FTO Checker

Market & IP Intelligence

YOUR INVENTION DESCRIPTION

"A neuromorphic edge processing chip for battery-powered IoT devices performing sensor fusion and anomaly detection at sub-milliwatt power consumption. The architecture replaces clock-driven logic with event-driven spiking neural network circuits on a 22nm FD-SOI process, enabling always-on monitoring without cloud connectivity. It integrates analog front-ends for up to eight heterogeneous sensors — accelerometers, microphones, gas sensors, thermal arrays — and runs inference directly on spike-encoded data without analog-to-digital conversion. An on-chip learning engine adapts detection thresholds to local baselines after deployment. Applications include industrial predictive maintenance, structural health monitoring, and wildlife acoustic monitoring."

TABLE OF CONTENTS

Report date: 04-03-2026. **Report number:** 41TB22

EXECUTIVE SUMMARY

We analyzed your invention across 120M+ patent publications from 100+ patent offices using keyword matching, claims analysis, and classification codes, then expanded results through Google's citation graph and similarity engine (details in Patent Intelligence).

Beyond patents, we screened scientific literature for prior art and technology readiness, mapped the competitive landscape and market timing, and tracked recent funding activity in the space to provide a complete due diligence picture.

RESEARCH ACTIVITY

2017 2026

Peak in 2023

PATENT FILINGS

2017 2026

Peak in 2025

PUBLIC INTEREST

2017 2026

Peak in 2026

FUNDING ACTIVITY

2017 2026

Peak in 2025

ACTIVE PATENTS

14

Your jurisdiction(s): Europe, US, CA

PENDING PATENTS

18

Your jurisdiction(s): Europe, US, CA

The neuromorphic edge processing market remains emerging, with research peaking in 2023, patents in 2025, and public interest in 2026. The IP landscape includes 14 active patents and 18 pending applications, dominated by Intel with 9 patents (4 active), alongside Ubotica Technologies, Snap, Cywee Group, and Leptude. Competitive activity centers on Intel, IBM, BrainChip Holdings, Qualcomm Technologies, and SynSense, accompanied by 6 recent transactions with amounts mostly undisclosed. R&D concentrates in the US, accounting for 56% of 54 patents. Technical coverage reveals low activity in heterogeneous sensor data integration. The regulatory environment for industrial IoT edge devices

features moderate complexity, with the EU Cyber Resilience Act mandating cybersecurity and the US applying voluntary NIST frameworks.

MARKET INTELLIGENCE

The neuromorphic chip market, valued at USD 1. 73 billion in 2024, is projected to reach USD 8. 86 billion by 2034, reflecting robust growth driven by AI edge computing demands. Competition is intense among eight key players, with Intel dominating through 9 patents (4 active) in neuromorphic edge processing for IoT sensors, alongside IBM and BrainChip Holdings. R&D concentrates heavily in the US, accounting for 56% of 54 patents, while recent activity includes 6 tracked deals. Regulatory landscapes vary, with the EU Cyber Resilience Act imposing mandatory cybersecurity for industrial IoT edge devices and the US favoring voluntary NIST frameworks, both stressing secure-by-design principles.

Market outlook

💪 STRENGTHS

- Neuromorphic chip market valued at USD 1. 73 billion in 2024, projected to reach USD 8. 86 billion by 2034.
- Edge-based neuromorphic processing dominates, driven by real-time IoT and smart sensor demands.
- Proven energy efficiency enables multi-year battery life in edge devices like Syntiant's NDP120.

📉 WEAKNESSES

- High R&D complexity requires collaborations among universities, agencies, and semiconductor firms.
- Current solutions face integration challenges with existing CPUs, GPUs, and cloud ecosystems.
- Market fragmentation persists due to varying software toolchains and compatibility issues.

🎯 OPPORTUNITIES

- Edge AI for IoT grows at 51. 4% CAGR, suiting ultra-low power anomaly detection in sensors.
- Asia-Pacific expands fastest at 52. 49% CAGR, fueled by China AI mandates and Japan robotics.
- Convergence of spiking neural networks with heterogeneous sensors boosts predictive maintenance.

⚠️ THREATS

- Intel dominates with 9 patents (4 active) in neuromorphic edge processing for IoT sensors.
- IBM, Qualcomm lead hardware with low-power chips for industrial IoT and edge analytics.
- BrainChip's Akida 2. 0 commercially deploys event-driven inference, pressuring sub-milliwatt innovations.

Competitive landscape

Key players developing products in this technology space.

COMPANY	PRODUCT / SOLUTION	HQ
Intel	Loihi neuromorphic chip (self-learning processor simulating 128 million neurons and 64 billion synapses).	🇺🇸
IBM	Neuromorphic computing systems and brain-inspired AI architectures.	🇺🇸
BrainChip Holdings	Akida Neuromorphic System-On-Chip (NSoC) for edge computing and IoT.	🇦🇺
Qualcomm Technologies	Zeroth platform and neuromorphic chips for edge AI, autonomous vehicles, and robotics.	🇺🇸
SynSense	Mixed-signal neuromorphic silicon for signal processing and neural simulation.	🇨🇭
General Vision	NeuroMem technology (cognitive memory chips for pattern recognition and sensory processing).	🇺🇸
Innatera Nanosystems	Ultra-low-power neuromorphic microcontroller with analog-mixed signal computing design.	🇳🇱
SensiML	SensiML Analytics Toolkit (AutoML platform for AI processing on IoT endpoints).	🇺🇸

Recent deals

Recent funding rounds, acquisitions, and partnerships involving key players in this space.

Kuva Systems **— Undisclosed** — 03/2026

Sensirion Connected Solutions acquired Kuva Systems to expand its methane emissions monitoring portfolio.

Digi International **— Undisclosed** — 03/2026

Digi International acquires Particle to accelerate ARR growth and strengthen its Embedded-as-a-Service offering.

Sensirion, Sintropy.ai, Repcom **— Undisclosed** — 03/2026

Sensirion partners with Sintropy. ai and Repcom to drive innovation in AI-driven sensor technology, focusing on collaboration to develop advanced sensor solutions for automation and AI applications.

Losant **— Undisclosed** — 02/2026

SUSE announced the acquisition of Losant, a Cincinnati-based industrial IoT platform.

Analog Devices **— Undisclosed** — 01/2026

Sense announced a strategic investment from Analog Devices, Inc. , a global semiconductor leader, to enable further development of grid edge intelligence and management solutions.

Tageos and Wiliot **— Undisclosed** — 01/2026

Tageos and Wiliot partner to develop and launch a new passive Bluetooth Low Energy (BLE) inlay, EOS-654 BLE G3, to accelerate ambient IoT and battery-free BLE sensing.

Regulatory snapshot

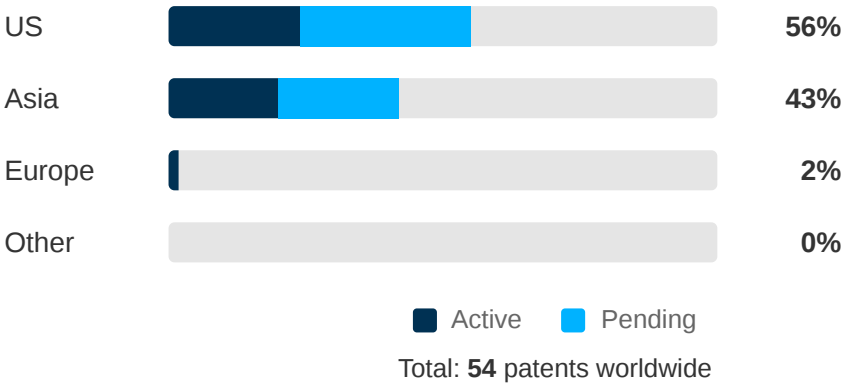
The regulatory path for industrial IoT edge devices is moderately complex, with the EU Cyber Resilience Act (CRA) imposing mandatory cybersecurity requirements and the US taking a lighter-touch approach through voluntary frameworks. Industrial manufacturers must navigate product classification schemes in the EU while adhering to NIST guidance in the US, with both regions emphasizing secure-by-design principles.

- US: Compliance with FCC Part 15 (RF emissions) and voluntary adherence to NIST IR 8259 foundational cybersecurity activities for IoT manufacturers; the FCC's IoT Cybersecurity Labeling Program (47 CFR 8. 203) provides voluntary labeling criteria rather than mandatory requirements.
- EU: Mandatory compliance with the EU Cyber Resilience Act (Regulation EU 2024/2847) requiring secure-by-design manufacturing, vulnerability handling, and post-market support; industrial devices may fall into Class I or Class II categories under Commission Implementing Regulation (EU) 2025/2392, with Class II products requiring third-party conformity assessments. CE marking and EN 18031 (harmonized cybersecurity standard for connected radio equipment) are also required.

Upcoming: EU — The EU Data Act obligations for data portability and interoperability took effect September 12, 2025, requiring industrial IoT products to provide users direct access to data and reduce vendor lock-in. US — No major new mandatory regulations identified; focus remains on voluntary NIST frameworks under Executive Order 14028.

Regional R&D activity

Global distribution of patent filings by region, indicating where R&D investment is concentrated.

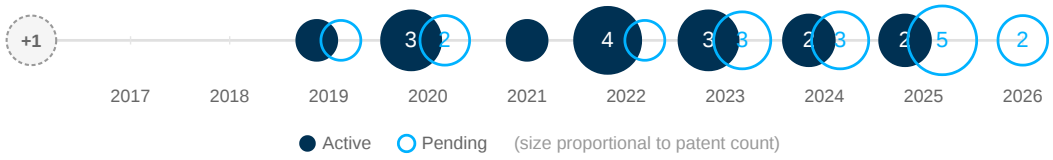


Total: **54** patents worldwide

PATENT INTELLIGENCE

This section provides a **deeper analysis of the patent landscape** by examining technical coverage, classification patterns, and key players.

Your jurisdiction(s): Europe, US, CA



Search strategy

We decomposed your invention into concept groups, key terms for patent claims analysis, and relevant CPC classification codes:

- **Concept groups:** neuromorphic processing, spiking neural networks, event-driven architecture | sensor fusion, multi-sensor integration, heterogeneous sensor data | edge computing, on-device processing, local inference | low power consumption, energy-efficient design, sub-milliwatt operation.
- **Claims terms:** performing sensor fusion, event-driven processing, integrating heterogeneous sensors, adapting detection thresholds, spike-encoded data processing.
- **CPC codes:** G06N3/063, G06F17/18, G06N20/00, H04L12/24.

Using these elements, we ran **three complementary searches** — classification codes + keywords, patent claims analysis, and broad synonym matching — then expanded results through Google's citation graph and similarity engine. Results were deduplicated by patent family.

Technical coverage analysis

Maps your invention's core concepts against the patent landscape. Shows which ideas are heavily patented versus absent, helping identify white space opportunities or crowded areas.

ESTABLISHED COVERAGE

spiking neural networks	**6** active **8** pending

MODERATE COVERAGE

neuromorphic processing	**5** active **7** pending
sensor fusion	**3** active

	4 pending
edge computing	**2** active
	3 pending
on-device processing	**2** active
	2 pending

EMERGING COVERAGE

No concepts at this level

POTENTIAL WHITE SPACE

heterogeneous sensor data integration

💡 Established coverage in spiking neural networks (≥10 patents) reveals mature core technology. Moderate coverage in neuromorphic processing and sensor fusion (3-9 patents) indicates active development. Gap in heterogeneous sensor data integration (0 patents) shows unpatented area.

Adjacent technologies

Identifies technologies present in existing patents but absent from your invention. Shows complementary approaches to consider for product development or defensive patenting.

CONCEPT	PATENTS
hyperdimensional computing	**1**
ternary logic computation	**1**
koopman operator approximation	**1**

CONCEPT	PATENTS
collective perception services	**1**
vehicle-to-everything communication	**2**

💡 Low patent density in hyperdimensional computing (1 patent), ternary logic computation (1 patent), koopman operator approximation (1 patent), collective perception services (1 patent), and vehicle-to-everything communication (2 patents) reveals nascent competitive landscape with sparse activity in neuromorphic edge alternatives.

Notable patent holders

Discusses the organizations and inventors dominating patent activity in your field. Shows potential collaboration opportunities, licensing candidates, or competitors requiring careful analysis.

MAJOR PATENT HOLDERS

Intel

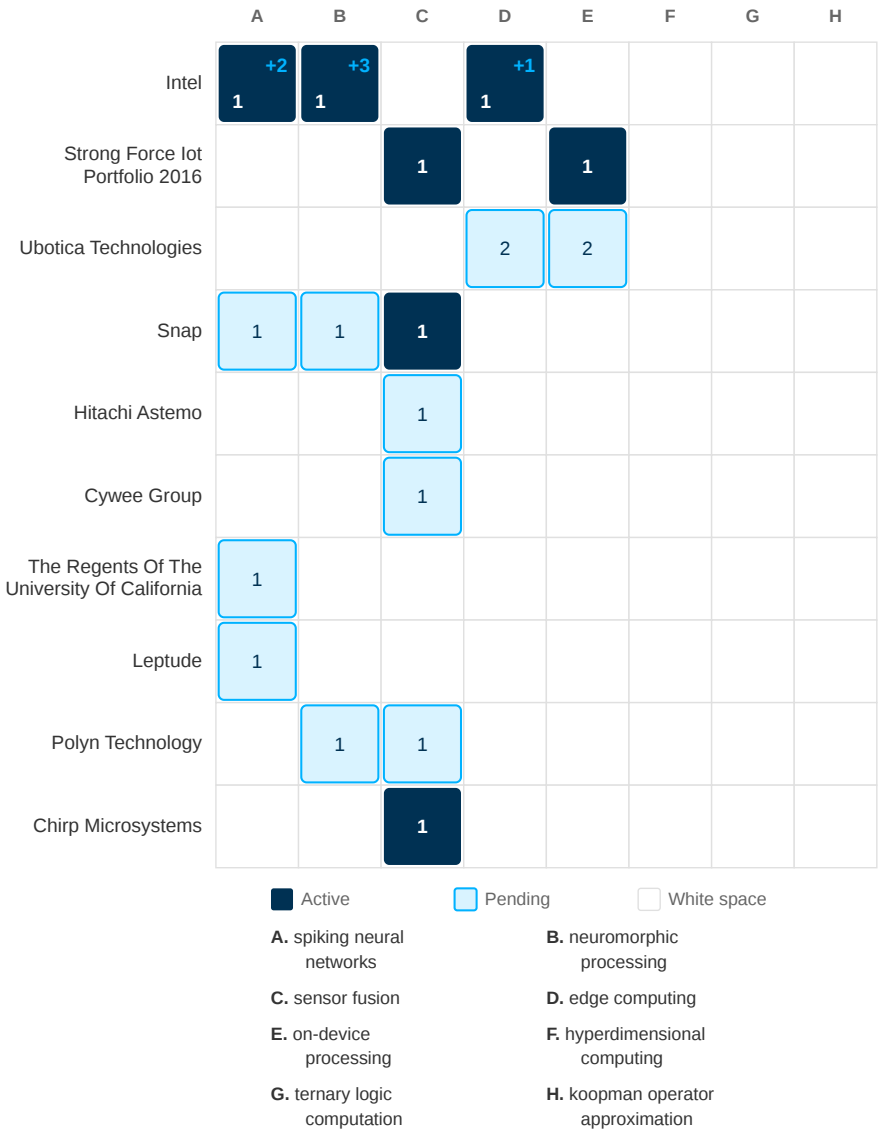
→ Semiconductor design and manufacturing leader

9 patents (4 active, 5 pending)

OTHER NOTABLE ENTITIES

Ubotica Technologies — 2 patents (challenger)
Snap — 1 patents (challenger)
Cywee Group — 1 patents (challenger)
Leptude — 1 patents (challenger)
LLC (vvrr — 1 patents (challenger)

💡 Intel dominates with 9 patents (28% of total), revealing hardware giant's lead in neuromorphic edge chips. Concentration signals high technical barriers from process expertise like 22nm FD-SOI. Neuromorphic startups and sensor firms absent, likely lacking integration scale. Pattern indicates early-stage R&D with Intel shaping standards.



Patent classifications

We targeted CPC codes G06N3/063, G06F17/18, G06N20/00, H04L12/24.

💡 Classification pattern shows even dominance of spiking neural architectures (G06N3/049 44%, G06N3/063 44%) and temporal processing (G06N3/045 34%), revealing innovation focus on event-driven neuromorphic cores. Supporting codes

emphasize learning (G06N3/088 25%). Absent are sensor hardware (G01) and power management (H02J) areas.

Research activity

Academic research publications related to your invention's technology domain. These indicate R&D activity and emerging scientific foundations.

Internet of Things: A Survey on Enabling Technologies, Protocols, and Applications

IEEE Communications Surveys & Tutorials (01-01-2015)

→ Overview of IoT technologies, protocols, and applications for practical implementation.

Wearable smart sensor systems integrated on soft contact lenses for wireless ocular diagnostics

Nature Communications (01-01-2017)

→ Wearable smart sensors in contact lenses enable wireless ocular health monitoring and diagnostics.

Passban IDS: An Intelligent Anomaly-Based Intrusion Detection System for IoT Edge Devices

IEEE Internet of Things Journal (01-01-2020)

→ Passban IDS enhances IoT security through intelligent anomaly detection for edge devices.

An Energy-Efficient SDN Controller Architecture for IoT Networks With Blockchain-Based Security

IEEE Transactions on Services Computing (01-01-2020)

→ Proposes an energy-efficient SDN controller architecture enhancing IoT security using blockchain technology.

Energy-Efficient Data Collection and Device Positioning in UAV-Assisted IoT

IEEE Internet of Things Journal (01-01-2019)

→ Optimizes energy-efficient data collection and positioning for UAV-assisted IoT applications.

💡 Ulsan National Institute of Science and Technology (South Korea) leads with highest citation impact at 913 average citations across 11 papers, followed by Southwest Jiaotong University (China) with 12 papers averaging 189 citations. Publication concentration peaked 2015-2020, indicating field maturation with declining recent output. Funding remains institution-driven without coordinated international support. Average citation rate of 284 reflects moderate research visibility, with 42% open access adoption suggesting emerging knowledge dissemination practices in IoT technologies.

YOUR TOP 10 MOST SIMILAR ACTIVE PATENTS

See our patent scoring methodology for details on how scores are calculated.

1. **Spiking neural network accelerator using external memory**

   Publication number: US11593623B2
   Publication date: 28-02-2023
   Inventor(s): Berkin Akin
   Patent holder(s): Intel
   Jurisdiction: US

   View patent → View similar patents →

   💡 This patent enables spiking neural network operations using external memory, emphasizing state management and spike communication. Overlaps in spiking architecture with user invention, but differs by relying on external memory rather than on-chip learning and sensor integration.

   📤 Share patent overview

2. **Systems and methods for processing data collected in an industrial environment …**

   Publication number: US11996900B2
   Publication date: 28-05-2024
   Inventor(s): Charles Howard Cella
   Patent holder(s): Strong Force Iot Portfolio 2016
   Jurisdiction: US

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   💡 This patent enables on-device sensor fusion and data storage in industrial IoT systems, multiplexing sensor inputs for real-time processing. Overlaps with user invention's sensor fusion; differs by focusing on data storage rather than ultra-low-power anomaly detection.

   📤 Share patent overview

3. **Managing session continuity for edge services in multi-access environments**

   Publication number: US12302234B2
   Publication date: 13-05-2025
   Inventor(s): Arvind Merwaday
   Patent holder(s): Intel
   Jurisdiction: US

   View patent → View similar patents →

💡 This patent enables session continuity management for edge computing services using edge controller coordination. It shares edge processing focus with the user invention but emphasizes session handover, contrasting with the user's sensor fusion and anomaly detection capabilities.

📤 Share patent overview

4. **Systems and methods for processing data collected in an industrial environment …**

Publication number: US12282837B2

Publication date: 22-04-2025

Inventor(s): Charles Howard Cella

Patent holder(s): Strong Force Iot Portfolio 2016

Jurisdiction: US

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💡 This patent enables on-device sensor fusion and data storage for industrial IoT, multiplexing sensor inputs for a fused data stream. Overlaps with user invention in sensor fusion; differs by focusing on data storage, not neuromorphic processing.

📤 Share patent overview

5. **Three dimensional object-localization and tracking using ultrasonic pulses**

Publication number: US10816639B2

Publication date: 27-10-2020

Inventor(s): Richard J. Przybyla

Patent holder(s): Chirp Microsystems

Jurisdiction: US

View patent → View similar patents →

💡 This patent enables ultrasonic pulse-based 3D object localization and tracking, employing sensor fusion algorithms. Overlaps in sensor fusion; differs by focusing on ultrasonic localization versus the user's neuromorphic chip for low-power, multi-sensor anomaly detection in IoT devices.

📤 Share patent overview

6. **Staged training of neural networks for improved time series prediction …**

Publication number: US10650045B2

Publication date: 12-05-2020

Inventor(s): Henry Gabriel Victor Bequet

Patent holder(s): Sas Institute

Jurisdiction: US

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💡 This patent enables staged training of neural networks for time series prediction using non-neuromorphic processing. Overlaps with user invention in neural network application; differs by focusing on training methodology rather than low-power, event-driven architecture for IoT devices.

📤 Share patent overview

7. **System for continuous validation and threat protection of mobile applications**

Publication number: US10986113B2
Publication date: 20-04-2021
Inventor(s): Vincent De Sapio
Patent holder(s): Hrl Laboratories
Jurisdiction: US

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💡 This patent enables continuous mobile app validation using spiking neural networks for threat detection. Shares neuromorphic processing focus with user invention but targets mobile security, contrasting with the user's sensor fusion and anomaly detection in IoT devices.

📤 Share patent overview

8. **Human-like emulation enterprise system and method**

Publication number: US11287847B2
Publication date: 29-03-2022
Inventor(s): Kurtis John Ritchey
Patent holder(s): Virtual Video Reality By Ritchey, LLC (vvrr, LLC)
Jurisdiction: US

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💡 This patent enables human-like emulation using biological or artificial neural networks for self-reliance. Overlaps with neuromorphic processing focus; differs in application scope, targeting enterprise systems rather than IoT devices for sensor fusion and anomaly detection.

📤 Share patent overview

9. **Apparatus and methods for haptic training of robots**

Publication number: US10717191B2
Publication date: 21-07-2020
Inventor(s): Filip Ponulak
Patent holder(s): Brain
Jurisdiction: US

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💡 This patent enables haptic training of robots using neuromorphic processing for object recognition and motor commands. It shares neuromorphic processing with the user invention but focuses on robotic control rather than sensor fusion and anomaly detection.

📤 Share patent overview

10. **Device and method for calculating convolution in a convolutional neural network**

Publication number: US11507804B2

Publication date: 22-11-2022

Inventor(s): Olivier Bichler

Patent holder(s): Commissariat A L'energie Atomique Et Aux Energies Alternatives

Jurisdiction: US

View patent → View similar patents →

💡 This patent enables convolution computation in spiking neural networks using convolution kernels, optimizing event-driven processing. It shares the event-driven architecture with the user invention but focuses on convolution layers, not sensor fusion or ultra-low power consumption.

📤 Share patent overview

YOUR TOP 10 MOST SIMILAR PENDING PATENTS

These are patent applications that have been published but not yet granted. They represent potential future patents in your technical domain.

1. **End-to-end neuromorphic acoustic processing**

   Publication number: US20240221756A1
   Publication date: 04-07-2024
   Inventor(s): Kuba Tomasz Lopatka
   Patent holder(s): Intel
   Jurisdiction: US

   View patent application → View similar patents →

   💡 This patent enables dynamic power mode switching between DSP and neuromorphic processing for acoustic recognition. It overlaps with the user invention's neuromorphic approach but differs by focusing solely on acoustic tasks, lacking multi-sensor integration and on-chip learning.

   📤 Share patent overview

2. **Packed event message processing in neuromorphic clusters**

   Publication number: US20250335755A1
   Publication date: 30-10-2025
   Inventor(s): Amirreza Yousefzadeh
   Patent holder(s): Snap
   Jurisdiction: US

   View patent application → View similar patents →

   💡 This patent enables packed event message processing in neuromorphic clusters, optimizing data throughput. It shares neuromorphic architecture with the user invention but focuses on cluster communication efficiency, differing from the user's edge processing and sensor integration focus.

   📤 Share patent overview

3. **Vehicle control device and electronic control system**

   Publication number: US20250010882A1
   Publication date: 09-01-2025
   Inventor(s): Hideyuki Sakamoto
   Patent holder(s): Hitachi Astemo
   Jurisdiction: US

   View patent application → View similar patents →

💡 This patent covers sensor fusion in self-driving vehicles using a second arithmetic block for object data processing. Overlaps with user invention in sensor fusion; differs by focusing on vehicle control rather than IoT edge processing.

📤 Share patent overview

4. **Method and apparatus for performing motion recognition using motion sensor …**

Publication number: US20130162525A1

Publication date: 27-06-2013

Inventor(s): Zhou Ye

Patent holder(s): Cywee Group

Jurisdiction: US

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💡 This patent enables motion recognition via sensor fusion by converting sensor data into a global coordinate system. Overlaps with user invention in sensor fusion; differs by focusing on motion detection rather than anomaly detection or ultra-low power consumption.

📤 Share patent overview

5. **Procedural neural network synaptic connection modes**

Publication number: US20190042915A1

Publication date: 07-02-2019

Inventor(s): Berkin Akin

Patent holder(s): Intel

Jurisdiction: US

View patent application → View similar patents →

💡 This patent enables procedural neural network synaptic connection modes, optimizing network size and programmability. Overlaps with user invention's neuromorphic processing. Key difference: patent focuses on synaptic configurations, while user invention emphasizes ultra-low power sensor fusion and anomaly detection.

📤 Share patent overview

6. **Artificial intelligence framework combining a spiking neural network and a …**

Publication number: US20230071730A1

Publication date: 09-03-2023

Inventor(s): Mohsen Imani

Patent holder(s): The Regents Of The University Of California

Jurisdiction: US

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💡 This patent enables spiking neural network frameworks for neuromorphic data processing, focusing on synaptic state representation. It shares neuromorphic architecture with the user invention but differs by emphasizing synaptic dynamics over low-power, sensor fusion applications.

📤 Share patent overview

7. **… data processing combining matmul-free techniques and spiking neural networks**

Publication number: US20250390723A1

Publication date: 25-12-2025

Inventor(s): John A Fortkort

Patent holder(s): Leptude

Jurisdiction: US

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💡 This patent enables hybrid neural computation by integrating MatMul-free techniques with Spiking Neural Networks, optimizing data processing efficiency. It shares neuromorphic architecture with the user invention but focuses on hybrid computation rather than ultra-low power sensor fusion.

📤 Share patent overview

8. **Systems and Methods for Deploying and Updating Neural Networks at the Edge of a …**

Publication number: US20250363357A1

Publication date: 27-11-2025

Inventor(s): Aubrey Dunne

Patent holder(s): Ubotica Technologies

Jurisdiction: US

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💡 "This patent enables neural network updates on low-bandwidth edge devices via centralized training. It shares edge processing focus with user invention but emphasizes network updates, contrasting with user invention's autonomous learning and sensor fusion capabilities for anomaly detection.

📤 Share patent overview

9. **Neuromorphic Analog Signal Processor for Predictive Maintenance of Machines**

Publication number: US20230081715A1

Publication date: 16-03-2023

Inventor(s): Aleksandrs Timofejevs

Patent holder(s): Polyn Technology

Jurisdiction: US

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💡 This patent enables analog vibration signal processing using operational amplifiers for machine predictive maintenance. Overlaps with user invention in predictive maintenance focus; differs by analog processing approach versus user's digital neuromorphic architecture for broader sensor fusion applications.

📤 Share patent overview

10. **Systems and Methods for Deploying and Updating Neural Networks at the Edge of a …**

Publication number: US20200272899A1

Publication date: 27-08-2020

Inventor(s): Aubrey Dunne

Patent holder(s): Ubotica Technologies

Jurisdiction: US

View patent application → View similar patents →

💡 This patent enables neural network updates on edge devices with low-bandwidth uplinks, focusing on centralized training. Overlaps with user invention's edge processing but differs by emphasizing remote updates rather than on-chip learning and sensor fusion.

📤 Share patent overview

NEXT STEPS

Run a new FTO Checker search

Try again with a modified description to explore other patent families or technical variants.

Start New Search →

⚠ This is an **automated early-stage analysis** designed to help you explore potential patent risks. It is **not legal advice**, and we cannot guarantee freedom to operate or absence of infringement risks. If you plan to commercialize your invention, we recommend discussing the results with a qualified patent attorney.