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2024 COMPANY OF THE YEAR

IN THE GLOBAL ARTIFICIAL INTELLIGENCE CHIP INDUSTRY

DEEPX

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2024 BEST PRACTICES AWARD

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. DEEPX excels in many of the criteria in the artificial intelligence chip space.

Expanding Horizons in the AI Chip Market

The artificial intelligence (AI) chip market is brimming with opportunities, driven by expanding AI applications, strong government support, and a robust manufacturing ecosystem. The evolution of AI, including generative AI and edge AI models, is driving innovations in smart home appliances, autonomous vehicles, robots, virtual reality, and augmented reality. As these technologies become integral to everyday life, the demand for on-device AI processors—enabling real-time processing with enhanced data privacy and low latency—is surging. This trend positions **DEEPX** as a key player in the rapidly growing edge AI market.

However, significant challenges persist. High power consumption and costs associated with traditional GPUs have hindered mass AI application adoption in the world. Running AI in the cloud introduces high latency, serious privacy and security concerns, dependence on reliable internet connectivity, and increased operational costs due to power and cooling demands in data centers. These limitations are propelling a shift toward on-device AI, where data processing happens locally, offering faster, more secure, and cost-effective alternatives—especially critical for battery-powered applications requiring energy efficiency and high performance.

In this context, **DEEPX's DX-M1** chip stands out as a game-changer. Specifically designed to address the limitations of traditional GPUs, the DX-M1 excels in power efficiency and AI inference capabilities, making it ideal for edge AI applications. While GPUs are powerful for training AI models, they are less suitable for

deployment in edge devices due to high power consumption—GPUs consume significant energy, reducing battery life and increasing operational costs; heat generation—excessive heat requires complex cooling solutions, adding to the device size and cost; and cost inefficiency—GPUs are expensive to scale across multiple devices, limiting their practicality for widespread deployment.

The DX-M1 overcomes these hurdles by offering low-power operation with its energy-efficient design that extends battery life and reduces the need for extensive cooling systems; high-performance AI inference optimized for real-time decision-making, processing AI tasks swiftly without relying on cloud connectivity; and scalability through cost-effective production, making it suitable for mass deployment across various industries. Its integration into customer products—currently undergoing rigorous mass-production validation—demonstrates its practical applicability and market readiness.

By directly addressing the power, cost, and scalability challenges of traditional GPUs, DEEPX's DX-M1 chip resolves the pain points that have long hindered widespread AI adoption in edge devices. Its innovative architecture positions it as the ideal solution for overcoming barriers in this rapidly evolving market. With a strategic focus on industry-customized AI chips, DEEPX is poised to capture new growth opportunities globally.

Innovating Today for a Smarter Tomorrow: DEEPX's Story

Founded in 2018 and headquartered in Seoul, South Korea, DEEPX is a pioneering company in on-device AI. It develops advanced AI semiconductors that optimize performance, reduce power consumption, and enhance cost efficiency across various industries, including smart camera modules, smart mobility, smart factories, consumer electronics, smart cities, surveillance systems, and AI servers.

Addressing Market Challenges

By focusing on on-device AI, DEEPX significantly reduces AI's power consumption and the cost of AI services, expanding the AI market. Despite challenges like the need for high AI computing power within limited power constraints, the company achieves performance benchmarks and verifies the efficiency of its chips through proof of concept with potential customers. DEEPX outperforms competitors in AI accuracy (mean average precision [mAP]), performance (tera operations per second [TOPS]), efficiency (frames per second per watt [FPS/W]), support for state-of-the-art algorithms, and total cost of ownership (TCO).

Limitations such as battery constraints and insufficient cooling mechanisms have traditionally hindered AI deployment on edge devices. DEEPX overcomes these barriers by optimizing accuracy, performance, and TCO while emphasizing software efficiency. These advancements set new benchmarks for AI implementation on the edge, making it possible to expand what edge devices can achieve in a cost-effective and power-efficient manner.

DEEPX's DX-V3 is a cutting-edge AI Vision System-on-Chip that transforms robotics by enabling simultaneous processing of up to 12 live camera channels with integrated three-dimensional sensing, all while consuming less than 5W of power. The chip delivers 15 TOPS of computational power, supports a 12-megapixel (MP)image signal processor with 600 MP/second throughput, and incorporates proprietary quantization technology to optimize AI models for embedded deployment. This innovation allows robots to achieve advanced environmental awareness and spatial mapping without expensive light detection and

ranging (better known as LiDAR) systems, enhancing autonomous navigation and object manipulation across industries like industrial automation, service robotics, and exploration drones.

Furthermore, DEEPX contributes to reducing carbon emissions in AI servers that are notorious for high energy consumption due to power-hungry GPUs. With its **DX-H1 PCIe Card** the company delivers a tenfold increase in efficiency compared to traditional GPU-based solutions, significantly lowering energy use and reducing the environmental impact of data centers.

Looking ahead, DEEPX is pioneering super-scale AI performance at less than 5W with its next-generation product, DX-M2 chip, a critical advancement for the evolution of generative AI (GenAI). The DX-M2 is precisely engineered to run next-generation large language models (LLM) on-device with ultra-low power consumption, revolutionizing how AI services are delivered. By enabling the federated operation of LLMs, the DX-M2 seamlessly combines server-side and on-device AI processing. This federated approach dramatically reduces energy consumption, emissions, and operational costs while enhancing data privacy and security. It minimizes latency and dependence on constant network connectivity, providing a more efficient and responsive AI experience.

In collaboration with LG Uplus, DEEPX is set to unveil an AI chip that powers the GenAI model ixi-GEN, offering low-power, high-performance solutions across sectors like telecommunications, robotics, and mobility. The DX-M2's ability to facilitate federated LLM operations positions it at the forefront of AI innovation, making super-scale AI accessible in portable, battery-powered devices without sacrificing performance. With the DX-M2, DEEPX is poised to redefine the landscape of AI technology, pushing the boundaries of what is possible in on-device AI and solidifying its role in driving the future of federated AI solutions.

Technology Strengths

DEEPX's all-in-one AI solution, DX-GEN1, powered by the company's neural processing unit (NPU), sets a new industry standard by delivering exceptional accuracy and power efficiency. This comprehensive solution transforms the AI landscape by offering superior performance compared to existing technologies.

DEEPX optimizes and supports the latest AI algorithms faster than any competitor in the market. As AI algorithms evolve—becoming smarter, lighter, and more complex—developers aim to incorporate these advancements into their applications. The company's AI semiconductor supports a wide range of models for edge AI applications, including popular ones like YOLOv5, the latest YOLOv10, Vision Transformers, Visual Language Models, and up to 200 other AI models.

Unlike GPUs, which consume significant power and can suffer from overheating, DEEPX's AI chips provide an effective power-to-performance ratio with GPU-level accuracy, facilitating widespread AI adoption. Operating under 5W root-mean-square, the DX-M1 consumes significantly less power than many GPU-based solutions that often require much higher power and face thermal challenges. Remarkably, it can efficiently run a spectrum of deep learning models, from Lite models like MobileNetV1 and Moderate models like ResNet50 to demanding Hard models like YOLOv7, all within this low-power envelope. This exceptional power efficiency across various model complexities

underscores the DX-M1's superiority in enabling advanced AI applications at the edge without compromising performance.

To illustrate the DX-M1's low heat generation, an experiment ran YOLOv5 at 640×640 resolution and 30 FPS under identical conditions on both the DX-M1 and a competitor's product. The competitor's device reached temperatures of 60.7°C, sufficient to melt butter placed on it, demonstrating significant heat generation and potential thermal issues. In contrast, the DX-M1 maintained a temperature of just 35.5°C, not causing the butter to melt. This stark difference highlights the DX-M1's exceptional thermal efficiency, eliminating the need for complex cooling solutions and enhancing reliability.

In terms of AI accuracy (mAP) using the ResNet50 model, DEEPX achieves a score of 75.95, outperforming competitors whose scores range from 74.96 to 75.94 (GPU). Regarding performance (FPS/W), also based on ResNet50, DEEPX stands out with an impressive 592.0, significantly ahead of competitors ranging from 112.5 to 403.6.

Additionally, DEEPX's solution is highly efficient in terms of cost and resource usage. It uses DRAM—less than one-fourth of what some leading competitors require—and delivers 76.84 FPS/TOPS at a price point under $100 (based on ResNet50). In comparison, other market solutions require significantly more memory, have higher associated costs, and offer lower performance metrics at higher prices.

Key to this success is IQ8™, an INT8 model compression technology, and smart memory access, which reduces dynamic random-access memory (DRAM) usage to less than typical GPU levels, a significant advantage for inference workloads. Additionally, the company has developed novel memory architectures that minimize DRAM access, leveraging neural network data locality with multiple internal memory units and predictive data access operations. This approach enhances energy efficiency, boosts performance, and lowers the bill of materials for application systems.

A key factor in this success is IQ8™, an INT8 model compression technology, and smart memory access, which reduces DRAM usage to significantly lower levels compared to typical GPUs (191 megabytes [MB]) and competitors (30 to 50 MB). IQ8 offers a major advantage for inference workloads. Since the bottleneck in AI processing is DRAM access, many companies strive to address this challenge. For example, when utilizing NVIDIA for a single inference, 191 MB of DRAM is required, whereas DEEPX only needs 7 MB. This optimized DRAM access accelerates AI processing dramatically, enabling customers to achieve the smallest form factor and reduce DRAM requirements for hardware systems, thereby lowering overall implementation costs. By integrating these advancements, DEEPX delivers outstanding performance even with low-power double data rate memory (LPDDR) in the DX-H1 PCIe Module, achieving over 10 times higher performance-per-watt than traditional GPUs, positioning itself well ahead of global competitors.

The company offers a comprehensive software stack, the deep learning neural network, including a compiler called DX-COM, a run-time software called DX-RT, and Simulator, which support various soft frameworks like PyTorch, TensorFlow, and Caffe, etc. This software development kit facilitates easy and fast porting of AI models to DEEPX's NPU, streamlining the development process and enabling developers to harness the full potential of its hardware. With features like automatic model conversion, quantization, optimization, compilation, debugging, and profiling analysis, the company's software stack enhances the efficiency and effectiveness of AI model deployment on its NPUs.

Additionally, DEEPX is developing DX-Stream, a powerful and efficient video processing software framework for handling multiple video streams, performing AI inference, and executing highly efficient advanced video analytics. Utilizing a modular plugin architecture, DX-Stream supports seamless integration of AI models and customizable video processing pipelines, catering to various edge AI applications.

Best Practices

DEEPX's value proposition stems from a deep understanding of market needs and a commitment to innovation. The company positions itself as a leading industry participant by addressing weaknesses observed in competitors. Recognizing the demand for cost-effective solutions with lower power consumption, DEEPX has developed a new architecture for its NPU, prioritizing efficiency without compromising performance. Additionally, the company has pioneered quantization software technology, enabling customers to maintain model accuracy while reducing computational overhead.

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>
> ***- Ojaswi Rana***
> ***Best Practices Research Analyst***

Moreover, DEEPX's vision extends beyond specialized applications to democratizing AI by embedding AI capabilities into every device. By developing on-device AI solutions, the company reduces the total cost of ownership for AI services while expanding the technology's reach. DEEPX is paving the way for AI to become ubiquitous through partnerships with key industry players and ongoing discussions with robot platform, smart factory, and surveillance devices companies.

DEEPX is developing technology that enables the federated operation of ultra-large AI models on servers and large AI models on devices. This approach emerges as the fundamental solution to widely popularize small AI models, LLMs, and GenAI. This initiative opens up new opportunities in sectors like smart assistants, real-time translation, and conversational AI, where low latency, data security, and privacy are paramount.

The company offers the Early Engagement Customer Program (EECP), enabling customers to seamlessly explore DEEPX's offerings and select the chip that best aligns with their business needs. Up to 120 global companies have been validating their new products featuring the company's chips.

Strategic collaborations and focused development efforts demonstrate DEEPX's commitment to innovation and efficiency. The company actively engages in validation projects with leading players in the AI network video recorder market, such as Dahua, Hikvision, and Reolink in China, as well as LG, S1, and Hanwha Vision in South Korea. By partnering with these industry leaders, DEEPX expands to penetrate the surveillance devices market and provide advanced AI semiconductors that enhance video processing and analytics capabilities.

In the industrial PCs market, DEEPX collaborates with global leaders such as Inventec, ASUS, Innodisk, and Supermicro from Taiwan. These companies help DEEPX integrate its AI chips into high-performance

computing solutions, targeting sectors like smart factories, smart buildings, and smart cities, which require robust and efficient processing power.

Moreover, the company collaborates with Hyundai-Kia Robotics Lab to qualify the mass production of its low-power, high-performance AI semiconductors as superior alternatives to GPUs in robotics platforms. This partnership enhances robotics efficiency and capabilities, solidifying DEEPX's position in the robotics market.

In the smart factory sector, DEEPX works closely with POSCO DX to ensure seamless mass production. By optimizing manufacturing processes and revolutionizing industrial automation, DEEPX reinforces its position as a critical partner in the industry.

Furthermore, through its strategic partnership with LG Uplus with sLLM model iXi, DEEPX is poised to integrate its AI semiconductors into LG Group companies' products, expanding its influence across telecommunications and consumer electronics sectors. This collaboration broadens DEEPX's market reach and aligns with its vision to democratize AI technology.

The AI semiconductor market is undergoing a major transformation across industries with the rapid development of AI technology. In particular, introducing low-power, high-performance, and low-cost AI infrastructure is essential for smart factories, physical security systems, robots, and AI servers, driving the demand for AI semiconductors.

To meet the timing of this market, DEEPX tests the chip for compatibility with a variety of standard interfaces and form factors required by the industry and has prepared it to support various applications and portfolios depending on customer needs. The company expects to start mass production development cooperation with more than 10 global customers in the second half of 2024 and more than 20 customers in the first half of 2025.

In addition, DEEPX actively hones the cutting edge of AI chip technology and strives to lead the way. It has over 282 patents pending in the United States, China, and Korea, the most in the world for on-device AI chip development.[1]

Frost & Sullivan is impressed by DEEPX's innovative approach to addressing market challenges and leveraging technology strengths to pioneer advancements in the AI industry. Through its unique focus on on-device AI and commitment to optimizing AI algorithms, the company reduces the cost of AI services while expanding the market for AI solutions. By developing cutting-edge hardware solutions prioritizing efficiency and accuracy, DEEPX drives the widespread adoption of AI technology across various industries.

Building Trust through Proactive Engagement: DEEPX's Customer-centric Approach

Providing an exceptional customer experience is at the core of DEEPX's strategy. The company prioritizes customer-centric practices by actively engaging with clients and comprehensively understanding market demands well in advance of product releases. This proactive stance enables DEEPX to adapt swiftly to evolving market needs, ensuring that its solutions are finely tuned to industry requirements.

[1] *Frost & Sullivan Interview of DEEPX,* June 4, 2024.

By fostering close customer relationships, the company demonstrates its commitment to providing exceptional service. Devoted application engineers offer round-the-clock support to address any issues promptly. This personalized approach reduces development time and fosters trust and confidence among clients, leading to successful proof-of-concept initiatives and, ultimately, decisions to proceed with mass production. Moreover, DEEPX exemplifies its dedication to supporting clients throughout the development process, granting access to essential resources, and establishing continuous communication channels for seamless collaboration and accelerated progress.

Furthermore, the company's leadership, spearheaded by Chief Executive Officer (CEO) Lokwon Kim, fosters a strong company culture centered on inclusivity and accountability. By offering stock options to all employees (not just upper management), DEEPX instills a sense of ownership and belonging, ensuring that every team member is invested in the company's success. Additionally, the leadership's belief in the potential of Korean semiconductor technology beyond memory chips motivates its experts to innovate and excel, driving them to develop cutting-edge solutions that compete globally.

This commitment to innovation and global leadership was further solidified when CEO Lokwon Kim became the first leader of an AI semiconductor company to be invited to the World Economic Forum's Davos Forum. During the Forum, Kim proposed key agendas for the AI era, focusing on the urgent need to reduce energy consumption in AI computational processing. He introduced the concept of an "energy trading system for AI computing," where organizations using energy-intensive solutions would purchase energy usage permits, while those using energy-efficient technologies could sell these permits, creating a financial incentive for innovation. These proposals highlight the critical challenges of the AI era and position DEEPX as a global leader in driving sustainable and energy-efficient AI technologies. This focus on individual accountability, national contribution, and international influence enhances retention rates and fosters a culture of dedication and excellence, ultimately delivering greater customer value.

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> ***Best Practices Research Analyst***

In addition, to effectively target the global market for its first mass-produced products, DEEPX recruits talented individuals with more than 10 years of professional experience and know-how in the field of system semiconductors. The company also established a strategic production group to secure the yield of the foundry, establish a cost control system, manage the supply chain, develop a system for product quality and testing, and create an efficient cooperation system with design houses and outsourced semiconductor assembly and test.

Frost & Sullivan commends DEEPX for its exemplary commitment to customer-centric practices, which form the cornerstone of its strategy. The company adeptly tailors its solutions to evolving industry needs through proactive client engagement and deep market insight. This commitment, coupled with personalized support and the EECP program, builds trust, speeds up development, and drives successful initiatives, delivering outstanding value to clients.

Charting Success: DEEPX's Brand Strategy and Financial Milestone

DEEPX prioritizes brand awareness as a pillar of its business strategy, leveraging technology and strategic communication channels to showcase its capabilities. The company effectively communicates its solutions and problem-solving approach to potential customers through various media and press outlets, ensuring market visibility. Notably, DEEPX's recognition at the Consumer Electronics Show 2024 with three prestigious awards for embedded systems, robotics, and green data centers significantly enhances its brand reputation, generating valuable leads and affirming the success of its brand-focused initiatives.

DEEPX recently concluded its Series C funding round, securing an impressive $80.5 million investment.[2] This substantial capital injection positions the company to accelerate the mass production of its inaugural product line, paving the way for global distribution. Additionally, it expedites the development and launch of next-generation LLM on-device solutions, driving future growth and revenue generation. DEEPX has begun mass production of its first-generation AI semiconductor. As a first step, the company has signed a mass production contract with Samsung Foundry's design house to mass produce DX-M1, a 5nm process semiconductor. While currently experiencing modest revenue from sample sales, DEEPX anticipates a significant uptick in revenue starting next year.[3]

Frost & Sullivan believes that the company's strategic focus on brand awareness and substantial Series C funding round underscore its trajectory towards market leadership and sustained growth. This recognition and the significant investment enhance DEEPX's brand reputation and position it for accelerated expansion, enabling its innovative product line's mass production and global distribution while driving revenue growth in the coming years.

Conclusion

DEEPX effectively addresses critical gaps in the artificial intelligence (AI) chip market, notably in power efficiency and on-device AI capabilities. With the rising demand for edge AI applications necessitating real-time processing and low latency, DEEPX's emphasis on on-device AI processors provides tailored solutions that optimize performance within stringent power constraints. This strategic focus decreases the cost of AI services and broadens the AI service market, aligning with the escalating need for edge computing solutions. Moreover, the company's Early Engagement Customer Program empowers clients to explore its offerings, selecting chips that best suit their business requirements, thereby fulfilling the market's need for customizable solutions.

Overall, DEEPX addresses market gaps with a strong leadership focus that incorporates customer-centric strategies and exemplifies best practice implementation. The company innovates by developing groundbreaking technological solutions, delivering cost-effective solutions with lower power consumption while maintaining performance and accuracy, setting itself apart from competitors. DEEPX prioritizes proactive client engagement, fostering close customer relationships, reducing development

[2] Yoolim Lee, "Ai Chipmaker Deepx's Valuation Vaults up in Skylake-Led Funding," Bloomberg.com, May 9, 2024, https://www.bloomberg.com/news/articles/2024-05-09/ai-chipmaker-deepx-s-valuation-vaults-up-in-skylake-led-funding.

[3] *Frost & Sullivan Interview of DEEPX,* June 4, 2024.

time, and accelerating successful initiatives. Additionally, its inclusive company culture inspires employees to innovate and excel, enhancing customer value and driving success.

With its strong overall performance, DEEPX earns Frost & Sullivan's 2024 Global Company of the Year Award in the AI chip industry.

What You Need to Know about the Company of the Year Recognition

Frost & Sullivan's Company of the Year Award is its top honor and recognizes the market participant that exemplifies visionary innovation, market-leading performance, and unmatched customer care.

Best Practices Award Analysis

For the Company of the Year Award, Frost & Sullivan analysts independently evaluated the criteria listed below.

Visionary Innovation & Performance

Addressing Unmet Needs: Customers' unmet or under-served needs are unearthed and addressed by a robust solution development process

Visionary Scenarios Through Mega Trends: Long-range, macro-level scenarios are incorporated into the innovation strategy through the use of Mega Trends, thereby enabling first-to-market solutions and new growth opportunities

Leadership Focus: Company focuses on building a leadership position in core markets and on creating stiff barriers to entry for new competitors

Best Practices Implementation: Best-in-class implementation is characterized by processes, tools, or activities that generate a consistent and repeatable level of success

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

Customer Impact

Price/Performance Value: Products or services provide the best value for the price compared to similar market offerings

Customer Purchase Experience: Quality of the purchase experience assures customers that they are buying the optimal solution for addressing their unique needs and constraints

Customer Ownership Experience: Customers proudly own the company's product or service and have a positive experience throughout the life of the product or service

Customer Service Experience: Customer service is accessible, fast, stress-free, and high quality

Brand Equity: Customers perceive the brand positively and exhibit high brand loyalty

About Frost & Sullivan

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The Growth Pipeline Engine™

Frost & Sullivan's proprietary model to systematically create ongoing growth opportunities and strategies for our clients is fuelled by the Innovation Generator™.

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Key Impacts:

- **Growth Pipeline:** *Continuous Flow of Growth Opportunities*
- **Growth Strategies:** *Proven Best Practices*
- **Innovation Culture:** *Optimized Customer Experience*
- **ROI & Margin:** *Implementation Excellence*
- **Transformational Growth:** *Industry Leadership*

The Innovation Generator™

Our 6 analytical perspectives are crucial in capturing the broadest range of innovative growth opportunities, most of which occur at the points of these perspectives.

Analytical Perspectives:

- Mega Trend (MT)
- Business Model (BM)
- Technology (TE)
- Industries (IN)
- Customer (CU)
- Geographies (GE)