General Object Detection on Industrial Settings

# Summary of the project

This project aims to develop a Minimum Viable Product (MVP) for an AI-powered general object detection system tailored for industrial settings. Building upon the work of the previous cohort, this iteration will focus on creating a functional, deployable product. The system will be designed to detect and categorize a wide range of objects commonly found in industrial environments, including but not limited to doors, people, fire extinguishers, and various types of equipment.

# Objectives

1. Dataset Compilation:

* Identify and compile a comprehensive public dataset specifically for industrial settings.
* Ensure the dataset includes a diverse range of objects such as doors, people, fire extinguishers, machinery, tools, and safety equipment. The complete list of objects are included in below sections.

2. Object Detection Model:

* Utilize pre-trained models (e.g., YOLO, Faster R-CNN) and fine-tune them for industrial object detection.
* Optimize the model for real-time performance in various industrial environments.

3. MVP Development:

* Create a user-friendly interface for easy deployment and use in industrial settings.
* Implement basic functionalities essential for practical use in industry.

4. Performance Optimization:

* Ensure the system can operate efficiently on standard hardware commonly available in industrial environments.
* Optimize for speed and accuracy to meet the demands of real-world industrial applications.

## Object Categories

1. Safety Equipment

• Fire extinguisher • Safety shower • Eye wash station • First aid kit • Emergency exit sign

1. Personal Protective Equipment (PPE)

• Hard hat • Safety glasses • Gloves • Protective suit • Respirator

1. Machinery and Equipment

• Turbine • Generator • Pump • Valve • Control panel • Forklift • Crane

1. Infrastructure

• Door • Window • Staircase • Ladder • Pipe • Vent

1. Monitoring and Control

• CCTV camera • Sensor • Gauge • Monitor/Screen • Alarm

1. Storage and Containment

• Storage tank • Waste container • Pressure vessel • Fuel rod assembly

1. Signage

• Warning sign • Hazard symbol • Information poster

1. Vehicles and Transportation

• Truck • Rail car • Utility vehicle

1. Utilities

• Fire hydrant • Electrical cabinet • Light fixture

1. People

• Worker (in standard uniform) • Worker (in protective gear)

1. Miscellaneous

• Radiation detector • Tool box • Barricade/Safety barrier • Spill kit

# Expected Outcomes

1. Functional MVP: A deployable object detection system tailored for industrial environments. This is to be stored in GitHub page.

2. Comprehensive Dataset: A curated public dataset covering a wide range of industrial objects.

3. Performance Metrics: Documented accuracy and speed of the system in detecting various industrial objects.

4. User Guide: Clear instructions for deployment and use in industrial settings.

5. Documentation: A dynamic document that have all of the R&D, key decision, models, and results.

# Data

To support the development of our industrial object detection MVP, we will focus on compiling a comprehensive public dataset. Potential sources include:

- Open Images Dataset: Contains a large number of annotated images, including many industrial objects.

- COCO Dataset: While not specifically industrial, it contains many relevant object categories.

- Specific industrial datasets from research institutions or previous industrial AI projects.

We will also explore data augmentation techniques to enhance the diversity and size of our compiled dataset.

# Methodologies and Plan of Attack

1. Dataset Compilation and Preparation (1-2 weeks):

- Research and identify relevant public datasets.

- Download, clean, and preprocess the data.

- Augment the dataset if necessary to ensure comprehensive coverage of industrial objects.

2. Model Selection and Initial Training (2 weeks):

- Evaluate pre-trained models (YOLO, Faster R-CNN, RetinaNet) on a subset of the industrial dataset.

- Select the best performing model considering both accuracy and speed.

- Begin initial training on the full dataset.

3. MVP Feature Development (2 weeks):

- Implement core detection and classification functionalities.

- Develop a basic user interface for interaction with the system.

4. Integration and Testing (2 weeks):

- Integrate the trained model with the MVP interface.

- Conduct thorough testing in simulated industrial environments.

- Optimize performance based on test results.

5. Documentation and Deployment Preparation (1 week):

- Create user documentation and deployment guides.

- Prepare the system for easy deployment in industrial settings.

6. Final Testing and Refinement (1 week):

- Conduct final round of testing.

- Make any necessary refinements to ensure MVP readiness.

# Project Management and Reporting

- Weekly Progress Updates: Short reports on completed tasks and upcoming objectives.

- Intermediate Demo Sessions: Demonstrate progress and gather feedback from stakeholders.

- Final Report and Presentation: Comprehensive overview of the MVP, its capabilities, and potential future enhancements.

This MVP will serve as a foundation for future iterations, allowing for real-world testing and feedback from industrial users to guide further development and refinement of the object detection system.