GA Drawing Analysis Using AI-Based Detection and OCR Models

1. Purpose

This memorandum outlines the methodology, technology stack, and results for the GA Drawing Analysis project, which leverages state-of-the-art AI models to automate the extraction of tables, nozzle symbols, and notes from General Arrangement drawings.

2. Background

General Arrangement (GA) drawings contain critical engineering data. Manual extraction and interpretation are time-consuming and error-prone. The project aims to automate this process using advanced object detection and OCR techniques.

3. Technology Stack

- **Object Detection:** YOLOv8 (nano and standard) for cropping and detecting regions of interest (notes, tables, nozzles, views).
- **OCR & Table Parsing:** PaddleOCR with PPStructureV3 for recognizing text and table structures.
- **Notes Extraction:** DONUT model for structured note extraction.

4. System Resources

Resource	Specification
GPU	RTX 4070 Ti (12GB VRAM)
CPU	Intel Core i9-14900KF (24 cores)
RAM	64 GB

Currently, all inference runs on CPU for consistency and reproducibility.

5. Methodology

- **YOLOv8n for Notes and Tables**
  - Dataset: 11 annotated images augmented to 33; 1 validation image
  - Resolution: 2048
  - Performance: mAP50 = 99.5%, mAP = 93.9%

- **YOLOv8 for Views Detection**
  - Dataset: 11 annotated images augmented to 33; 1 validation image
  - Resolution: 1536
  - Performance: mAP50 = 99.5%, mAP = 95.1%

- **YOLOv8 for Nozzles Detection**
  - Dataset: 40 annotated images (with augmentation); 2 validation images
  - Resolution: 1024
  - Performance: mAP50 = 96%, mAP = 85%

- **DONUT for Notes Extraction**
  - Dataset created with Deepseek, 11 training images (runtime augmentation enabled), 1 test image
  - Edit Distance (ED): 0.031

6. Deployment and Usage

- Models are containerized using Docker and orchestrated via Docker Compose.
- API endpoint exposed at `localhost:8000/detect` for image processing requests.
- Detailed instructions for setup and running are available in the project README.

7. Conclusion

The integrated AI pipeline demonstrates good results in extracting critical information from GA drawings, significantly reducing manual effort and improving data reliability.

8. Next Steps

- Extend dataset size for further accuracy improvements.
- Optimize inference speed, including GPU acceleration.
- Enhance table extraction with seq-to-seq models like DONUT.

Prepared by Ahsen Nazir