

Production Safety Towards "Smart", Digital Transformation of Manufacturing Accelerates —Aotu and Intel® Factory Production Safety Solution

In 2021, the World Health Organization and the International Labor Organization jointly released A Global Monitoring Report: WHO/ILO Joint Estimates of the Work-related Burden of Disease and Injury, 2000–2016. The report showed that globally in 2016, it was estimated 1.9 million people died from work-related causes. The leading occupational risk factor was exposure to long working hours (39.6%), followed by occupational exposure to particulate matters, gases and fumes (24.0%) and occupational injuries (19.3%). It can be seen that not working overtime, safety of working environment and safe behaviors of employees are related to reduced occupational diseases and injuries.

Therefore, in order to ensure the safety of working environment and the standardization of employee behaviors, factory normally set up a safety department, which is responsible for the education, training, supervision and management of production safety. At the same time, many factories use cameras to monitor key scenes, and assign special personnel to be responsible for 24-hour supervising and reminding relevant personnel in time when safety problems are found.

As "smart manufacturing", "smart factory" and "digital transformation" are ways to high-quality development of manufacturing industry, many manufacturing enterprises have not only introduced intelligent software and hardware solutions in production, but also paid attention to how to use emerging technologies and intelligent products realizes guaranteed, efficient and economical production safety.

Project Requirements: Intelligent Transformation of Video Management for Production Safety in Large Beverage Bottling Factory

A large beverage company, formed by joint ventures of Fortune 500 companies, has 20 bottling factories in China and operates 19 provincial markets including Beijing, Tianjin, Hebei and Shandong, covering 81% of China land area and 51% of the total population of mainland China.

Through market research and field survey to existing intelligent projects, this company realized that both production process and production safety management needs to be digitally upgraded. In response to its pain points, Aotu and Intel® jointly provided an intelligent video solution for factory production safety. By comprehensively transforming the existing video management system with artificial intelligence technology, it realizes standardized AI inspection and warning for key scenarios and employee behaviors for safety compliance, which further improves management ability of production safety, timely discovers and solves various safety problems in production and operation of the factory, and eliminates various hidden dangers of production that might cause serious personal casualties and safety accidents.

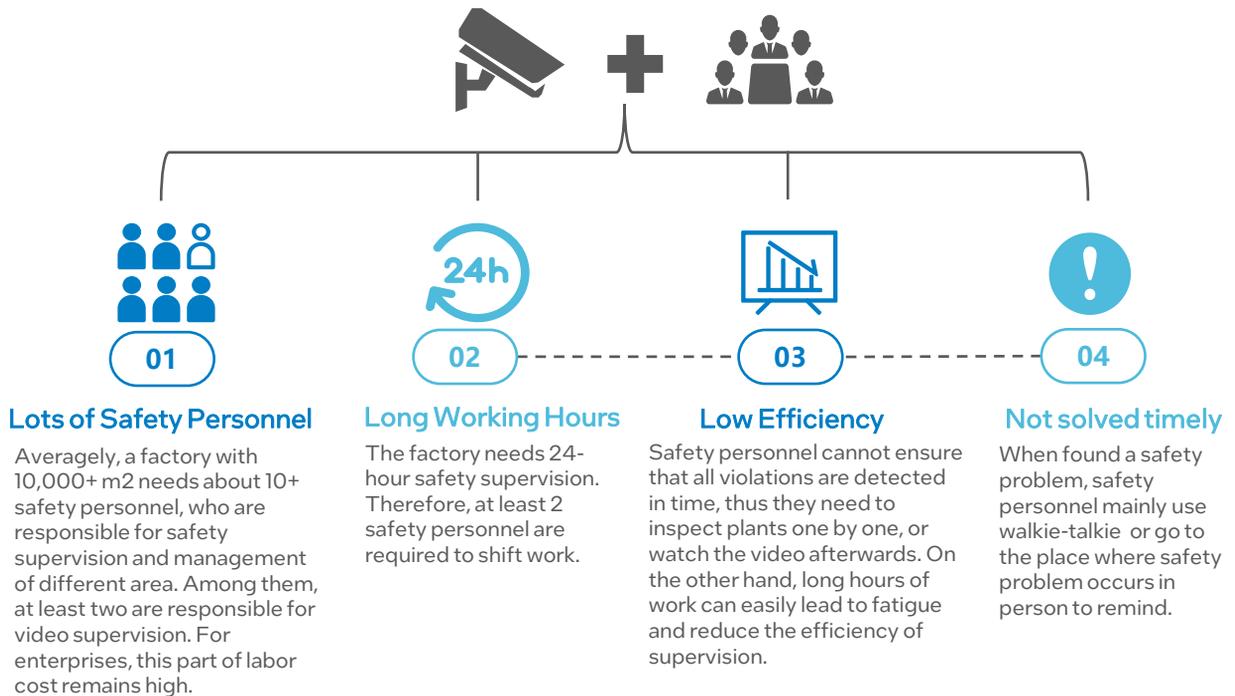


Figure. Drawbacks of Manual Safety Management

Solution: Intelligent Video Management Solution for Factory Production Safety Based on Intel® Product and Reference Algorithms

Aotu and Intel® jointly developed an intelligent video solution for factory production safety, which is based on 11th Gen Intel® Core™ processor, Intel® Xeon® scalable processor, OpenVINO™ Toolkit, and deep learning reference algorithms. The solution provides VisionCapsule® algorithms that have been tested in actual scenarios and integrated into the Aotu BrainFrame® open AI vision operating system. It also launched an industrial vision AI box/AI edge server, providing Graphics User Interface (GUI) for AI video algorithm management and deployment, and supporting factory production safety. Furthermore, based on analysis and verification of the needs of terminal factory in the early stage, key scenarios and applications were screened out. This solution provides 12 customized scenario algorithms, covering 18 key scenarios and nearly 1,000 supervision points in the factory.

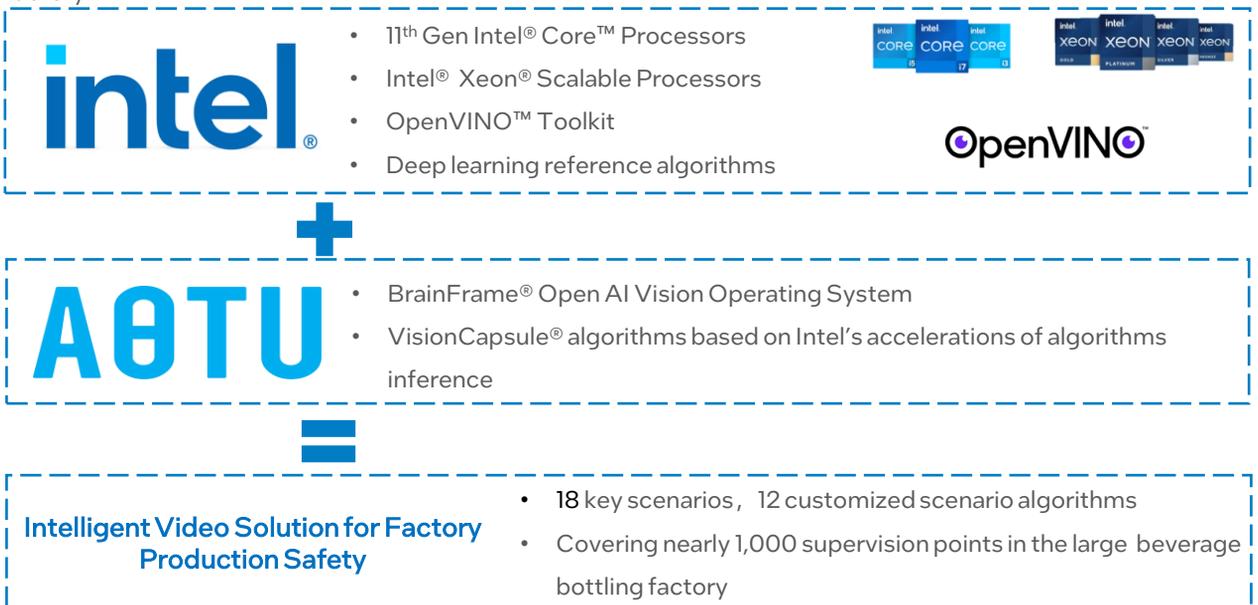


Figure. Intelligent Video Management Solution for Factory Production Safety Jointly Developed by Aotu and Intel®



Roofs in the factory	Inside the ceiling of workshop	Cesspit area
Source pool area	Septic tank	Grease trap
Elevator well	Inside the boiler	Cable trenches in closing underground
Motor-pumped well over 2.5m	Raw material (packaging material, white sugar, bottle embryo) handling area	Product delivery area
Fructose receiving area	Where people and vehicles meet except loading and unloading area	Loading area
Climbing area	Limited space work area	Logistics warehouse area

Figure.18 Key Scenarios Covered by Intelligent Video Solution for Factory Production Safety



Hard hat wearing detection	Seat belt/reflective vest detection	Illegal climbing
Perimeter protection of core restricted area	Personnel statistics in restricted area	Illegal entry into dangerous areas
Sidewalk walking behaviors detection	Use mobile phone detection	Limited number of personnel in the loading and unloading area
Intelligent management of safety rope wearing	People entry/break-in record	Hard hat feature detection

Figure.12 Customized Scenario Algorithms of Intelligent Video Solution for Factory Production Safety

During the implementation of this solution, original camera coverage of the bottling factory were consolidated, and parameter configuration was updated for specific business scenarios, thus forming a complete set of procedures: access to video streaming - video AI analysis - warning & violation video replay - manual verification - emergency classification and handling. This procedure reduces the workload of safety personnel and ensures that safety issues are fully reported. Moreover, manual verification and emergency classification and handling, as the gating mechanisms, to prevent any action is taken without human-in-loop.

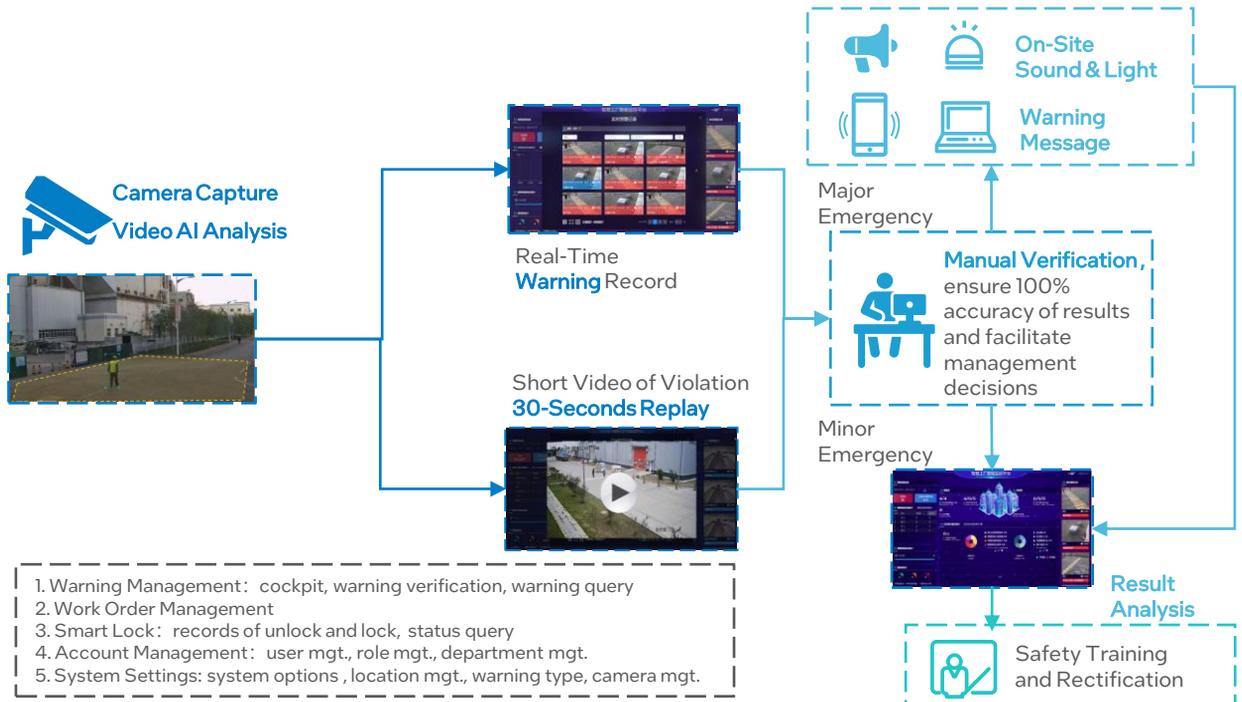


Figure. Procedure and Functions of Intelligent Video Management Solution for Factory Production Safety

Advantages: The Integration of Intel's Products and Aotu's Solutions, Short Development and Deployment Cycle and Cost-Effective

This solution has three advantages:

First, with 11th generation Intel® Core™ processor and Intel® Xeon® scalable processor, this solution provides system-level optimization and acceleration for scenarios such as deep learning, AI, and machine vision, satisfying needs for AI computing power in different scenarios.

In this solution, the 11th Gen Intel® Core™ processor is suitable for standardized scenarios with light load. Equipped with Intel® Iris® Xe graphics, which has up to 96 execution units and 2 video decode boxes, offers unique advantages in intelligent image and video processing, deep learning and so on. For customized scenarios with heavy loads, Intel® Xeon® scalable processor is more suitable. Intel® Xeon® scalable processor not only has ultra-high computing performance, but is also optimized for the diverse workload types and performance requirements of edge intelligent scenarios, supporting greater memory and providing better IO performance. Moreover, in order to meet the needs of industrial scenarios, the processor is designed with industrial-grade ruggedness, high reliability, and wide temperature range to ensure continuous and stable operation of equipment in harsh industrial environments.

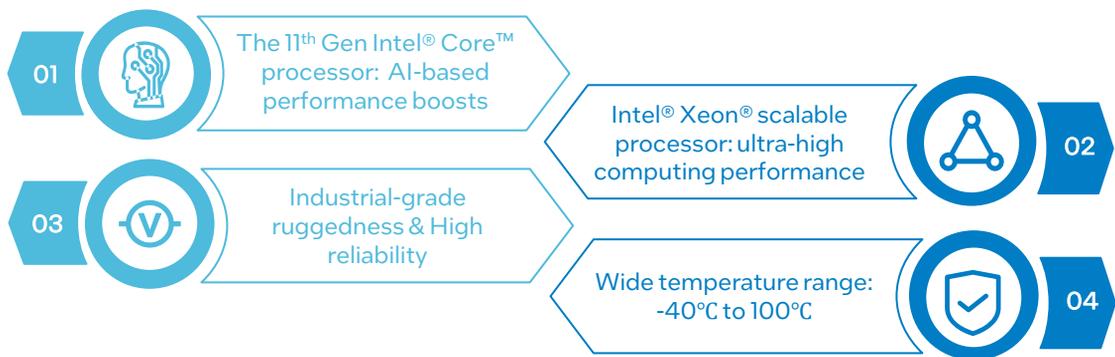


Figure. Advantages and Features of Intel's Processors

In addition, this solution use OpenVINO™ Toolkit which optimizes and accelerates deep learning algorithms to fully exploit the performance of Intel's hardware. OpenVINO™ supports workloads scaling across Intel® CPUs, GPUs, iGPUs, VPU, FPGAs, and other hardware platforms or accelerators, thus maximizing performance. Meanwhile, OpenVINO™ provides pre-trained models and reference algorithms for different scenarios, such as hard hat recognition, safety vest recognition and other safety algorithms, shortening costs and development cycle of the algorithm.

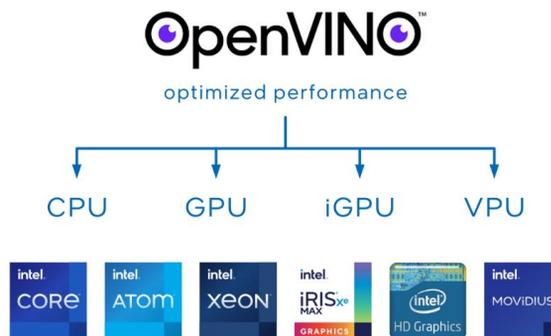


Figure. Intel® OpenVINO™ Toolkit

Secondly, this solution adopts the Aotu BrainFrame® AI visual operating system and OpenVisionCapsule algorithm packaging format to realize timely download, plug-and-play zero-code algorithm loading and deployment, visual AI deployment, and simple operation. Therefore, this solution significantly reduces the threshold of AI products and improve user-friendliness.

BrainFrame® is an AI visual operating system developed by Aotu, which provides a graphical interface for algorithm configuration and AI developed API, which provides AI developer community and system integrators with zero-code, low-code AI application integration development and deployment platforms.

BrainFrame® supports and OpenVisionCapsule open-source algorithm packaging format, is compatible with third-party algorithm loading, and can achieve plug-and-play algorithm for different application scenarios. OpenVisionCapsule converts the algorithm model developed based on OpenVINO™ Toolkit into the format of OpenVisionCapsule. After the conversion, it only needs to be placed in the corresponding folder, and BrainFrame® can automatically recognize and load it for operation.

Thirdly, this solution is an integrated software and hardware application for factory production safety management, a hardware platform that flexibly adapts to computing power requirements of scenarios, and a plug-and-play algorithm and software platform with zero-code loading and deployment. It meets diversified customer needs and efficiently respond to complex and changing industrial scenarios, which not only reduces the workload of system integration, shortens the development cycle, makes deployment more convenient, but also reduces the cost of application, operation and maintenance, and has higher cost performance and stronger reproducibility.

Simple Form:

Directly use existing camera to deploy the industrial vision AI box/AI edge server integrated with the Aotu’s software on site, and can be used immediately after accessing to video. Product with software and hardware integration, and a large number of preset standardized scenario capabilities. Short deployment cycle, and strong reproducibility.

High Flexibility and Openness:

Support local or cloud deployment. Flexible configuration of different cameras to different intelligent capabilities and scenario algorithm maintenance and switching, implementing visualization in seconds and easily handling various analysis and statistical tasks. Compatible with third-party algorithm encapsulated in VisionCapsule®, plug-and-play .

Cost-Effective:

The flexible configuration of computing power and applications enables the solution to save more than 30% of the relative cost under the same scale. Can be quickly expanded and supports customized scenarios. After adding VisionCapsule® algorithms as needed, configuration loading is implemented, what you see is what you get, and no development is required.

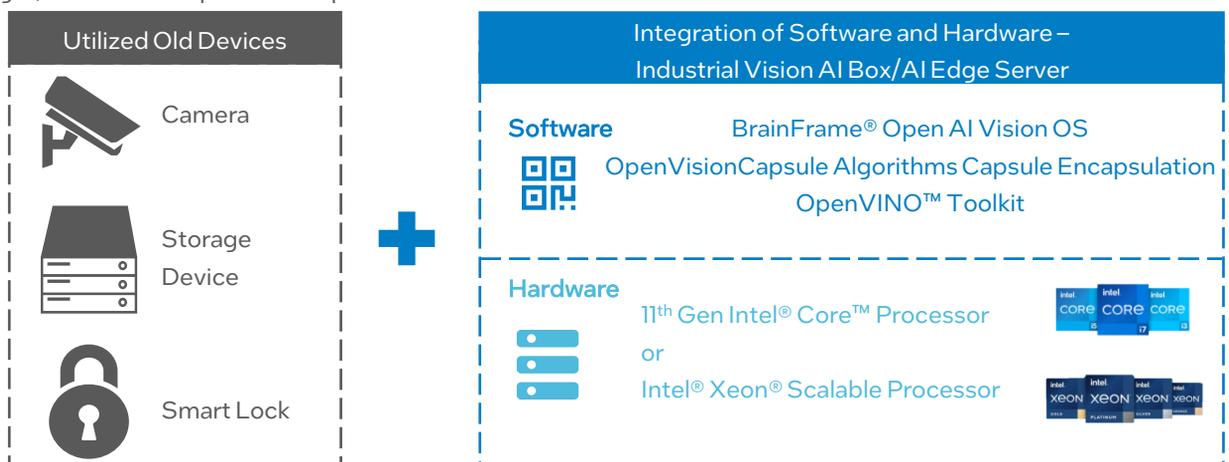


Figure. Architecture of Intelligent Video Management Solution for Factory Production Safety

Effects: Improved Safety Management Plan, Improved Efficiency of Information Exchange, and Provided Data Support

Factory production safety solution jointly developed by Aotu and Intel® improved safety management and efficiency of information exchange in the factory, and provided reliable data support for factory management optimization.

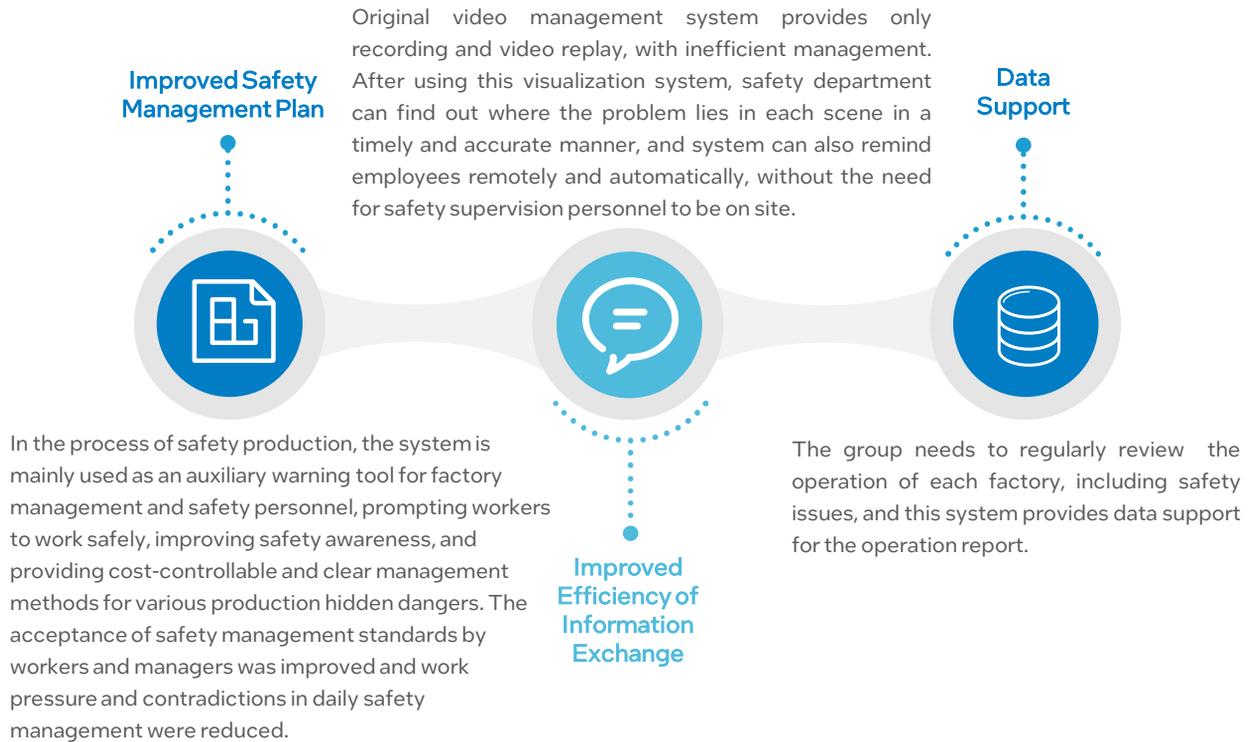


Figure. Effects of Intelligent Transformation of Video Management for Production Safety in Large Beverage Bottling Factory

Future: More Than Production Safety, Intel® Will Continue Injecting Momentum into Smart Manufacturing

The orderly production of factories is inseparable from production safety. Intelligent video management solution for factory production safety jointly developed by Aotu and Intel® is applicable to a wide range of manufacturing factories. It can fix pain points in traditional production safety management and efficiently discover and solve safety problems, as well as provide a higher rate of return for enterprises with high cost-performance ratio.

In addition to production safety, smart manufacturing also includes process digitalization and automation, logistics automation, predictive analysis and so on, involving various emerging technologies such as AI, cloud computing, edge computing, and 5G. Smart manufacturing will synergize and apply more cutting-edge technologies. In order to help the transformation of manufacturing industry in China, Intel® will continue focusing on emerging technology such as machine vision, AI, Internet of Things, 5G, etc. On the one hand, Intel® will continue playing the role of an infrastructure builder, providing hardware with high computing power and laying cornerstone of digital transformation. On the other hand, Intel® will join more ecological partners to directly solve the pain points of industry transformation, jointly promote smart manufacturing solutions, and empower smart manufacturing, making industrial production safer, more efficient and smarter.

About Intel®:

Intel®(NASDAQ: INTC) is an industry leader, creating world-changing technology that enables global progress and enriches lives. Inspired by Moore's Law, we continuously work to advance the design and manufacturing of semiconductors to help address our customers' greatest challenges. By embedding intelligence in the cloud, network, edge and every kind of computing device, we unleash the potential of data to transform business and society for the better. To learn more about Intel's innovations, go to newsroom.intel.com and intel.com.

About Aotu:

Aotu is committed to innovation in the field of AI, focusing on computer vision algorithms and AI operating system software technology. Its product - BrainFrame® - has been deployed in multiple sectors including industrial/IoT and enterprise/management. Smart machines offer people better opportunities to improve work and life. Aotu strives to be a leader in rapid AI deployment, bringing advanced AI technologies into production with unprecedented ease, enabling machines to see and understand the world, ultimately improving our lives. For more information, please visit Aotu's official website dilililabs.com.



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