COMPUTER VISION-BASED PPE DETECTION SYSTEM

FA-2

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Introduction

At construction sites, PPE (personal protective equipment) guarantees worker safety.

Manual safety inspections are laborious and prone to mistakes made by people.

This project automatically detects personal protective equipment (PPE) such as vests, masks, and hardhats using artificial intelligence.

PROBLEM STATEMENT

Construction sites lack automated PPE compliance monitoring

Supervisors cannot manually track every worker.

GOAL

To create an AI-based PPE detection system to ensure safety compliance automatically.

DATASET PREPARATION

Collected and labeled images of construction workers with/without PPE.

Annotated six categories: Hardhat, Mask, Vest, No-Hardhat, No-Mask, No-Vest.

Data split: 70% training, 30% testing.

MODEL TRAINING PROCESS

Training done on Google Colab using pretrained YOLOv8 weights.

Fine-tuned the model to detect PPE items accurately.

Model learns to identify and classify PPE presence and compliance.

MODEL EVALUATION

Precision: Accuracy of detections (fewer false positives).
Recall: Ability to detect all PPE items (fewer misses).
F1-Score: Balance between precision and recall.
mAP: Overall detection performance across all PPE types.

Results:
Precision – 0.91
Recall – 0.88
F1-Score – 0.89
mAP@50 – 0.92

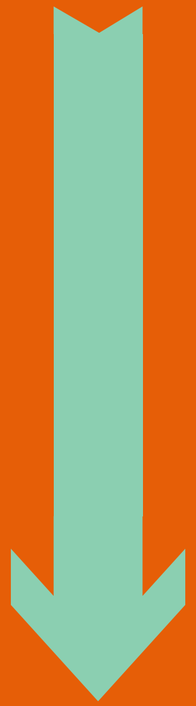
WORKFLOW SUMMARY

Data Collection and Annotation

Model Training (YOLOv8)

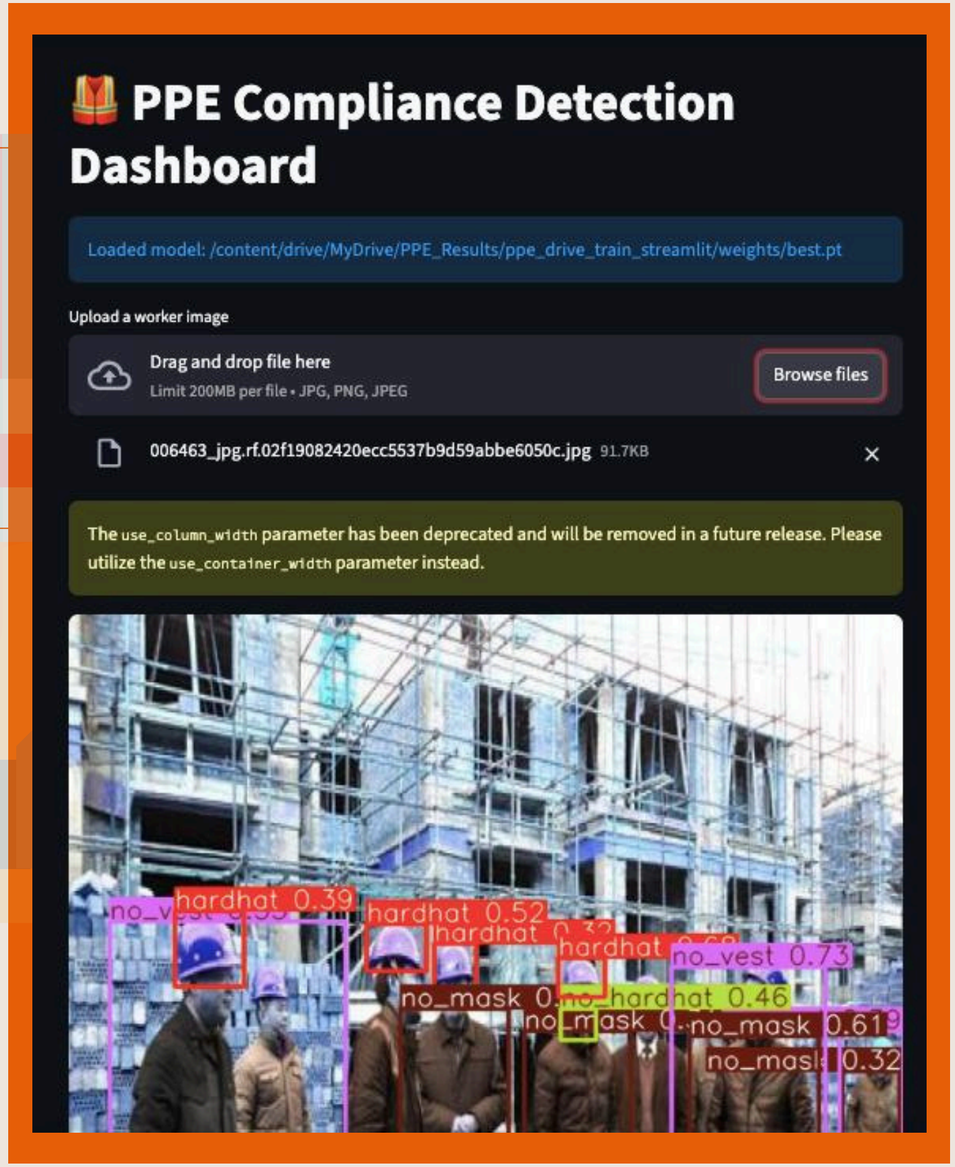
Model Testing and Evaluation

Deployment via Streamlit



RESULTS

The trained model accurately detects PPE items in real-time images. Bounding boxes and compliance colors appear correctly. The system works under different lighting and camera angles.



Future Improvements

Add detection for more PPE types (gloves, goggles, boots).

Improve accuracy in low-light or crowded environments.

Integrate live CCTV feeds for real-time monitoring.

Retrain YOLOv8 with a larger dataset.

Links:

Dataset:
https://drive.google.com/drive/folders/1kgIurqWk2Tdj1rWZVdNKD3HTmE2XPaB1?usp=drive_link

Result:
https://drive.google.com/drive/folders/1hvN-zjb5RFOmshDtEP9awP4GiWe3-FZY?usp=drive_link

Colab notebook:
https://colab.research.google.com/drive/1vTwKb8H0tlkGMz282RfUj1AhTPesKJXG?usp=sharing

Streamlit:
https://crawlier-scrawny-tenesha.ngrok-free.dev/

CONCLUSION

THIS PROJECT SHOWS HOW AI AND COMPUTER VISION IMPROVES SAFETY MONITORING.

USING YOLOV8, THE SYSTEM PROVIDES FAST AND ACCURATE PPE DETECTION.

REPRESENTS A COMPLETE AI WORKFLOW: FROM DATA TO REAL-TIME DEPLOYMENT.

THANK YOU