# Project Summary: Helmet Detection using YOLOv5 on Google Colab

This project involves training and deploying a YOLOv5 model to detect helmet usage among motorcyclists in real-time video feeds. The primary objective is to identify and classify motorcyclists as either 'with helmet' or 'without helmet' using computer vision techniques. The model is trained on a custom dataset and deployed on Google Colab, with all relevant files saved to Google Drive for easy access and storage.

## Key Steps

### 1. Mounting Google Drive:

Using drive.mount('/content/drive') to access Google Drive, enabling easy saving and retrieval of dataset, model weights, and results.

### 2. Training the YOLOv5 Model:

Initialized the YOLOv5 model (pre-trained on COCO) and set it up to train on a custom helmet detection dataset. Configured training parameters:

- data.yaml: Specifies dataset paths and class names (with helmet and without helmet).

- epochs=50: Set for sufficient model learning without overfitting.

- imgsz=640: Ensures images are resized to 640x640 pixels for consistent processing.

- batch=16: Defines the batch size based on available resources.

- name='helmet\_detection\_yolov5': Names this training experiment for easy identification.

After training, the model reached optimal accuracy in distinguishing between helmeted and non-helmeted riders.

### 3. Inference on Video:

Loaded a trained model (/content/drive/MyDrive/helmet\_detection\_model.pt) to perform real-time detection on a sample video. Processed each frame, identifying riders with or without helmets. Used cv2\_imshow (Google Colab-compatible) to display annotated frames in real-time. The system added bounding boxes around detected individuals and labeled them with confidence scores to visually confirm helmet usage.

### 4. Saving the Trained Model:

Saved the final model weights to Google Drive (helmet\_detection\_model.pt) for future use or further refinement, ensuring easy access for deployment or additional training.

## Applications

This helmet detection system can be implemented in real-world scenarios for public safety and law enforcement. By integrating with traffic monitoring systems, authorities can efficiently monitor helmet compliance among motorcyclists, promoting road safety and compliance with local laws.

## Future Work

Potential improvements include:

- Enhancing the dataset with diverse lighting and weather conditions for robustness.

- Experimenting with different YOLO versions or architectures to improve detection accuracy and processing speed.

- Deploying the model on edge devices or integrating it with cloud-based video surveillance systems for large-scale applications.

This project demonstrates a complete workflow, from data handling and training to real-time deployment and model saving, utilizing Google Colab and Google Drive effectively for large-scale training and storage.