Project Report: PPE Detection Using YOLO

1. Introduction

This project focuses on detecting Personal Protective Equipment (PPE) using a YOLO-based object detection model. The system processes images and identifies PPE items, ensuring safety compliance in various work environments. The dataset annotations are converted from Pascal VOC format to YOLO format to train the model effectively.

2. Dataset and Annotation Conversion

The dataset consists of images annotated in Pascal VOC format. To train the YOLO model, these annotations are converted into YOLO format using two separate scripts:

- pascalVOC_to_yolo.py: Converts all Pascal VOC XML annotations to YOLO format, including all classes specified in classes.txt.
- pascalVOC_to_yolo_ppe.py: Converts Pascal VOC XML annotations to YOLO format but excludes the "person" class, ensuring that only PPE-related objects are considered.

This separation allows for training two different models:

- A model that detects both persons and PPE.
- A model that detects only PPE items (useful for specific safety compliance applications).

3. Implementation Details

The project consists of the following key components:

- **Annotation Conversion Scripts**: Python scripts (pascalVOC_to_yolo.py and pascalVOC_to_yolo_ppe.py) for converting Pascal VOC XML annotations into YOLO format.
- **Model Training**: The YOLO model is trained using the converted dataset.
- **Inference Script**: A script (inference.py) to test the model on new images and visualize detections.
- **Packaging and Submission**: The project structure is maintained with dynamically updated paths, ensuring ease of use and reproducibility.

4. Usage Instructions

To convert Pascal VOC annotations to YOLO format, run the appropriate script:

For general YOLO annotation conversion:

python pascalVOC_to_yolo.py <input_directory> <output_directory> <classes_file>

For PPE-only YOLO annotation conversion:

python pascalVOC_to_yolo_ppe.py <input_directory> <output_directory> <classes_file>

For inference on test images:

python inference.py --weights model_best.pt --source test_images/

5. Conclusion

This project successfully enables PPE detection using YOLO by processing Pascal VOC annotations and converting them into a YOLO-compatible format. The separation of person and PPE detection allows for flexibility in different use cases. The model can be further optimized by fine-tuning hyperparameters and exploring real-time deployment options.

6. Submission Contents

- Annotated dataset (YOLO format)
- Annotation conversion scripts (pascalVOC_to_yolo.py, pascalVOC_to_yolo_ppe.py)
- Model training and inference scripts
- Documentation and usage instructions