Occlusion-Aware Object Detection Using a Custom Dataset

Mohammad Dawood Omidi

Objective

The main goal of this project is to develop a computer vision model capable of detecting a specific object in images, even when it is partially occluded. The model will be trained and fine-tuned using a custom dataset collected within the university environment.

Proposed Approach

Data Collection

- **Setting:** Pictures will be captured within the university, including classrooms, labs, and outdoor spaces.
- **Object of Interest:** The object to be detected (e.g., a specific object such as a lab apparatus or a piece of university equipment) will be chosen based on its prevalence in these environments.
- **Occlusion Scenarios:** Images will be taken under various occlusion conditions—partially hidden behind desks, other objects, or from different angles.
- **Dataset Size:** At least 400 images will be captured, ensuring diversity in lighting, angle, and occlusion levels.

Model Development

- **Base Model:** A state-of-the-art object detection architecture such as Faster R-CNN or YOLO will be chosen as the baseline.
- **Training:** The model will be trained on the collected dataset using a deep learning framework (e.g., PyTorch or TensorFlow).
- **Occlusion Handling:** Techniques like feature-based approaches (SIFT, SURF) or deformable part models (DPM) may be integrated to improve detection under occlusion.

Fine-tuning and Performance Optimization

- **Data Augmentation:** The dataset will be augmented by applying transformations such as rotation, scaling, and synthetic occlusion to make the model more resilient to occlusions.
- **Evaluation Metrics:** Performance will be measured using precision, recall, and intersection-over-union (IoU), with a focus on the model's ability to detect occluded objects.

Expected Outcomes

A robust object detection system that performs well in occlusion scenarios, with potential applications in vision-based tasks.