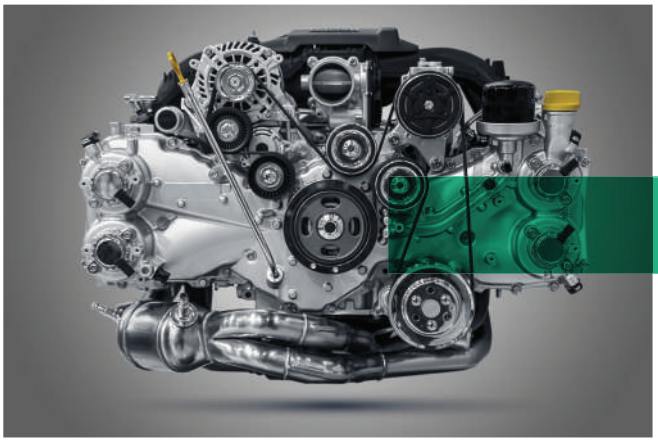
quantiphi
Solving What Matters

# Case Study

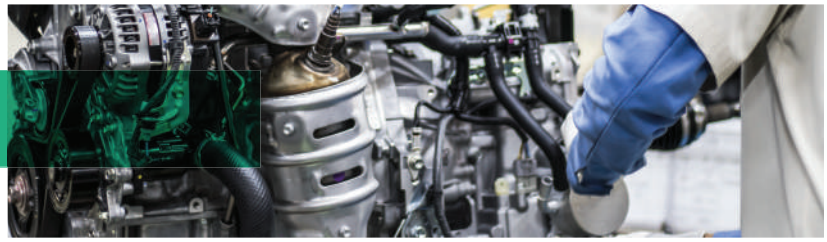
Engine Defect Detection with Visual Quality Inspection Solution for World's Sixth-Largest Automobile Manufacturer

## About The Customer

Our client is one of the "Big Three" automobile manufacturers in the United States that offers distinctive and sustainable solutions to meet the evolving needs of customers. This company with annual revenue of over $37B from sales of over 8 million cars, offers a full spectrum of choice from luxury, premium, and mainstream passenger vehicles to light commercial vehicles, as well as dedicated mobility, financial, and parts and service brands.

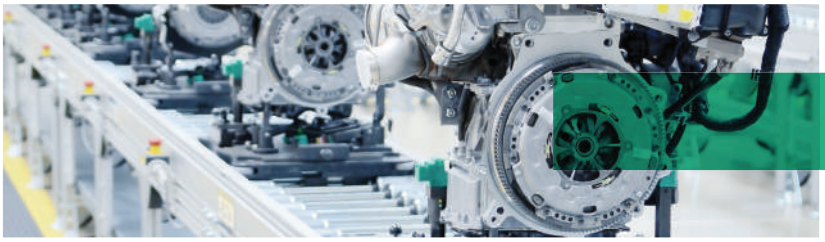


## The Business Context



The client's current quality inspection process for assembled engines leverages a combination of manual and computer-based decisions. In this case, manual inspection was necessary as the automated error rate results were unreliable.

The client, therefore, wanted to augment the plants' capabilities with much reliable and scalable computer vision machine learning models for quality inspection.



## Quantiphi's Solution

- Quantiphi developed a machine learning-based solution called Automated Visual Quality Inspection to identify the defect and localize the region of the defect.
- Automated Visual Quality Inspection Solution is a computer vision framework that uses deep learning to learn features, like sharpness, contrast, outline, shape, and many more to identify a defect in product images.
- Visual Quality Inspection solution was incorporated to detect defects on an engine part called Roller Finger Follower(RFF), a part capable of shutting down the cylinders while the engine is running.

- Using an industrial camera, images of the engine are captured at the assembly station. The client was already using a visual inspection solution, but with a 50% accuracy. Quantiphi used the Google Cloud Platform to train the Custom ML model, which would first localize the area of inspection and then identify if the region contains any defects.
- With this, we were able to develop a solution with over 99% accuracy in automated defect detection leading to annual savings of $4M.

## Quantiphi's VQI Solution Approach


Collection of images of the defective and non-defective parts

Image labeling for identifying the defective products and regions

Data augmentation to increase the no. of defective images (based on requirement)

Model training for creating a reusable model

Model deployment for live inference in the plant

## Challenges and Resolutions

**Camera & Lighting Conditions**

Started with a basic camera setup with the support of our Camera partner and collected images with multiple variations for the training data

**Lack of Defective Images**

Data Augmentation techniques were used to populate and inflate the dataset

**Latency & Network Outages**

Built a hybrid solution that facilitated inferences and on-prem model training and cloud storage

**Security & Redundancy**

Used Kubernetes and Anthos to ensure high availability and security

## Business Impact

**Cost savings in terms of reduced scrap and fewer quality inspectors**

A recurring automated inspection reduces the number of defective items leading to $4M savings in costs

**Reduced human bias**

The solution can be 100% automated, eliminating the need for any human intervention

**Scalable across plants**

Once deployed at an SKU, the solution can be scaled across all plants with reduced efforts

**Increased CSAT**

Regular and Timely inspection helps in eliminating the defective items, thereby increasing the customer satisfaction



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