

Business Understanding: Automated Defect Detection

1 Introduction

Factories rely on manual inspection to check products for defects like scratches and cracks. This process is slow, costly, and prone to human error. Our goal is to build an AI-powered system that automates defect detection using an unsupervised deep learning approach, improving efficiency, accuracy, and cost-effectiveness.

2 Who Will Benefit?

Our solution will help:

- Manufacturers – Reduce costs and streamline quality control.
- Quality Assurance Teams – Automate defect detection with greater consistency.
- Industrial Engineers – Gain insights into common defect patterns for process improvement.

3 Business Objectives

- Automate defect detection through anomaly detection techniques.
- Reduce reliance on manual inspections to cut costs and save time.
- Ensure consistent quality control by detecting subtle and rare defects.
- Build trust in AI by using reliable reconstruction error metrics for decision-making.

4 Data Science Objectives

- Train a convolutional autoencoder on defect-free (good) product images.
- Detect anomalies by measuring reconstruction errors on test images.
- Determine an optimal threshold for defect detection based on error distributions.
- Evaluate the model's performance using test data containing both good and defective samples.

5 Conclusion

Our deep learning-based defect detection system uses an autoencoder trained on normal samples to identify anomalies based on reconstruction error. This unsupervised approach enhances reliability, reduces cost, and enables faster and more accurate quality control processes in industrial environments.