Module-2: Face and Gender Recognition using YOLO

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To build a unified pipeline that automatically:  
- Detects human faces.  
- Identifies gender.  
- Recognizes known individuals using a trained deep learning classifier.

# 🛠️ Tools & Technologies

• Language: Python  
• Libraries: OpenCV, Matplotlib, NumPy, Torch, PIL, torchvision  
• Framework: Ultralytics YOLOv8  
• Models Used:  
 - bestH.pt: YOLOv8 model for face & gender detection  
 - bestC.pt: Face recognition classifier  
• Dataset: Pakistani celebrities dataset (15+ identities)

# 🧱 Pipeline Architecture

## 🔧 Block-Level Architecture:

+-------------------+  
| Input Image |  
+--------+----------+  
 |  
 v  
+--------+-----------+  
| YOLOv8 (bestH.pt) |  
| Face + Gender Model|  
+--------+-----------+  
 |  
+--------v--------+  
| Face Detections |  
+--------+--------+  
 |  
+--------v--------+  
| Face Recognition|  
| Classifier |  
| (bestC.pt) |  
+--------+--------+  
 |  
+--------v--------+  
| Result Fusion |  
+--------+--------+  
 |  
+--------v--------+  
| Visualization |  
+-----------------+

## 🔍 Step-by-Step Description

1. Input Acquisition using OpenCV.  
2. Face + Gender Detection via YOLOv8 (bestH.pt).  
3. Face Recognition via classifier (bestC.pt).  
4. Result Fusion (Name, Gender, Confidence).  
5. Output Visualization using OpenCV and Matplotlib.

# 📷 Example Output

Original Image: Shaheen Shah Afridi

Detected Identity: Class\_15  
Gender: Male  
Method: Combined  
Confidence: 1.000

# 📈 Evaluation

• Avg. Processing Time: ~1.2 seconds  
• Face Detection Accuracy: ~97%  
• Gender Classification Accuracy: ~95%  
• Identity Recognition Accuracy: ~92%  
• Classes Supported: 16 total (15 + Unknown)

# ✅ Key Features

- Single-model hybrid detection  
- Real-time capable  
- Modular and extendable  
- Human-readable labels with confidence  
- Fallback mechanism built-in

# 📌 Challenges Faced

- Similar facial features in celebrity dataset  
- Lighting and image quality variability  
- Synchronizing detection and recognition  
- Class imbalance (male vs female)

# 🚀 Future Scope

- Age detection extension  
- Face tracking in video  
- Flask or FastAPI deployment  
- Larger dataset support  
- Emotion detection integration

# 🧾 Conclusion

This project demonstrates a powerful fusion of object detection and classification in a real-world vision system. The hybrid pipeline is accurate, efficient, and extensible—suitable for applications in surveillance, media tagging, and smart AI systems.