

Case Study

Computer vision
Logistics and manufacturing



intel® tiber™
Edge Platform

AI-Enabled Inspection Dramatically Improves Logistics Efficiency for Intel®

An Intel team developed a custom computer vision application to assist a key inspection process, reducing inspection time by 90 percent¹ while improving accuracy, efficiency, and customer relationships.

"By introducing AI-based camera technology, our team is able to identify the damage immediately and send emails to the stakeholders within seconds, with pictures of the damage and information on the product."

—Stephen Noonan, Director, Global Logistics Customer Operations at Intel Corporation

Damaged boxes are a major problem that many businesses face. When cargo boxes are damaged during shipping, refunding the customer or replacing the products are only some of the costs. Damaged and returned boxes also cause lost time, warehouse space, and customer confidence. Seeing an opportunity to drive efficiency through innovation, an Intel logistics team employed Intel® Geti™ software and Intel® OpenVINO™ toolkit to develop a custom AI-enabled application capable of automating and optimizing box inspection. This scalable application has dramatically reduced inspection times while also improving accuracy, space allocation, data quality, and more.

Challenge: Reducing the impact of damaged products

Damaged boxes impact business results

With customers across the globe building advanced products, the Intel logistics team ships and receives an immense amount of computing goods through its warehouse every day. The boxes or cartons these products are shipped in can become damaged during transit. Every time a damaged box is shipped to a customer, it's likely to be rejected and returned—even if the products inside are in acceptable condition. When the team receives a damaged box, it might warrant filing an insurance claim, but doing so requires a time-consuming inspection and documentation process.

The time, space, and money that damaged boxes consume makes detecting and properly identifying them a critical process for the logistics team. If warehouse workers encounter an outgoing or incoming box they believe to be damaged, they need to thoroughly inspect the box according to industry standards and then determine the type of damage, its extent, as well as other factors. Performing these inspections with the naked eye is a challenging task. The worker has to examine multiple criteria and make a decision about the box's condition that determines whether to send it back, inspect it further, or allow it to continue as usual. Doing this accurately and efficiently requires training and experience.

If the box is indeed damaged, the warehouse worker then contacts an internal quality control (IQC) operator. If the IQC agrees with the determination, the box requires further examination by a factory materials engineer (FME), who makes the final determination on its condition and files a claim for the product. FMEs have limited time on-site, which means that a box could be waiting to be inspected and processed for extended periods. If the box has been improperly inspected in the warehouse as being damaged, it takes up critical space, elevates liability, delays claim filings, complicates customer relationships, and consumes the time of expert employees.

AI assisted inspections deliver efficiency

Examining this problem, the Intel logistics team found that properly inspecting potentially damaged boxes at the warehouse was the key to eliminating waste and improving efficiency. They found that their existing inspection process—which relied on naked eye inspections—introduced issues such as inconsistent assessments and a bias for risk aversion that led to acceptable boxes being flagged as damaged.

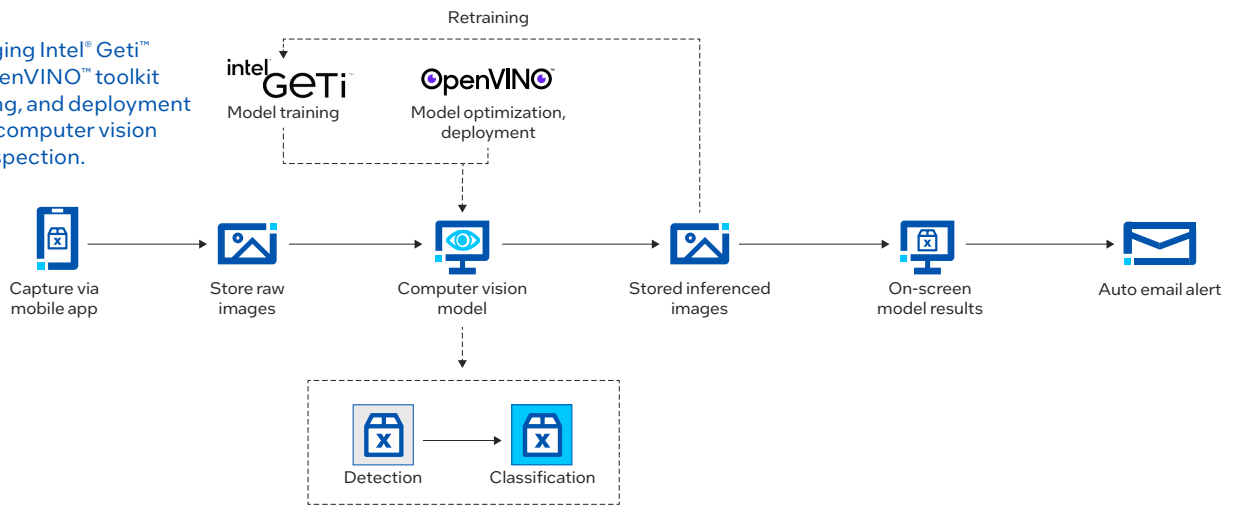
It was determined that significant efficiency gains could be achieved by equipping warehouse workers with a system capable of assisting box inspections. Leveraging computer vision to make determinations about potentially damaged boxes would save time for workers while reducing errors and capturing data that could enhance all aspects of their operations.

Solution: Speeding and simplifying computer vision solution development

Overcoming the high cost of AI-enabled automation

Typically, developing a specialized AI computer vision application from scratch requires significant funding, time, and expertise. You often need data scientists to prepare the data and train the AI model and software experts to optimize and deploy the application. The Intel logistics team was able to speed and simplify the AI and application development process by employing Intel Geti software to train the inspection vision model and the OpenVINO toolkit to optimize and deploy it.

Figure 1. Leveraging Intel® Geti™ software and OpenVINO™ toolkit training, retraining, and deployment of the customer computer vision model for box inspection.



What makes vision model development with Intel® Geti™ software so different?

Intuitive GUI makes getting started and making progress fast and easy

Smart annotations expedite and simplify data labeling

Active learning builds models faster with less data

Task chaining combines multiple computer vision tasks to solve complex problems

Built-in optimizations allow you to output production-ready models

SDK support for REST API simplifies and automates the development pipeline

Lowering the barriers to model development with Intel

Intel Geti software offers state-of-the-art capabilities to build vision models for object detection, classification, defect detection, and more, alongside an intuitive, easy-to-use graphical user interface (GUI).

The streamlined efficiency of Intel Geti software enabled the team to start quickly and make fast progress on training the computer vision model to inspect cartons and boxes.

The logistics team worked with an FME to identify sample images of boxes validated as being damaged or acceptable. This pool of images provided the dataset that was ingested by Intel Geti software. Data preparation and annotation, typically a time-consuming task, was greatly accelerated with the software. Smart data annotation tools made selecting the relevant parts of the image and marking them up very straightforward and intuitive. Active learning functionality, which is integrated into Intel Geti software, further speeds up model development by automatically selecting the best data to train the models with and incorporating human expert knowledge in the model training process.

Intel Geti software also allowed the team to enhance the model’s effectiveness by combining defect detection and classification tasks. Now the type of damage can be conveyed and recorded, expediting an appropriate response. Employing the Intel Geti SDK functionality simplified and automated pipeline development for deployment and implementation.

Flexible deployment with OpenVINO toolkit

OpenVINO toolkit enables powerful hardware optimization that accelerates inferencing on a wide range of Intel® compute solutions. OpenVINO made it easy for the Intel logistics team to deploy the defect detection application across different compute while ensuring consistent application performance.

Making the move to mobile is easier than ever

Initially, the application was operated with a static tabletop setup. However, moving the boxes around to scan them created additional work and inefficiencies, so the application was migrated to a mobile device. Now when a warehouse worker suspects that a box is damaged, they can use the mobile application to take a picture of the box and analyze its condition on the spot. If the computer vision application detects damage, it sends images of the box to ICQ personnel and the FME. By automatically providing reliable data and assessments to the required personnel, the app overcomes a complex communication process and accelerates the claim-filing process.



Intel® Tiber™ Edge Platform

The Intel Tiber Edge Platform integrates Intel Geti software and OpenVINO AI runtime, among other key components, to accelerate AI model development and scale global deployments successfully.

Intel Tiber Edge Platform is a modular solution designed to solve edge challenges across industries such as manufacturing, logistics, and retail. The platform enables enterprises to develop, deploy, run, manage, and scale edge applications and AI with cloud-like simplicity, leveraging an unmatched partner ecosystem.

[See what the Intel Tiber Edge Platform can do >](#)

Solution architecture

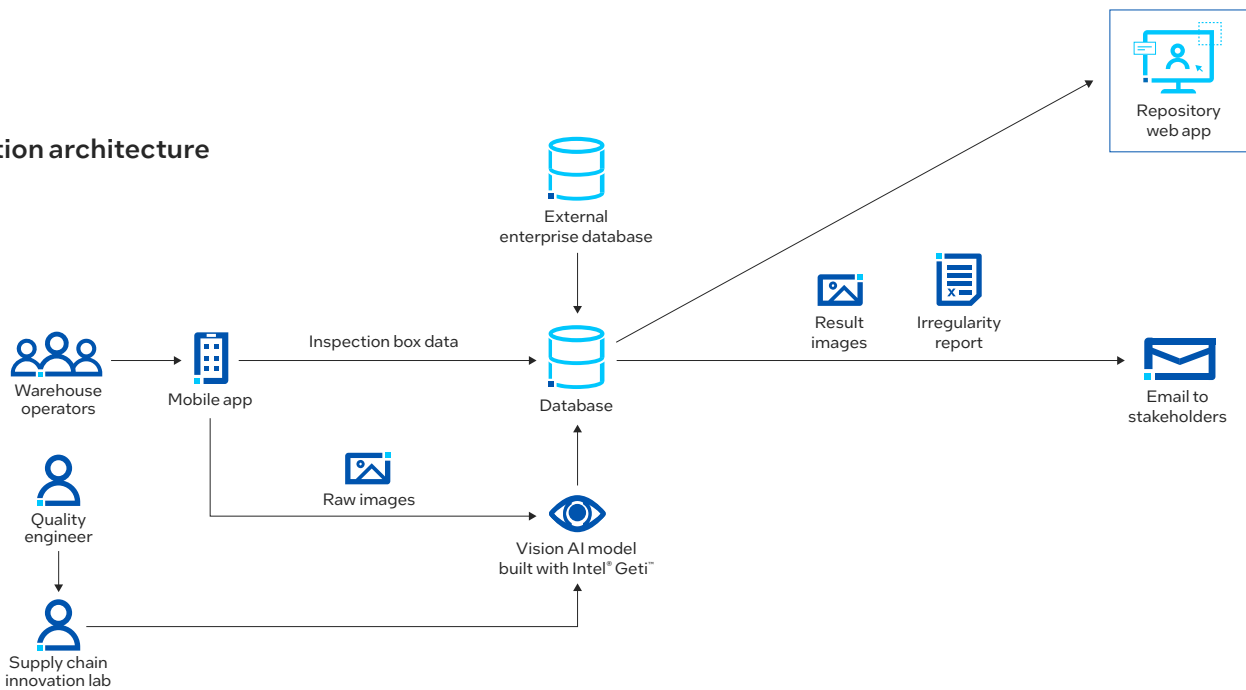


Figure 2. Efficient architecture automatically analyzes the asset’s condition and sends emails to appropriate parties.

Results: Dramatic improvements in efficiency and quality control

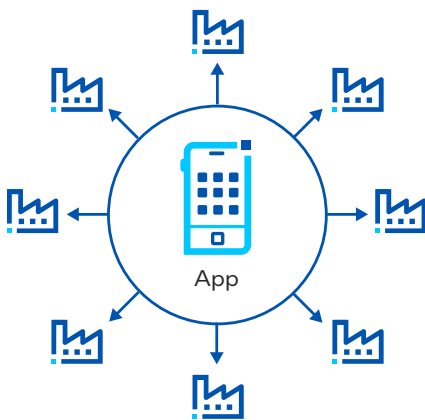
Dramatically faster condition determination process

With the AI application assisting in the inspection process, box inspection time was reduced by 90 percent.¹ This means that warehouse personnel are given instant feedback regarding the carton’s condition, enabling quick decision-making. Also, team members no longer need to manually send box images, email QE, and wait for the condition to be determined. Now the image is captured and analyzed in seconds, and an email with the box’s status is automatically sent out to the appropriate parties.

The custom-built computer vision application reduced box inspection time by 90 percent.¹

The inspection application also led to many other benefits:

- Improved inspection accuracy
- Lowered costs
- Delivered better logistics data
- Reduced inefficient use of warehouse space
- Improved human resource allocation



Greater accuracy in damage detection

Rather than relying on individual assessments to determine a carton’s condition, each box is examined objectively with consistent standards and criteria. The accuracy of the application enhances the efficiency of domain experts in the facility, who are now able to move forward with greater speed, thanks to improved confidence in the assessments.

The team is able to improve this accuracy over time, thanks to the easy AI model retraining made possible by Intel Geti software. As the team employs the defect detection application in day-to-day operations, new box types are being identified that require the model to be refined. With Intel Geti software, it’s easy for the team to capture additional images, quickly retrain the models, and update the application.

“Our warehouse teams are able to make decisions with a lot more confidence thanks to the mobile inspection application. They know they will be able to quickly and reliably identify damaged goods. Automating tasks frees up their time so they can focus on other areas of productivity.”

—Stephen Noonan, Director, Global Logistics Customer Operations at Intel Corporation

Fast scalability to new facilities and new goods

This application is driving innovation across Intel and is starting to incorporate new use cases. The box damage inspection application was quickly scaled to eight additional sites and has been extended to inspect raw materials, finished goods, and capital goods. Building the vision models with Intel Geti software also allows for quick retraining and the ability to adjust inspection factors, such as lowering the tolerance for defects in order to inspect finished goods.

Reduced costs and more efficient use of space

By reducing the time required to perform inspections, the team saves money on every case of a damaged or potentially damaged box. The application has also streamlined and accelerated the process of finalizing a claim for damage. Using the application to assist in box inspection has helped cut the time to file a claim. What’s more, as fewer boxes are misidentified as being damaged, the team is able to use precious storage space more effectively.

Better data capture and customer experiences

Previously, documenting damaged cartons relied on manual record keeping and processes that made tracking a challenge. With the mobile defect detection app, the condition of any carton in question is immediately available in a shared database, complete with images, location, and other critical data points. This new level of real-time awareness helps improve supply chain efficiency. Enhanced asset visibility and returns tracking also give the Intel team more ways to respond to customer needs and enhance their experience. What’s more, this data is a source for analytics that can identify issues and enable solutions.

Making greater use of talent and human resources

Employing the mobile application has freed up time for domain experts working in the facilities. They no longer need to be involved in processing and storing boxes, and they don’t need to spend as much time on every instance. This improved efficiency leaves expert employees with more time for critical tasks, helping the whole team to be more efficient.

AI innovation is closer than ever with Intel Geti software

By leveraging the power of Intel Geti software and OpenVINO toolkit, the Intel logistics team was able to address a complex challenge that hampered their ability to exceed expectations. They were able to train a specialized computer vision model, develop a custom application, and deploy it to mobile devices in much less time than is typically required.

The success of this application and the relative ease with which it was developed have inspired a vision for further innovation. Many more Intel facilities will adopt this solution and new use cases as well.

Reach out to learn more

Intel can help you achieve AI innovation faster and more simply than ever before. Reach out to your Intel representative to start tackling your edge AI challenges with us.

Intel Tiber Edge Platform

Build, deploy, run, manage, and scale edge and AI solutions on standard hardware with cloud-like simplicity.

[See the capabilities of Intel Tiber Edge Platform >](#)

Intel Geti Software

Build computer vision models in a fraction of the time and with less data.

[Simplify model building >](#)

OpenVINO toolkit

OpenVINO toolkit accelerates AI inference with lower latency and higher throughput.

[Learn more about OpenVINO >](#)



1. Source: Intel internal data.

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