

PROJECT REPORT

SpaceSafe-AI

Keeping Space Stations Safer, Smarter, and AI-Ready

BY- TECH TITANS

HACKATHON -
Duality AI Hackathon

TEAM LEADER

Tanishka Chaudhary

TEAM MEMBERS

**Priyanshi Singh &
Satyam Gupta**

Introduction

SpaceSafe is an AI-driven safety monitoring application designed to detect the presence, absence, or misplacement of critical safety equipment—such as fire extinguishers, oxygen tanks, and toolboxes—within a space station in real time. It utilizes YOLOv8 for object detection and alerts crew members or ground control via a dashboard if essential gear is:

- Missing from its assigned location
- Obstructed
- Misplaced or floating in zero-gravity

Dataset & Setup

Dataset

- Provided by Falcon (Synthetic data)
- Classes: Toolbox, Oxygen Tank, Fire Extinguisher
- Format: YOLOv8

Tools & Libraries

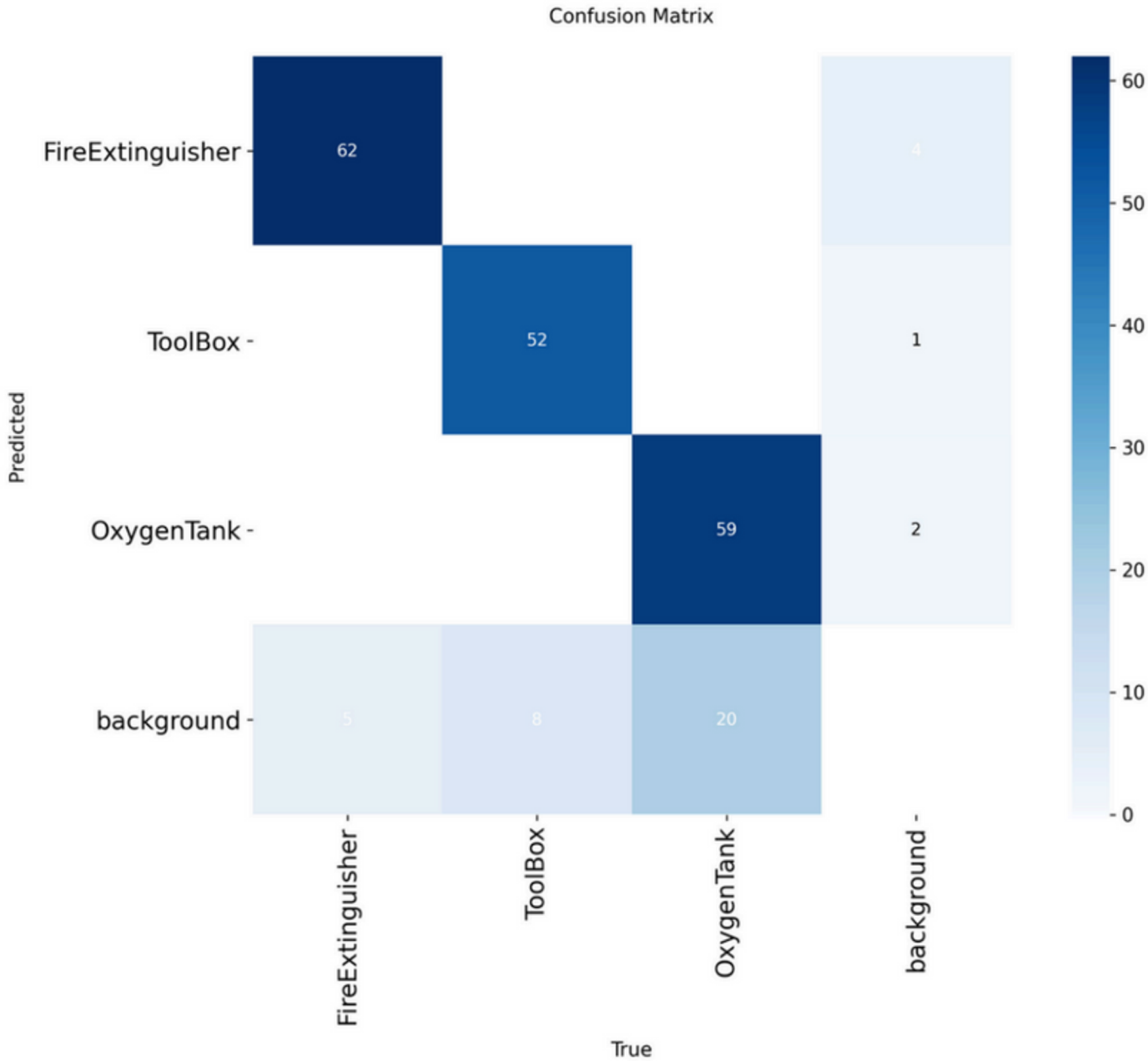
- Python, YOLOv8, OpenCV, Ultralytics, Matplotlib
- Platform: Falcon for synthetic data generation and benchmarking

Methodology

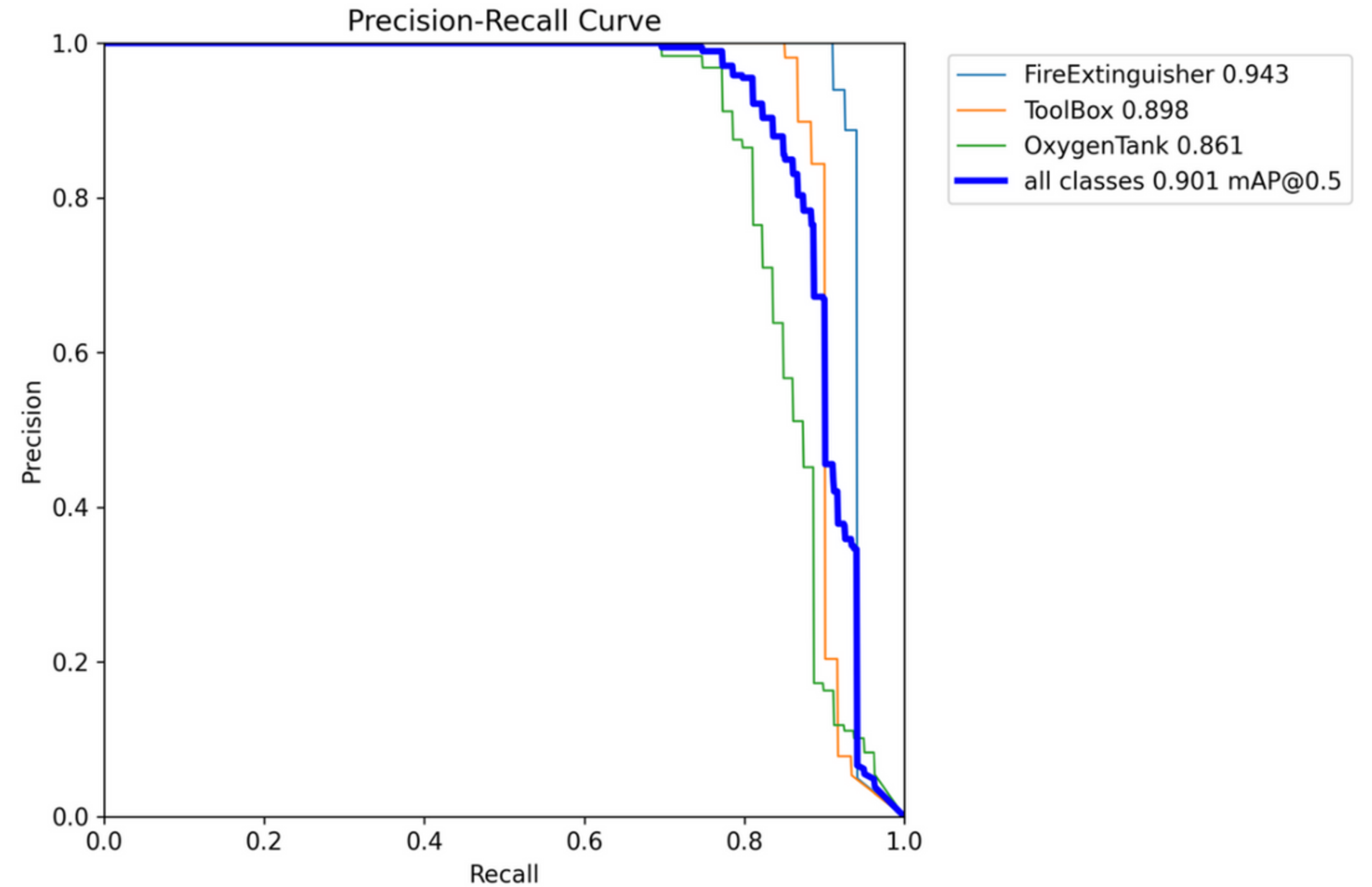
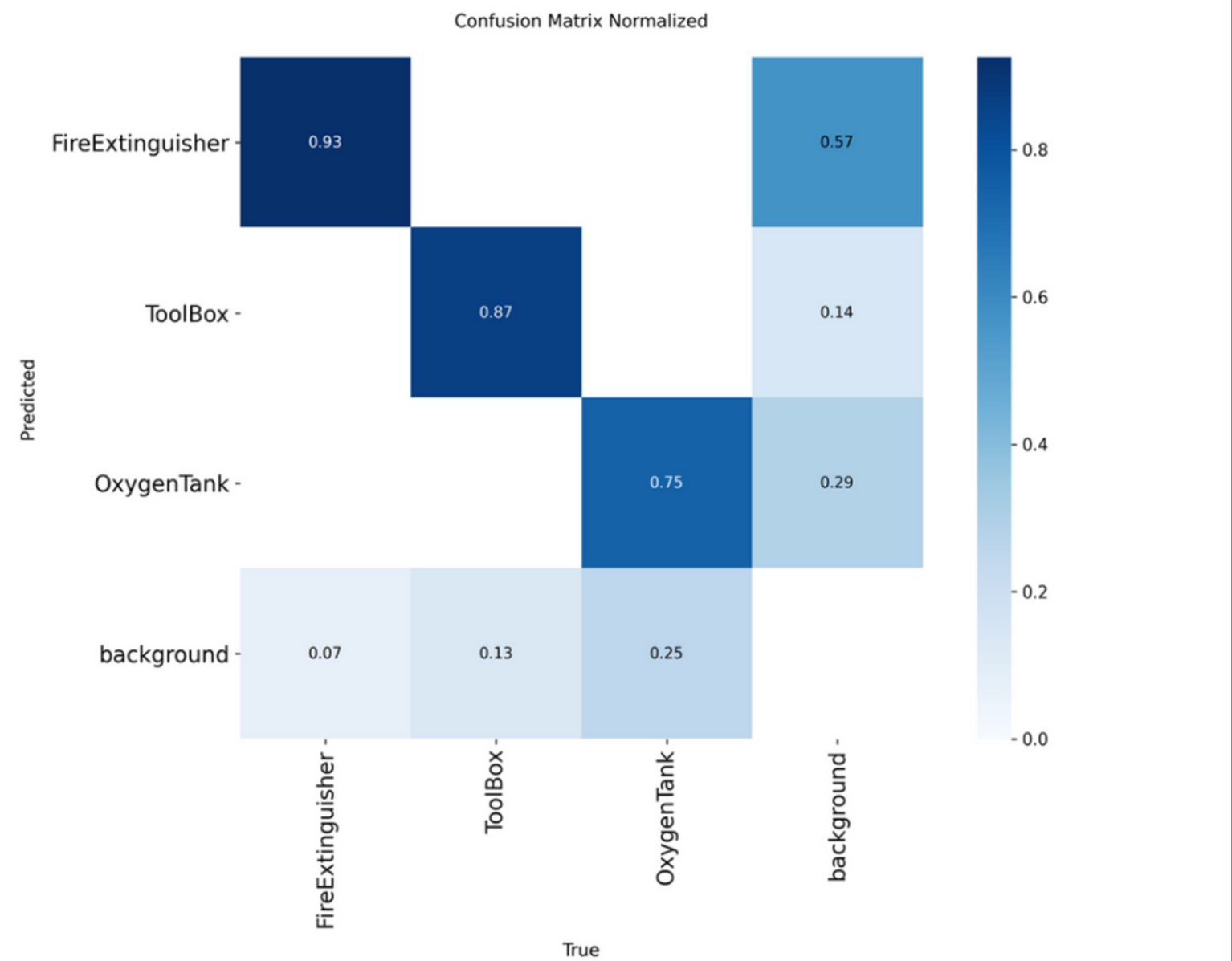
- Set up environment using setup_env.bat for Falcon's dataset.
- Explored dataset with 3 classes: toolbox, oxygen tank, fire extinguisher.
- Trained a YOLOv8m baseline model with pretrained weights.
- Tuned learning rate, epochs, and applied data augmentations.
- Evaluated performance on the test set (mAP, precision, recall).
- Visualized predictions and analyzed misclassifications.
- Repeated training with optimizations to improve accuracy.

Model Performance Summary

Metric	Value
mAP@0.5	90,00%
mAP@0.5:0.95	78,01%
Precision	93,13%
Recall	83,40%



Model Inference Results



How Falcon Helps Improve the Model

Falcon allows synthetic data generation to simulate:

- ✓ Low-light or emergency conditions
- ✓ New modules or equipment additions
- ✓ Occlusion and motion blur

Challenges & Learnings

Challenges:

- Handling false positives with small object classes.
- Maintaining mAP while keeping model size small.
- GPU memory limitations .

Learnings:

- Hands-on with YOLOv8
- How synthetic datasets can outperform real-world data in safety-critical tasks
- Power of Edge AI for real-time applications

Conclusion

- Successfully developed a YOLOv8-based object detection model tailored for space station safety monitoring.
- Achieved strong performance across all three critical classes: toolbox, oxygen tank, and fire extinguisher.
- Leveraged Falcon's synthetic dataset to train and evaluate the model effectively.
- Demonstrated how AI can assist in real-time hazard detection and safety assurance in zero-gravity environments.

Empowering safer space missions through vision-based AI.

Thank You!

Feel free to ask any questions.

Project Repo:

https://github.com/tanishka2402/Space_Station_Ai.git