Intel® AI for Manufacturing Certificate Course

Week 7: Assignment Report – Group Project – Computer Vision in Manufacturing

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Project Title:

Surface Defect Detection in Metal Components using Computer Vision

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1. Problem Statement

In manufacturing industries, particularly in automotive or aerospace sectors, **surface defects like cracks, dents, and scratches on metal components** can lead to serious quality and safety issues.
Manual inspection is:

- Time-consuming
- Inconsistent due to human fatigue
- Not scalable for high-speed production lines

There is a need for an automated, accurate, and scalable solution for **real-time surface defect detection**.

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2. Proposed Solution

We propose using a **Computer Vision system powered by deep learning** to automate surface defect detection. The project plan involves:

- Capturing high-resolution images of metal parts on the production line using industrial cameras.
- Training a Convolutional Neural Network (CNN) model to detect and classify defects like:
  - Cracks
  - Surface roughness
  - Scratches
  - Dents
- Integrating the model with a factory monitoring system for real-time alerts.

Steps:

1. Data collection and image labeling
2. CNN model development using TensorFlow or PyTorch
3. Model validation and tuning
4. Deployment via edge devices or cloud platform
5. Real-time dashboard for defect monitoring

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3. Impact

Operational Impact

- **Improved Inspection Speed**: Inspections can be performed in real-time with high throughput.
- **Increased Accuracy**: Reduces false positives/negatives compared to human inspection.
- **Cost Saving**: Early detection prevents wastage and reduces returns and recalls.

Business Impact

- Enhances product quality and brand reputation
- Helps meet international quality standards (ISO, Six Sigma)
- Strengthens customer trust and reliability

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4. Ethical and Legal Considerations

Ethical Aspects

- Ensure that the model does not unintentionally **bias** inspection results due to poor training data.
- Maintain transparency in how the AI system flags defects and how decisions are made.

Legal Compliance

- Data collection must comply with **industrial data privacy policies**.
- If images of workers are accidentally captured, **GDPR or local privacy regulations** must be followed.
- Model decisions should be auditable and explainable to meet regulatory standards in safety-critical industries.

Conclusion

This project aims to demonstrate how **AI and computer vision can transform quality control** in manufacturing. With proper implementation, it can lead to enhanced efficiency,

better safety, and high-quality product output, all while maintaining ethical and legal compliance.