ADLINK
LEADING EDGE COMPUTING

AI-powered Six-Sided Product Case Inspection at ADLINK Factory



Revolutionizing Manufacturing Excellence with AI-Powered Inspection

Highly accurate Automated Optical Inspection (AOI) solution from ADLINK that heightens accuracy and shortens inspection time enables health monitoring of the manufacturing process to an optimal advantage of the business.

Solution Brief

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Introduction

In the dynamic landscape of modern manufacturing, Industry 4.0 has ushered in a wave of technological innovations, making AI integral to automating and refining inspection procedures. Traditionally reliant on human oversight, manufacturing inspection is undergoing a transformation with advanced tools and equipment. Today, sophisticated methods and AI-based systems have already started to get incorporated into the inspection process of various products, including but not limited to disk heads, steel strips, syringes, and semiconductors[1]. This solution brief explores how ADLINK's Deep Learning Acceleration Platform is at the forefront of this evolution, propelling AI-powered quality inspection to new heights.

Overview

Industries across communications, electronics, automobiles, consumer goods, and raw materials are embracing AI-powered quality inspection for its potential to increase productivity by up to 50% and achieve defect detection rates of 90%.[2] Real-time tracking, facilitated by data-driven techniques and IoT-enabled sensor technology, ensures continuous product health assessment throughout the manufacturing lifecycle. While visual inspection accuracy hovers around 80% in the industry, ADLINK's solution targets 100% inspection in advanced manufacturing systems, mitigating the time-consuming and costly nature of manual visual inspection. Although Computer Vision (CV) algorithms have automated parts of the process, challenges persist. AI-based models, however, demonstrate an impressive 99.86%[3] accuracy on image data of casting products, with Machine Learning (ML), Pattern Recognition (PR), and Deep Learning (DL) enhancing manufacturing capabilities.



Challenges

Traditional inspection methods grapple with formidable challenges such as high costs, low accuracy, and limited learning capabilities. The industry has historically relied on human operators, showcasing an accuracy rate of 85% in rejection precision-manufactured parts while the industry average was 80%. Another recent study concluded that operator errors accounted for 23% of the inaccuracies in quality control in the oil and gas industry.[4] Conventional machine-vision-based inspection, while effective in specific scenarios, suffers from manual feature definition bottlenecks. The iterative nature of production line changes requires manual redesign, leading to prolonged development cycles. Additionally, it necessitates 10,000 images to learn all possible scratches, relying on image processing algorithms to identify scratches based on size, depth, and appearance.

1 - Rao A.R. Future Directions in Industrial Machine Vision: A Case Study of Semiconductor Manufacturing Applications
2 - Smartening up with Artificial Intelligence (AI) - McKinsey
3 - Sundaram S, Zeid A. Artificial Intelligence-Based Smart Quality Inspection for Manufacturing. Micromachines (Basel). 2023 Feb 27;14(3):570. doi: 10.3390/mi14030570. PMID: 36984977; PMCID: PMC10058274.
4 - General Electric the Impact of Digital on Unplanned Downtime. [(accessed on 10 January 2022)]

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Solutions

ADLINK solution harnesses the effectiveness and prowess of AI-based inspection

ADLINK's Deep Learning Acceleration Platform addresses these challenges with a powerful AI-based inspection solution. Seamlessly integrated with the NVIDIA Jetson hardware platform, the DLAP series enhances production efficiency, reducing the total cost of ownership. Proven in ADLINK's manufacturing line, the solution achieves 99.6%[5] accuracy in visual inspection and a 80% reduction in inspection time. The DLAP-411-Orin, powered by NVIDIA® Jetson AGX Orin™, introduces a revolutionary six-sided visual inspection solution incorporating NVIDIA Omniverse for sophisticated training with a quick turnaround.

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5 - As reported by ADLINK 2023.

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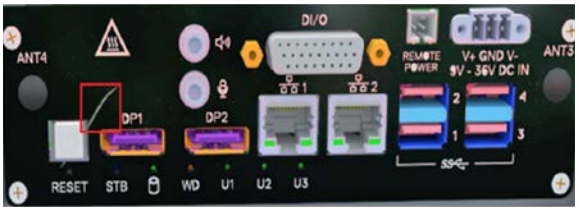
Highly accurate and fast development results powered by NVIDIA Omniverse

ADLINK's solution stands out with its utilization of NVIDIA Omniverse for training, providing a nuanced understanding of complex features. The Jetson AGX Orin processing/inference engine, featuring an 8/12-core Carmel Arm 64-bit CPU and 1792/2048-Core Ampere GPU, significantly enhances manufacturing inspection processes, allowing for precise defect detection. Its high-performance CPU ensures rapid and efficient data analysis, while the GPU's parallel processing capabilities accelerate AI and deep learning workloads. This enables advanced visual inspection, precise defect detection, and real-time decision-making, contributing to enhanced accuracy, precision, and overall efficiency in manufacturing inspection.

Jetson AGX Orin series				
Jetson Modules	Jetson AGX Orin Developer Kit	Jetson AGX Orin 64GB	Jetson AGX Orin Industrial	Jetson AGX Orin 32GB
AI Performance	275 TOPS		248 TOPS	200 TOPS
GPU	2048-core NVIDIA Ampere architecture GPU with 64 Tensor Cores			1792-core NVIDIA Ampere architecture GPU with 56 Tensor Cores
GPU Max Frequency	1.3 GHz		1.2GHz	930MHz

NVIDIA Omniverse plays a pivotal role in virtual scratch generation, significantly boosting inspection accuracy. Unlike traditional models, Omniverse automates scratch data generation for AI-based training, eliminating the need for extensive datasets and accelerating the training process. Traditional models may require around ten thousand images, but Omniverse's efficiency allows for a faster and more streamlined training cycle, resulting in a remarkable leap in inspection accuracy.

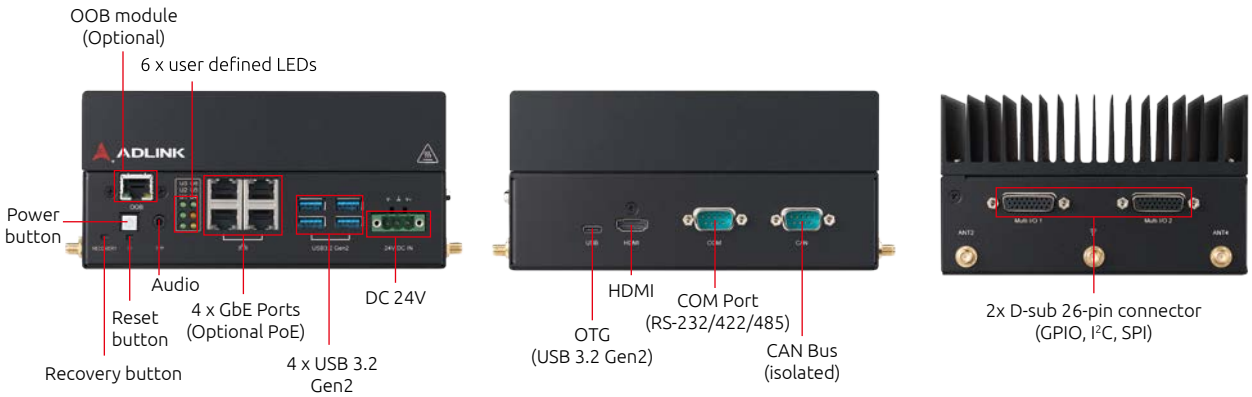
A virtual scratch simulated by NVIDIA Omniverse (Virtual Data)



An actual scratch and a missing component found (Result)



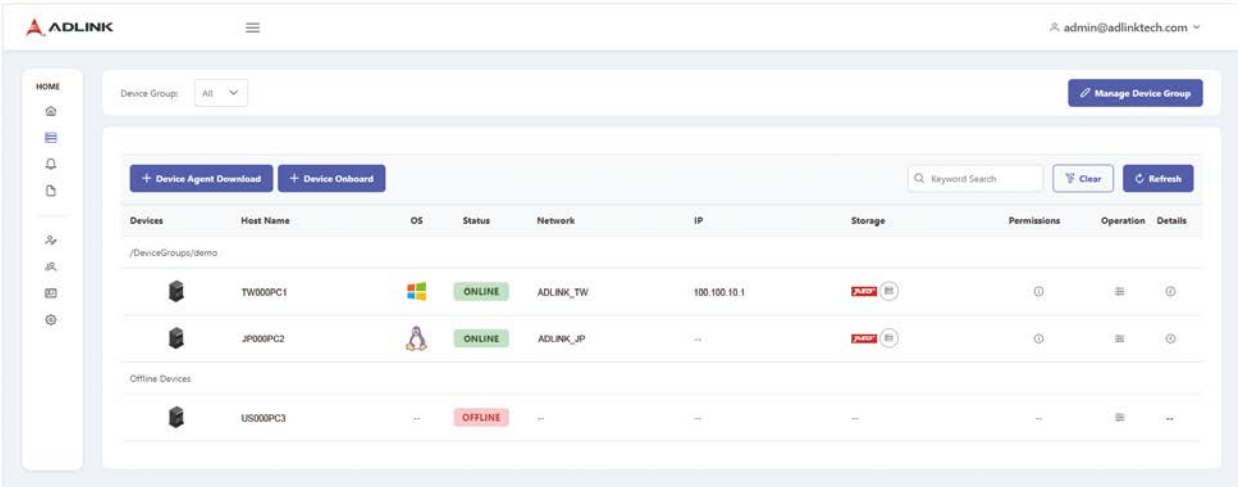
Beyond its technical prowess, ADLINK's solution is designed for seamless deployment in tough industrial settings. The ruggedized compact form factor supports Linux® Operating System and Jetpack 5.1.2, providing 4 Power over Ethernet (PoE) and 4 USB 3.2 Gen 2 ports to support various industrial cameras. Its fanless and compact design ensures 24/7 operation, making it a reliable asset in demanding manufacturing environments. Such comprehensive I/O featured on a single device eliminates the complications in deployment.



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Added value only from ADLINK, EdgeGO

ADLINK's solution comes with an optional EdgeGo, a native software development kit for remote device management. EdgeGo streamlines real-time device registration, monitoring, onboarding, and organization, ensuring seamless deployment and frictionless 24/7 runtime. The software allows users to visualize connected devices, retrieve relevant data to a customized dashboard, and send event notifications, maximizing device and data security.



EdgeGO

Insight

In the pursuit of 100% inspection accuracy, ADLINK's DLAP-411-Orin redefines the manufacturing inspection landscape. By harnessing the capabilities of deep learning, machine vision becomes more adaptable, efficient, and capable of handling complex features. Accurate defect inspection is crucial for overall process health, mitigating challenges from high production costs to compromised quality. ADLINK's Deep Learning Acceleration Platform series offers advanced solutions for quality control, preventive maintenance, operational efficiency, and sustained competitiveness in the Industry 4.0 era. Predictive maintenance enhanced by AI allows for better prediction and avoidance of machine failure, leading to increased asset productivity and reduced maintenance costs. Asset productivity increases of up to 20% are possible, and overall maintenance costs may be reduced by up to 10%.[6]

Conclusion

As industries progress towards intelligent manufacturing, ADLINK's Deep Learning Acceleration Platform series emerges as the unrivaled standard for quality and defect inspection. This innovative solution not only elevates inspection accuracy but also contributes to increased productivity and reduced operational costs. Enterprises adopting ADLINK's DLAP series position themselves at the forefront of Industry 4.0, establishing unparalleled benchmarks for efficiency, precision, and manufacturing excellence. With ADLINK, the future of manufacturing quality is reshaped, and delivering a seamless, advanced, and indispensable approach to inspection is pivotal in amplifying manufacturing yield.

6 - Smartening up with Artificial Intelligence (AI) - McKinsey

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