

# Steel Surface Defect Detection Using Deep Learning

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- ▶ Surface defects like cracks, dents, and scratches reduce the quality and strength of steel, making accurate detection essential in manufacturing.
- ▶ Manual inspection is slow and inconsistent, especially in high-speed production environments.
- ▶ This project proposes an automated defect detection system using the **YOLOv11** deep learning model for its high speed and accuracy.
- ▶ The model was trained on a custom **Roboflow dataset** and implemented in **Python** using **Google Colab** with GPU support.
- ▶ Results indicate effective detection of various defects, demonstrating the system's potential as a **scalable solution**.

- ▶ Steel is vital in industries like automotive, construction, and aerospace.
- ▶ Surface defects (cracks, pits, scratches) affect performance and quality.
- ▶ Manual inspection is slow and unreliable in fast-paced production.
- ▶ Deep learning offers automated solutions in Industry 4.0.
- ▶ This project uses **YOLOv11**, implemented on Colab and deployed via Hugging Face.

# Literature Review



S.No	Title	Merits
1	Model Compression – Maojie Sun et al. (2024)	Enables real-time use through pruning and quantization.
2	GDM-YOLO – Tinglin Zhang et al. (2024)	Improves small defect detection and precision.
3	ECA-YOLOv5 – Fei Ren et al. (2024)	Enhances localization and classification.

## Packages

- ▶ YOLOv11 – Deep learning object detection model.
- ▶ Roboflow – Dataset preparation and management.

## Libraries

- ▶ Ultralytics YOLO – For training and inference.
- ▶ OpenCV – Image processing and visualization.

# Images

Steel Surface Defect Detection

