SOLUTION BRIEF

AI for Edge Computing
Textile Factory Automation

End-to-End Solution Powers Textile Industry Transformation

Machine vision helps improve production efficiency and reduce equipment downtime for today's busy garment manufacturers

Kinco 步科

AOTU

The textile industry has experienced waves of transformations over its long history, from the cultivation of textile materials and silk weaving to mechanized production. With the rapid change in consumer preferences and growth of e-commerce, another market revolution is on its way. Today, cookie-cutter garments are no longer appealing to consumers. Personalized garments of choice have become the mainstream. Small batches, multiple varieties, and short delivery periods are critical attributes for the next phase in the textile industry.

At the same time, the emergence of digital technology and innovation marks new opportunities for the industry to capitalize on these trends by improving its production process. With technologies such as artificial intelligence (AI), textiles are being transformed across printing, sampling (garment), cutting, sewing, packaging, warehousing, and logistics. This new way of working is enabling increased agility in responding to market demands, reduced material waste, and improved operational efficiency.

For example, in the eastern Chinese city of Hangzhou, designers quickly create garments according to the latest trends and samples. The items are produced, inspected, packaged, and transported within a few days and then made available through "display windows" in online clothing stores. Since consumer preferences may change rapidly as trends change, this process must be niche, price competitive, and fast to satisfy consumers' needs.

Due to these and other industry shifts, the textile industry finds itself at the threshold of an exciting new era. However, making the most of these new opportunities is not without its challenges.

Challenge: From large-scale clothing production to customizations

Rising labor costs continue to be an obstacle for textile manufacturers as well as the automation of production processes and precision operation. Labor makes up a sizable portion of the industry's operational costs, putting the companies able to reduce that cost at a considerable advantage compared to the competition.

Meanwhile, in traditional textile and garment factories, growing demand increasingly overwhelms production, quality inspection, sampling, cutting, sewing, and order management. Workers find themselves struggling with fatigue along with other emotional and physical factors, all of which can negatively impact a factory's productivity during the manufacturing process.

Defect detection and quality control have been specifically large challenges in the textile industry. Consider the Shaoxing Shanhai Textile Co. factory (hereinafter referred to as Shanhai). During the textile-making process, quality inspection specialists will regularly check the quality of the fabric. Usually, a single staff member

is responsible for managing multiple looms, inspecting them one by one. If a defect is found, the worker is required to turn off the machine and repair the problem before restarting the production process. Due to the varying skill levels of the workers, the length and accuracy of the inspections vary, often leading to failure of detection, causing material waste.

Another challenge pertains to the ordering process in a traditional garment factory. Whether it is transferring new samples to the warehouse or tracking product quantities, styles, and shipment status, the practice that goes into ordering remains for most a manual process. This frequently results in problems such as low order transparency and poor synergy with the sales department, impeding desired responsiveness to the fast-paced market and increasingly fierce competition.

Companies like the Dianshi Clothing Co., Ltd. in Hangzhou need new garment production processes to improve both efficiency and quality at a reasonable cost. Textile production processes can achieve this reasonable cost and improvements in efficiency and quality through the use of technologies such as machine vision.

Solution: End-to-end solution harnesses machine vision and edge technology

Kinco is focused on revolutionizing the textile industry and collaborating with ecosystem partners to deliver end-to-end solutions. The textile manufacturing solution uses machine vision to implement continuous, fast, accurate, and automated data insights. The solution is powered by Intel® Xeon® and Intel® Core™ processors for computing AI acceleration. It was developed by leveraging **Intel® Edge Insights for Industrial**, and integrates with the following:

- Aotu.ai's **BrainFrame** smart vision platform
- AI reference algorithms in OpenVisionCapsules and the Intel® Distribution of OpenVINO™ toolkit
- Manufacturing execution system (MES)

The solution provides smart AI insights from edge to cloud and satisfies the demands of surface defect detection, order tracking, order linking, and other related requirements in the textile industry.

The Edge Insights for Industrial software package provides functions such as video ingestion, storage, analytics, and transmission. It offers a robust edge computing software infrastructure and delivers video/image capture, storage, classification, data analysis, reporting, and closed-loop control. It can integrate third-party platforms and algorithms, such as Aotu.ai's BrainFrame smart vision platform and algorithms. It can interface with MES, warehouse management systems (WMSs), and other industrial systems, and connect to edge servers and cloud applications. The scalable and modular architecture allows users to focus on use case–specific application development while saving time and effort by taking advantage of the edge AI capabilities prepackaged with Edge Insights for Industrial.

The Intel Distribution of OpenVINO toolkit is one of the key ingredients for rapidly developing deep learning vision applications. It supports the industry AI frameworks as well as standard and custom layers to easily deploy deep learning inference into applications. In addition, the toolkit accelerates the development and deployment of deep learning vision applications and supports heterogeneous computing across Intel®-based hardware platforms.

Aotu.ai's BrainFrame is a real-time smart vision inference platform with automated algorithm fusion and scheduling for computer vision and deep learning algorithms. It enables fast, scalable, and customizable deployments on edge computing. It is an open platform, allowing system integrators to drag and drop algorithms in OpenVisionCapsules format, making it ideal for sophisticated continuous monitoring, tracking, and analysis tasks for industrial applications. Aotu.ai's BrainFrame has been integrated with Edge Insights for Industrial–based platforms to provide a complete intelligent industrial solution.

OpenVisionCapsules is an open format set of tools released by Aotu.ai and OpenCV. It facilitates the creation of portable algorithm "capsules" that can be easily distributed and deployed to compatible hardware and software for interoperability between smart vision devices. OpenVisionCapsules provides complete support for the Intel Distribution of OpenVINO toolkit, fully leveraging the optimization and acceleration offered by the toolkit on Intel processors.

With the robust combination of cutting-edge tools and technologies, the end-to-end solution is able to deliver a range of benefits to textile manufacturers, including:

- **Improved textile production efficiency:** Using computer vision and deep learning on existing edge devices improves production efficiency with accurate and automated monitoring.
- **Reduced labor and operating costs:** The solution requires that less manual inspection, image collection, and maintenance be performed by staff.
- **Enhanced decision-making:** Classifying images into various common types helps textile and garment companies perform edge analysis on the production line with low latency and fast decision-making.
- **Increased revenue opportunities:** Textile and garment companies can analyze production data to enhance interactions with customers and potentially explore new revenue streams.

How it works

The end-to-end textile solution with Aotu.ai's BrainFrame and OpenVisionCapsules combines AI with heterogeneous edge computing by adding video sensing devices to the production lines of textile, printing, and garment companies. This brings significant benefits, including increased performance, integrated deep learning, and accelerated time to market for innovations.

Industrial hardware supplier JWIPC created edge computing nodes based on Intel® hardware and then partnered with system integrator Invisix, which used JWIPC's hardware (i.e., computing node), Edge Insights for Industrial software, and a deep learning surface defect detection algorithm to deploy the textile defect detection solution in the Shanhai factory. This algorithm was customized using the Intel Distribution of OpenVINO toolkit on an Intel® x86 architecture-based processor.

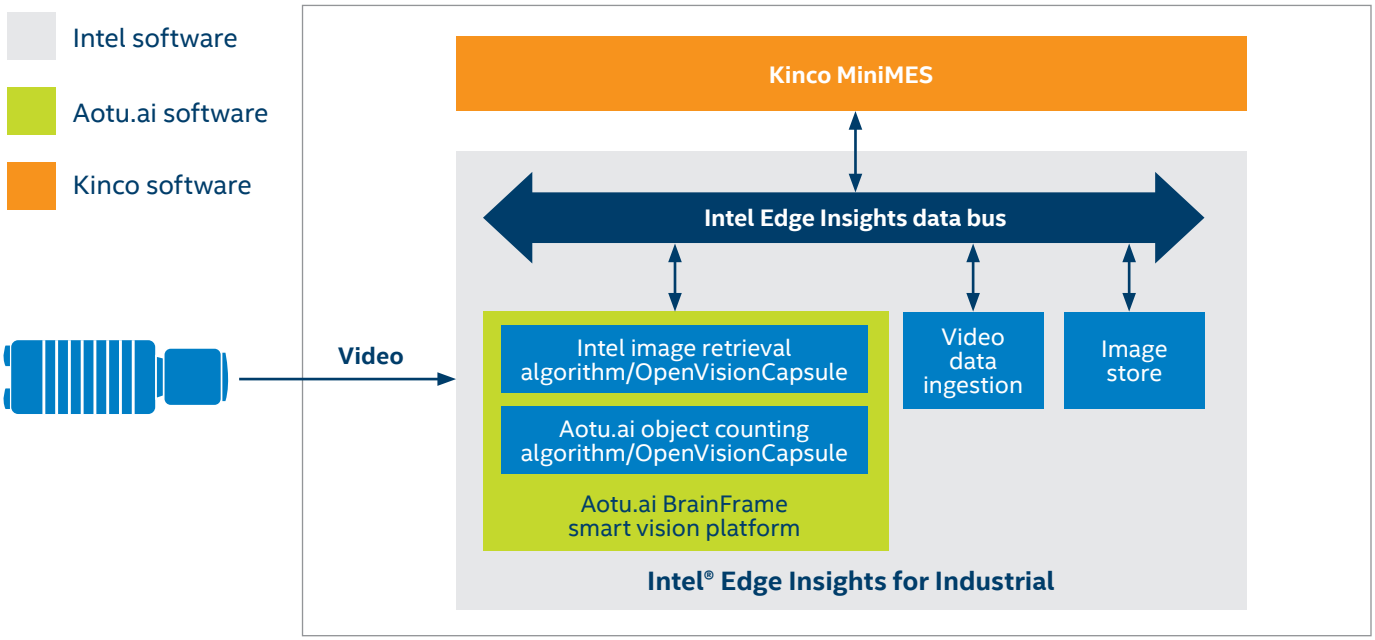
Product defects are captured by cameras and then images of the defective products are labeled and stored in the system and used by the detection platform to train the defect inspection algorithm model. The collected data is used to update the model, and once the model has reached the specified accuracy, it is deployed onto the production line to replace manual inspection work. Looms with defective products are located in a timely manner. An alarm alerts maintenance staff, instructing them to handle the defects in a timely manner, leading to reduced material waste and improved production efficiency.

Kinco, the automation solution supplier, provided the MiniMES production management system to implement a traceable production process. It integrated its MiniMES with an image-retrieval algorithm from Edge Insights for Industrial and Aotu.ai's BrainFrame smart vision platform to handle sophisticated computer vision and deep learning inference problems in the production process at garment factories. Several aspects of production transparency were improved, including:

- Capturing images at each step in the production process
- Analyzing the images at each step using automated algorithm fusion and scheduling offered by Aotu.ai's BrainFrame smart vision platform on the edge computing nodes
- Acquiring production data in real time
- Building the automated order management platform

In the sample production process, when sample production is completed, the system will use the data that is automatically captured via the cameras to identify the type of samples, patterns, and quantities and update the data in the order management platform. Factory management and the clients can then use PCs, phones, or other devices to check the order status, improving production visibility and bringing in new innovations to the factory ordering system.

Besides applications in the textile industry, the end-to-end solution also has many types of industrial algorithms integrated within it. Clients can quickly deploy and update their software and hardware based on use case–specific requirements.



Conclusion: Creating smart textile and garment factories

Machine vision systems can quickly obtain a large amount of video and image data and easily implement information integration, making such systems one of the key components in smart factory automation. Textile and garment companies can use machine vision systems in a wide range of applications, such as process monitoring, product inspection, and quality control. The data collected and insights generated can be used to guide and optimize overall factory productivity and operational efficiency.

Currently, Shanhai, Dianshi, and other textile and garment companies are verifying the implementation of the end-to-end solution into their production environment. With its powerful edge AI capabilities, solution stability, and reliability, Kinco's factory automation solution unleashes the transformation and modernization of the textile industry, creating a solid foundation for the smart garment factories of the future.

Learn more

Aotu.ai's BrainFrame plug-and-play smart vision platform delivers the continuous monitoring, tracking, and analysis required in today's smart factories. **Get the details ›**

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About Aotu.ai

Aotu.ai is a Silicon Valley–based start-up dedicated to innovation in the AI domain with expertise in computer vision, deep learning, and software engineering. Its product, BrainFrame, a smart vision platform, has been deployed in multiple verticals such as industrial/IoT and enterprise/administration. Aotu.ai strives to be the leader in rapid smart vision deployment, bringing advanced AI to production with unprecedented ease to improve people's lives with machines that see and understand the world.

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About Kinco

Kinco is one of the leading suppliers of manufacturing smart solutions in China. The company focuses on developing, producing, and selling automation standard products and intelligent hardware solutions, using Industrial Internet of Things (IIoT) technology to facilitate manufacturing digitalization and web collaboration for smart commerce.

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