

F R O S T & S U L L I V A N

# 2024 TECHNOLOGY INNOVATION LEADER

*IN THE GLOBAL VISION  
PROCESSING UNIT  
INDUSTRY*

F R O S T & S U L L I V A N

BEST  
2024 PRACTICES  
AWARD

**HAILO**

## Best Practices Criteria for World-Class Performance

Frost & Sullivan applies a rigorous analytical process to evaluate multiple nominees for each award category before determining the final award recipient. The process involves a detailed evaluation of best practices criteria across two dimensions for each nominated company. Hailo excels in many of the criteria in the vision processing unit space.

AWARD CRITERIA	
<i>Technology Leverage</i>	<i>Business Impact</i>
Commitment to Innovation	Financial Performance
Commitment to Creativity	Customer Acquisition
Stage Gate Efficiency	Operational Efficiency
Commercialization Success	Growth Potential
Application Diversity	Human Capital

### *Seeking to Create an Impact, Hailo Provides Efficient Technological Innovation*

Established in 2017, Israel-based Hailo Technologies is a semiconductor manufacturer specializing in artificial intelligence (AI) and developing AI processors for various applications. It creates specialized AI processors that allow edge devices to perform like data centers. By reimagining the traditional computer design, Hailo's processors enable smart devices to do complex deep learning tasks like object detection and segmentation in real time while consuming less power and space and at a low cost.

The company aims to empower clients to utilize neural networks and integrate AI into various edge devices and applications, enhancing people's lives and increasing productivity without sacrificing their security and privacy. Lowering the cost and increasing the efficiency of AI on the edge can accomplish this.

Hailo's recently launched Vision Processing Units (VPU) is a next-generation chip that combines its popular AI processor technology with a powerful system-on-chip tailored to create high-performance AI cameras specializing in superior image quality and advanced analytics. The VPU technology's core is its AI data flow processor architecture, a cutting-edge control system built on hardware and software that allows flexible operation while consuming less energy. The company uses this unique spatial computing approach for high-running, high-performance, low-power neural networks at the edge.

Hailo has been developing this technology for a few years, with hundreds of companies worldwide using

it. Its VPU is the only lineup of AI vision processor units in the market to perform advanced AI image enhancement and AI analytics on the same video screen without compromising performance. This is crucial, particularly when addressing AI picture enhancement, the industry's key tech trend. Its throughput of 20 tera operations per second (TOPS) on the device is at least three times more than that of a similar competing device on the market.

The high efficiency of the architecture helps maintain a very low power envelope of two to three watts of typical power consumption for a complete application running on a full application pipeline. For instance, the Hailo-15H can execute the industry benchmark ResNet-50 classification model at an astounding 700 FPS or the cutting-edge object identification model YoloV5M6 with high input resolution (1280x1280) at a real-time sensor rate.

A major differentiating factor for Hailo is that it develops in-house AI accelerators along with VPUs. This feature is useful when users need sophisticated solutions for complex AI applications. For example, Hailo

*"Hailo's Data Flow Architecture is a unique spatial computing approach for high-running, high-performance, low-power neural networks at the edge."*

*– Himanshu Mhatre  
Industry Analyst*

can cater effectively to an application that requires a computer to manage various data streams and cameras for vision purposes. Its AI processor and VPU enable users to utilize the same software, applications, and development environment throughout the workflow.

By offloading cloud analytics to save video bandwidth and processing, Hailo-15-enabled cameras reduce the total cost of ownership in large-scale camera deployments while enhancing privacy through data anonymization at the edge. The product is an incredibly sophisticated AI-based video analytics system that protects people's privacy while keeping them secure. It also enables businesses to run more effectively at a reduced cost and with less complicated network infrastructure.

The company's culture of creating customer impact contributes to innovation. Hailo believes the best way to innovate is to understand the needs and trends prevalent in the market. So, Hailo has a dedicated machine learning team that follows all the latest research and implementation at its customers' end while focusing on published literature. The company schedules regular meetings to present the research findings to all the team members interested in innovation. Hailo believes this is one of the most effective ways to spread knowledge and foster open innovation.

In addition, Hailo's experts work closely with its customers, ODMs and distributors worldwide to understand the end customer pain points and provide product feedback. This allows more advanced application engineering tailored to crucial customer needs. Hailo releases new versions of its software on a quarterly basis based on customer feedback.

As part of the new product development strategy, Hailo regularly conducts practice tests, brainstorming meetings, and events like hackathons to foster new ideas. Its patent portfolio of roughly 40 patents, of which >20 have been granted, reflects these activities.

Maximizing the proficiency of its AI processor specialists, superior R&D capabilities, and groundbreaking technology, Hailo has gained a distinguished name in the edge inferencing and vision processing space. Its industry-leading product delivers tremendous value in high-demand sectors.

## *Successful Commercialization Driven by Partnerships and Open Platform Implementation*

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Partnerships are Hailo's core strategy to gain a competitive advantage and a solid customer base. The company works with top partners to smoothly integrate their goods with its AI processors. It also focuses on producing dependable, high-quality, and simple-to-use solutions while meeting the strictest business requirements. Its wide range of reliable partners spans market segments and geographical areas, providing clients with cutting-edge solutions. Since its inception, the company has collaborated with numerous software, hardware, technology, and distribution partners. Hailo has about 50 partners globally as part of technology and new product development strategies.

Hailo's partners include software developers for its processor. It has dedicated partnerships in industry verticals such as industrial automation, surveillance, automotive, retail, medical, and smart city.

Challenges such as speed, dependability, time to market, and production costs are resolved through collaborative strategies, leading to substantially smaller AI models that run faster without sacrificing accuracy. Notable software partners include CVEDIA, LeddarTech, Innovatrics, 36ZERO Vision, and HD Vision.

- CVEDIA develops software in perimeter protection and security.
- LeddarTech works with Hailo to develop software related to an automotive and surround view system.
- Innovatrics collaborates with Hailo to make software for face recognition and security, among others.

Hailo's partner ecosystem also includes leading ODMs and hardware partners who seamlessly integrate their products with its processors, creating easy-to-use, dependable, and high-quality solutions that adhere to the industry's most rigorous standards. For instance, Hailo partnered with Advantech, a leading provider of industrial-embedded AI solutions, in August 2023. The collaborators will combine the Hailo-8 M.2 AI Acceleration Module with Advantech's i.MX 8M Plus-based platforms, enabling businesses to execute full-scale deep learning at best-in-class power efficiency.

Additionally, the company has special distribution partners to secure critical customers in various countries. Hailo's customers are in regions such as Japan, South Korea, Taiwan, China, Israel, Europe, India,

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and North America. Distribution partners allow Hailo to handle this vast network of customers and applications while enabling the company to focus on advancing its existing and new technologies.

The company cooperates with technology partners to offer joint reference designs for numerous applications, benefitting customers through a quick

time-to-market. Hailo has partnered with prominent semiconductor companies, including NXP Semiconductors, Renesas Electronics, and Socionext.

Hailo is the only VPU company in the market that has an open GitHub website with hundreds of AI models for developers to use. Since this model reduces customer dependence on Hailo, the need for Hailo to

employ model developers declines, thereby enhancing operational efficiency. The model is also beneficial and efficient for customers, allowing users with a broad partner ecosystem to develop many applications for its complete lineup of processors.

Frost & Sullivan considers Hailo's partnerships with many leading organizations as proof of the prominence of its technology in the industry. These collaborations demonstrate its customer-focused approach, expansion tactics, and commitment to operational efficiency, fortifying its competitive differentiation.

### ***Application Diversity and Growth Potential***

Edge computing leads to the development of intelligent cameras and cars, autonomous robots, sophisticated traffic control systems, intelligent buildings, clever industries, and more. AI at the edge can transform everything, opening new possibilities for applications that will improve and secure our planet, which Hailo's AI processing technology makes possible.

Hailo's VPU has expansive application potential, ranging from automotive and aerospace to manufacturing and retail. The three main areas Hailo has identified for its growth are:

1. Internet protocol cameras and the smart city market, which is growing rapidly worldwide
2. City management and public safety, which includes use cases such as traffic monitoring and physical security
3. The automotive market, where high growth is likely for functions such as advanced driver-assistance systems (ADAS), autonomous vehicles, off-road vehicles, and bikes

Hailo AI processor-based traffic monitoring systems use one or more cameras to provide high-performance, real-time AI video analytics at the edge. These devices have a built-in power budget and provide precise insights and alarms at low latency. The Hailo AI processor is perfect for incorporation into edge traffic management gateways or traffic cameras due to its tiny form size, exceptionally low power consumption, and affordability.

In the same way, Hailo AI processors for automobiles are built to scale and can handle the rigorous deep-learning workloads needed for ADAS and AD. A single low-power, compact chip from Hailo can process multiple video streams, and the chips can operate in tandem or a cascade while still achieving industry-leading efficiency, scalability, high processing throughput, and low latency. This makes advanced automation in automotive affordable and accessible even for mass-market vehicles.

The AI industry is growing exponentially, and this strong trend will continue as many applications seamlessly migrate from cloud-based applications to the edge. Although the company is highly active in surveillance, smart city, public safety, and automotive, there are still many markets to uncover its potential. Some are part of Hailo's technology roadmap, and a few are under exploration. Hailo expects to launch these new AI products between 2024 and 2025. The rise of generative AI is one of the key catalysts that will create new opportunities and horizons in the next five years.

With the release of VPU, Hailo is enabling high-performance AI in a camera form factor by utilizing its leadership in edge solutions, maturity in AI technology, and extensive software suite. Hailo expects to

address the growing demand for enhanced video processing and analytic capabilities at the edge by introducing superior AI capabilities into the camera.

In October 2021, Poalim Equity and Gil Agmon led a \$136 million private fundraising round for the company. With this funding, Hailo's valuation increased to \$1 billion, and its total funds reached \$224 million. The firm intends to use the fund to expand into new and existing international markets and respond to the rising demand for its AI processor for edge devices, which will enable the company to continue developing its next-generation products.

Frost & Sullivan recognizes Hailo for being at the forefront of the edge AI computing evolution, enabled by a customer-centric design approach and partnerships to create products that cater to vision-related applications for various end markets.

## Conclusion

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With its pioneering structure-defined data flow architecture, Hailo enables users to address the fundamental properties of neural networks while improving efficiency and flexibility. Camera designers, edge product and application developers, and integrators can experience an easy and affordable deployment since it uses a single software stack for all its product lines. This allows the execution of AI and video analytics with enhanced accuracy and faster inference time. Hailo stands out from competitors based on its commitment to innovation and customer impact through its culture. By maximizing strategic partnerships with leading industry stakeholders, Hailo delivers revolutionary edge AI capabilities.

With its strong overall performance, Hailo earns Frost & Sullivan's 2024 Global Technology Innovation Leadership Award in the vision processing unit industry.

## What You Need to Know about the Technology Innovation Leadership Recognition

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Frost & Sullivan's Technology Innovation Leadership Award recognizes the company that has introduced the best underlying technology for achieving remarkable product and customer success while driving future business value.

### Best Practices Award Analysis

For the Technology Innovation Leadership Award, Frost & Sullivan analysts independently evaluated the criteria listed below.

#### *Technology Leverage*

**Commitment to Innovation:** Continuous emerging technology adoption and creation enables new product development and enhances product performance

**Commitment to Creativity:** Company leverages technology advancements to push the limits of form and function in the pursuit of white space innovation

**Stage Gate Efficiency:** Technology adoption enhances the stage gate process for launching new products and solutions

**Commercialization Success:** Company displays a proven track record of taking new technologies to market with a high success rate

**Application Diversity:** Company develops and/or integrates technology that serves multiple applications and multiple environments

#### *Business Impact*

**Financial Performance:** Strong overall financial performance is achieved in terms of revenues, revenue growth, operating margin, and other key financial metrics

**Customer Acquisition:** Customer-facing processes support efficient and consistent new customer acquisition while enhancing customer retention

**Operational Efficiency:** Company staff performs assigned tasks productively, quickly, and to a high-quality standard

**Growth Potential:** Growth is fostered by a strong customer focus that strengthens the brand and reinforces customer loyalty

**Human Capital:** Commitment to quality and to customers characterize the company culture, which in turn enhances employee morale and retention

