Synth-QC: AI-Powered Defect Detection

Overview

Synth-QC addresses a major challenge in high-precision manufacturing: the lack of high-quality, labeled data for rare but critical defects. Traditional data collection is time-consuming and expensive. Our solution is a revolutionary generative AI platform that uses a proprietary Generative Adversarial Network (GAN) to create vast, diverse, and photorealistic libraries of synthetic defect images. This perfectly labeled, unbiased synthetic data is then used to train a highly accurate computer vision model.

Solution and Implementation

The solution's implementation is a two-phase process: **synthetic data generation** and **model deployment**. Our **GAN engine** takes a small set of real-world product images to procedurally generate a massive synthetic dataset. This data is then used to train a state-of-the-art computer vision (CV) model, such as a YOLO or Mask R-CNN, optimized for real-time inference on edge devices. The trained model is packaged into a containerized API that integrates with a manufacturer's existing production systems.

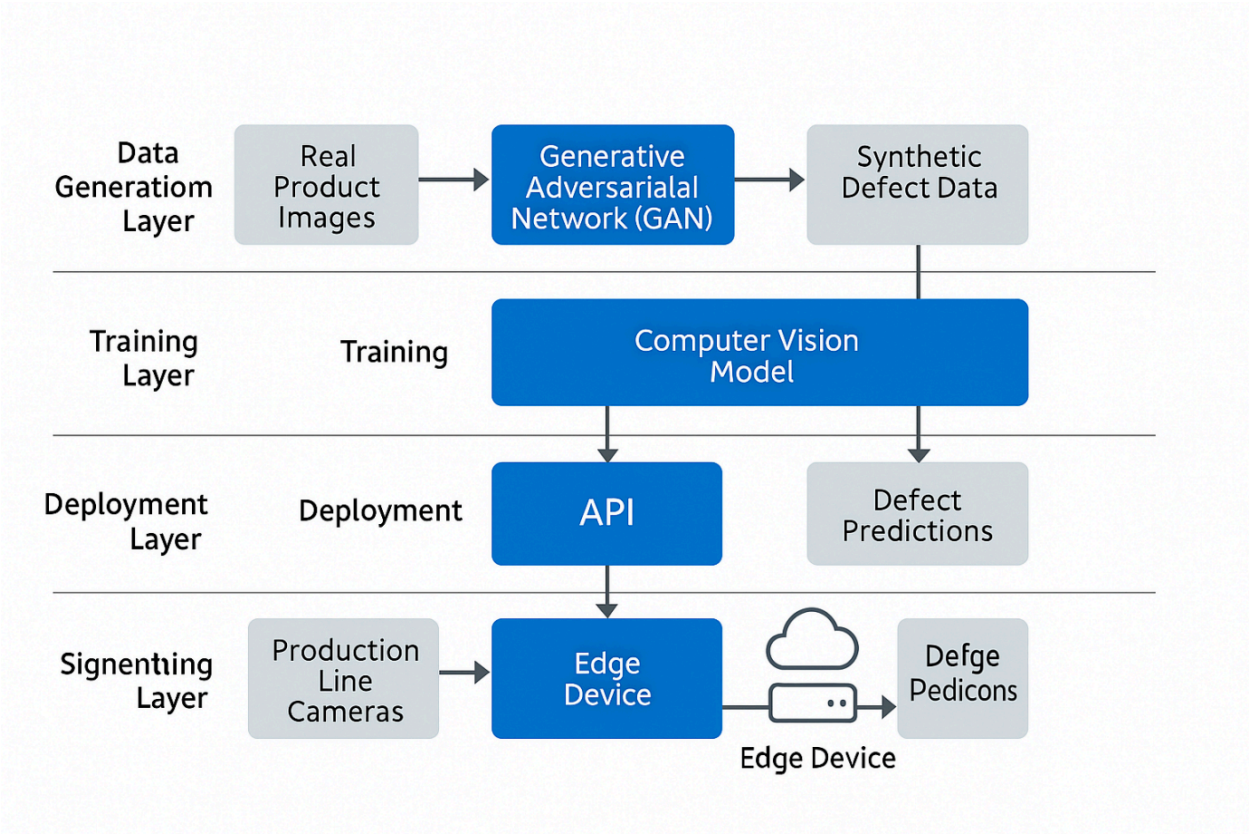
Objective

The primary objective of Synth-QC is to solve the data scarcity problem in AI-powered manufacturing quality control. We aim to achieve near-perfect defect detection accuracy, significantly reducing product recalls and waste, and to establish a scalable platform adaptable to various industries.

Methodology

Our methodology is built on a three-layer system. The **Data Generation Layer** uses GANs to create the synthetic datasets. The **Training Layer** uses this data to train a hyper-accurate computer vision model. Finally, the **Deployment Layer** delivers the trained CV model as a lightweight API on a local edge device, which receives images from production line cameras and returns predictions in milliseconds.

Highlevel system Diagram:



Significance

The global AI in manufacturing market is projected to grow to over **$62 billion by 2032**. Synth-QC provides a clear path to capturing a significant portion of this growth by delivering a superior and more cost-effective method of quality control. We address a critical data bottleneck, enabling the widespread adoption of AI in a field with a massive market.

Expected Outcomes

We expect to reduce the time and cost of deploying an accurate visual inspection system by over **60%**. The final deliverables will include a robust synthetic data generation pipeline, a pre-trained computer vision model with an accuracy of over **99.5%**, and a well-documented API for seamless client integration.