HUMAN FACE DETECTION

PROJECT OBJECTIVE

- Detect human faces in images and videos using deep learning
- Deploy a real-time detection system using yolov8
- Handle challenges like variation in pose, lighting, size, and occlusion

TECHNOLOGIES USED

- **libraries**: pytorch, opencv, albumentations, pandas, numpy
- **model**: yolov8 (pre-trained and fine-tuned)
- **tools**: streamlit, google colab, matplotlib
- **annotation format**: pascal voc, csv

DATASET & PREPROCESSING

- 800 images with face annotations
- annotations cleaned and converted to pascal voc format
- images resized to 800×800 to reduce memory use
- sample image + bounding boxes shown

DATA AUGMENTATION

- **used albumentations for:**
  - **flip, rotate, brightness/contrast, shiftscalerotate**
- **purpose: improve model generalization**
- **before and after images shown**

EXPLORATORY DATA ANALYSIS

- number of images and faces
- faces per image (mean, min, max)

MODEL TRAINING

- YOLOv8s model used (lightweight + fast)
- Data split into Train / Validation
- Configuration in YAML format
- Training Metrics:
  - Loss (Box, Objectness, Class)
  - mAP50 and mAP50-95

RESULTS

- Face detection samples (image, video, webcam)
- Accuracy & inference speed
- Confusion matrix (optional)
- Precision / Recall / mAP

DEPLOYMENT

- Deployed with Streamlit for:
  - Image, video, webcam inference
- Real-time detection frame rate
- Model exported and ready for TensorRT

CONCLUSION

- YOLOv8 effectively detects human faces
- Good accuracy, real-time capable
- Ready for use in surveillance, attendance, interaction systems