**Intel® Al for Manufacturing Certificate Course**

**Week 7: Assignment Report –**

**Group Project – Computer Vision in Manufacturing**

**Name:** Ayan Memon

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**Project Title:**

**Surface Defect Detection in Metal Components using Computer Vision**

**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**.

**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

**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

**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.