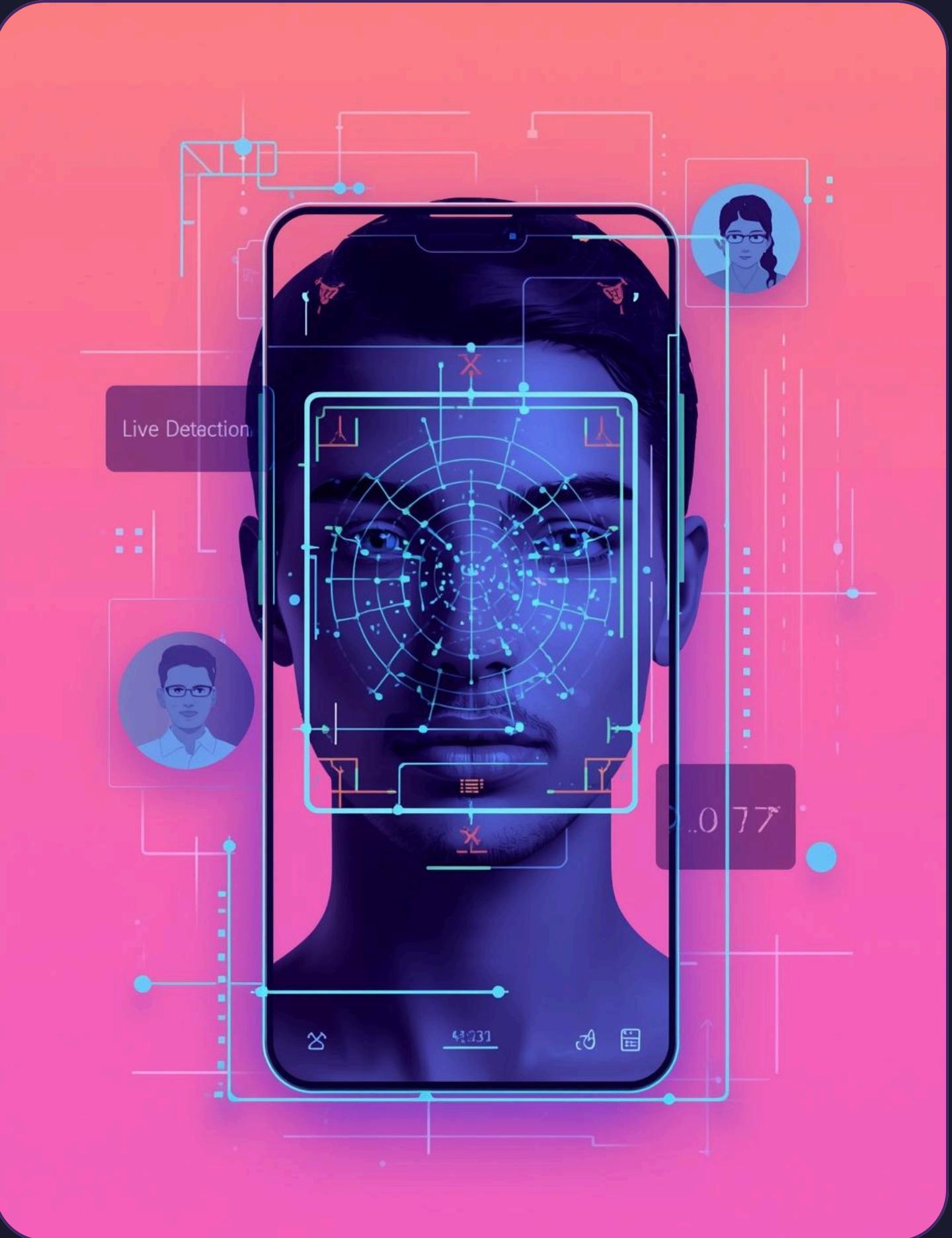
Ensuring **balanced datasets** for fair outcomes is crucial.

## Privacy Protection

Implementing **data anonymization** measures to safeguard identities.

# Key Achievements

- Successfully achieved 80% accuracy on LFW dataset
- Production-ready system with MLOps best practices
- Robust deployment on Hugging Face Spaces
- Scalable microservices architecture
- Commitment to fairness and privacy



# Challenges & Resolutions

- Challenge 1: Numpy array truth value error during registration
  - Resolution: Used explicit len() checks
- Challenge 2: Live video lag
  - Resolution: Implemented frame skipping (1 recognition/second)

# Thank You

