Progress Report: YOLOv8 Model Training on VisDrone Dataset

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I. PROGRESS SUMMARY

This week, we focused on refining the YOLOv5-based object detection and tracking pipeline. Our primary objective was to address challenges observed in the previous experiments, particularly in tracking performance and detection robustness.

A. Work Completed:

- Conducted additional training and fine-tuning of YOLOv5 on the VisDrone-MOT dataset.
- Instead of loading the entire YOLOv5 model, we selectively loaded only the required model weights to improve detection speed and reduce system overhead.
- Enhanced the tracking module to handle object tracking better in crowded and low-visibility environments. Applied smoothing techniques and refined object association logic to reduce frequent identity jumps.
- Addressed false identification and frequent ID switching issues present in the SimpleSORT algorithm by implementing DeepSORT, leveraging appearance feature embeddings for more accurate and consistent object re-identification across frames.
- Integrated the updated object detection and tracking modules into the full pipeline and conducted initial tests on VisDrone and other crowded datasets.
- Successfully integrated and fine-tuned the DeepSORT tracking algorithm on the VisDrone dataset, ensuring robust multi-object tracking with improved ID assignment and temporal consistency.

B. Milestones achieved:

- Successfully integrated a lightweight YOLOv5 detection module using only necessary weights, enhancing inference speed.
- Improved object tracking stability in dense and low-visibility environments compared to previous iterations.
- Reduced ID switching frequency in dynamic scenes, leading to more consistent multi-object tracking results.

II. CHALLENGES & RESOLUTIONS

A. Problems faced:

- False Detections: Changing confidence thresholds improved, but there are still some false positives.
- Drop in Detection Accuracy: After modifying the model to load only selected weights, a slight drop in overall detection accuracy was observed compared to the full model.

III. Upcoming Tasks

- Optimize computational efficiency for real-time application without loss of accuracy.
- Implement more advanced tracking algorithms (e.g., StrongSORT) to address ID switching and improve tracking robustness.
- Implement other tracking algorithms and perform comparison among ReID model to identify better algorithm.
- Evaluate ReID performance to improve identity consistency and reduce ID switches during long-term tracking.

IV. Conclusion

We integrated the YOLOv5 model with DeepSORT for object detection and tracking without retraining the YOLOv5 detector. As a results, while the system is able to detect and track objects, the overall tracking performance is optimal compared to approaches where the detection model is specifically trained and then combined with a ReID model. Moving forward, we will focus on improving the tracking accuracy by exploring better training strategies for detection and ReID integration,