

# Neuromorphic for AI computing and sensing: disruptive technologies are here!<sup>1</sup>

*Industrial, consumer and automotive are driving the adoption of neuromorphic with first products.*

## OUTLINE:

- Market forecasts:
  - The neuromorphic sensing market will reach up to US\$5 billion by 2030, with a 116% CAGR<sup>2</sup> between 2025 and 2030.
  - The neuromorphic computing market will reach US\$2 billion in 2030, with a CAGR<sub>2025-2030</sub> of 88%.
  - The three main segments will be consumer, industrial and automotive:
    - Until 2025, neuromorphic for industrial applications will remain a niche market with US \$2 billion in 2030 for computing and sensing combined.
    - Yole Développement (Yole) announces the mobile and other consumer applications will reach US \$2.8 billion in 2030.
    - Neuromorphic computing for automotive will reach US \$2 billion in 2030.
- Technology trends:

Nowadays, there is a strong need for power-efficient technologies to handle in a sustainable manner demanding AI workloads.

Neuromorphic technologies are a promising answer to this need as they can perform challenging AI tasks very efficiently.
- Supply chain:

The neuromorphic ecosystem consists today of three main categories of players: university & research institute, labs affiliated to large companies and start-ups.

Intel and IBM developed neuromorphic communities around their chips to help the software ecosystem grow.

---

<sup>1</sup> Extracted from: [Neuromorphic Computing and Sensing 2021 report](#), Yole Développement

<sup>2</sup> CAGR: Compound Annual Growth Rate

“AI<sup>3</sup> is hungry for performance, and Moore’s law dynamics will not suffice to cover the needs of the ongoing 5G/IoT<sup>4</sup>/AR<sup>5</sup>/Robotic revolution. The ecosystem is and will stay R&D-oriented for the next 3 to 5 years.” asserts **Adrien Sanchez, Technology & Market Analyst, Computing & Software division at Yole Développement (Yole)**. “Brute force is currently being used to leverage the power of AI, but this approach is not scalable. It will hit a heat wall, a data wall, and a cost wall related to the ability of the semiconductor industry to deliver at a certain pace, Moore’s law, the incremental cost to performance improvements”.

Current AI computing will not deliver, so what AI technology would be necessary? Neuromorphic computing and sensing solutions, drawing inspiration from what happens in the brain, have key specificities to compete within the existing AI landscape and constraints. These technologies will address most of the current challenges and could represent 20% of all AI computing & sensing by 2035.

In this context, Yole investigates disruptive technologies and related markets in depth, to point out the latest innovations and underline the business opportunities.

Released today, the Neuromorphic Computing and Sensing 2021 report, delivers an in-depth understanding of the neuromorphic ecosystem, and presents key technical insights and analyses regarding future technology trends and challenges.

Including market trends and forecasts, supply chain, technology trends, technical insights and analysis, take away and outlook, this study also delivers an in-depth understanding of the ecosystem and main players’ strategies.

What is the status of the neuromorphic ecosystem? What are the economic and technological challenges? What are the key drivers? Who are the players to watch, and what innovative technologies are they working on?

Yole presents today its vision of the neuromorphic computing and sensing technologies and the emerging applications behind.

As analyzed by Yole’s team in the new Neuromorphic Computing and Sensing 2021 report, industrial applications will be the first to use neuromorphic technologies, driven by high speed, low latency, and offline learning enabling more autonomous features and performance. Players such as Prophesee, Brainchip, and Nepes AI/ General Vision already have products in the market targeting industrial applications, and more players will follow in the coming years. The consumer market will also benefit from neuromorphic technologies enabling more AI applications at the edge on battery-powered devices, ensuring privacy and safety of personal data.

According to **Simone Bertolazzi, PhD, Senior Technology & Market analyst, Memory, at Yole**: “Current neuromorphic device architectures can also vary significantly with

---

<sup>3</sup> AI: Artificial Intelligence

<sup>4</sup> IoT: Internet of Things

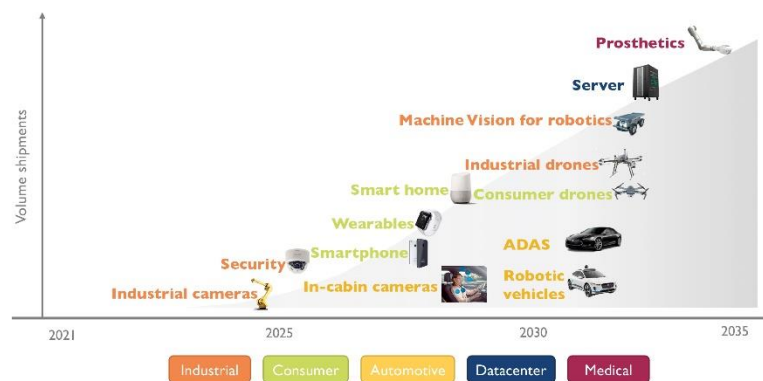
<sup>5</sup> AR: Augmented Reality

respect to the organization of the memory and computing components on the silicon chips. There is currently a clear trend towards “in-memory-computing” solutions: several companies are developing designs with mainstream embedded memory, like SRAM, distributed across cores or neurons; various players are also considering the adoption of emerging NVM<sup>6</sup> elements assembled in crossbar arrays, leveraging the “synopsis-like” properties of resistive memories, for example PCM, OxRAM, CBRAM”.

For **Pierre Cambou, MSc, MBA, Principal analyst in the Photonics and Sensing Division at Yole**: “In the automotive market, a host of applications will benefit from the low latency and low power consumption of neuromorphic technologies. While it will take longer for neuromorphics to be adopted in this promising yet challenging market, some projects have already been announced, such as Xperi’s Driver Monitoring System and Terranet’s ADAS cameras and laser.”

### Neuromorphic technologies - Adoption process between 2021 and 2035

(Source: Neuromorphic Computing and Sensing 2021 report, Yole Développement, 2021)



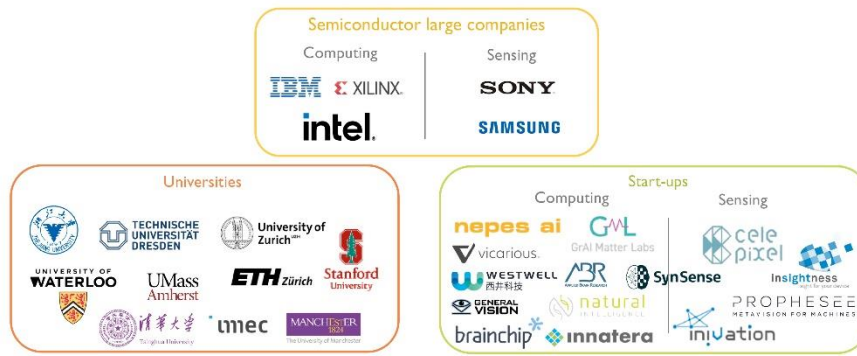
Additionally, the cloud server market could also benefit from neuromorphic computing technologies, leveraging low latency and online learning to improve the performance of applications such as cybersecurity and fraud detection. The considerable power efficiency could also help to limit the power consumption growth in data centers which is a growing concern. Large players such as Intel and IBM are already creating neuromorphic server prototypes by assembling their massively scalable Loihi and TrueNorth chips, respectively.

The neuromorphic ecosystem is today very dynamic with three main categories of players: university & research institute, labs affiliated with large companies, and start-ups. The latter are the first players to bring products to the market for edge computing, targeting industrial, automotive, and consumer applications. They will test new approaches in the market in a real-life environment.

<sup>6</sup> NVM: Non-Volatile Memory

## 2021 neuromorphic sensing and computing ecosystem

(Source: Neuromorphic Computing and Sensing 2021 report, Yole Développement, 2021)



Non-exhaustive list of companies

From their side, universities are forming extensive collaborations, often supported by governments, to develop the technology and understand the hard-science potential. This covers a vast range, starting from a simulation of the brain on a silicon chip, and involves partnerships with various companies to develop proofs-of-concept in the field. Labs affiliated with large companies are deeply involved in these collaborations and often take the lead. Intel and IBM developed neuromorphic communities around their chips to help the software ecosystem grow, increase the maturity of neuromorphic AI, and test use cases directly with application players.

All year long, *Yole Développement* publishes numerous reports and monitors. In addition, experts realize various key presentations and organize key conferences.



In this regard, do not miss the Embedded Vision Summit 2021 on May 25-28, 2021. **Pierre Cambou, Imaging Principal Analyst at Yole Développement** will present “The Transformation from Imaging to Sensing: Driving Market Revolution”. Register [here](#).

Make sure to be aware of the latest news coming from the industry and get an overview of our activities, including interviews with leading companies and more on [i-Micronews](#). Stay tuned!

### Press contacts

**Sandrine Leroy**, Director, Public Relations, [leroy@yole.fr](mailto:leroy@yole.fr)

**Marion Barrier**, Assistant, Public Relations, [marion.barrier@yole.fr](mailto:marion.barrier@yole.fr)

Le Quartz, 75 Cours Emile Zola – 69100 Villeurbanne – Lyon – France – +33472830189

[www.yole.fr](http://www.yole.fr) - [www.i-micronews.com](http://www.i-micronews.com) – [LinkedIn](#) – [Twitter](#)

### About our analysts

As a Technology & Market Analyst, Computing & Software, **Adrien Sanchez** belongs to the Semiconductor, Memory & Computing division at Yole Développement (Yole), part of the Yole Group of Companies. In collaboration with his team, Adrien produces technology & market analyses covering computing hardware and software, AI, machine learning and neural networks. Prior to Yole, he worked as an intern at AW Europe (Belgium), where he focused on image recognition & comprehension for ADAS. He also worked at ACOEM (France), where he focused on real-time sound classification using deep learning and edge computing. Adrien graduated with a double degree at Grenoble Institute of Technology PHELMA (Grenoble INP Phelma, France) and Grenoble Ecole de Management (GEM, France), and he earned an MSc on AI at Heriot-Watt University (Edinburgh, UK).

**Simone Bertolazzi, PhD** is a Senior Technology & Market analyst, Memory, at Yole Développement (Yole), working with the Semiconductor, Memory & Computing division. As member of the Yole's memory team, he contributes on a day-to-day basis to the analysis of nonvolatile memory markets and technologies, their related materials and fabrication processes. Previously, Simone carried out experimental research in the field of nanoscience and nanotechnology, focusing on emerging semiconducting materials and their opto-electronic device applications. He (co-) authored several papers in high-impact scientific journals and was awarded the prestigious Marie Curie Intra-European Fellowship. Simone obtained a PhD in physics in 2015 from École Polytechnique Fédérale de Lausanne (Switzerland), where he developed novel flash memory cells based on heterostructures of two-dimensional materials and high-k dielectrics. Simone earned a double M. A. Sc. degree from Polytechnique de Montréal (Canada) and Politecnico di Milano (Italy), graduating cum laude.

**Pierre Cambou** MSc, MBA, is a Principal analyst in the Photonics and Sensing Division at Yole Développement (Yole). Pierre's mission is dedicated to imaging related activities by providing market & technology analyses along with strategy consulting services to semiconductor companies. At Yole, Pierre is responsible for the CIS Quarterly Market Monitor while he has authored more than 15 Yole Market & Technology reports. Known as an expert in the imaging industry, he is regularly interviewed and quoted by leading international media. Previously, Pierre held several positions at Thomson TCS, which became Atmel Grenoble (France) in 2001 and e2v Semiconductors (France) in 2006. In 2012, he founded Vence Innovation, later renamed Irlynx (France), to bring to market an infrared sensor technology for smart environments. Pierre has an Engineering degree from Université de Technologie de Compiègne (France) and a Master of Science from Virginia Tech. (VA, USA). Pierre also graduated with an MBA from Grenoble Ecole de Management (France).

### About the report

#### **Neuromorphic Computing and Sensing 2021**

*Industrial, consumer, and automotive applications are driving the adoption of neuromorphic computing and sensing technologies. The first products are now hitting the market. – Performed by Yole Développement*

#### **Companies cited:**

ABR, Accenture, Adesto Technologies, ai Storm, Alibaba.com, Amazon, Ambarella, AMD, AMT, Anotherbrain, Antaios, Apple, Applied Materials, ARM, Aryballe Technologies, Avalanche Technology, Aspinity, AWS, Axis, Azure, Baidu, BMW, Brainchip, Canon, Celepixel, Ceva, Crossbar, Cogito Instruments, Dahua, Dialog, Facebook, Fraunhofer, General Vision, Global Foundries, Google, Gorilla, GrAI Matter Lab, Groq, HPLabs, Gyrfalcon Technology, HLMC, Hprobe, Huawei, IBM, IMEC, Infineon, and more...

### Related reports:

- [Emerging Non-Volatile Memory 2021](#)
- [Machine Vision for Industry and Automation 2021](#)
- [Cameras and Computing for Surveillance and Security 2020](#)
- [Artificial Intelligence Computing for Automotive 2020](#)
- [Sensors for Robotic Goods Transportation 2021](#)



## Press Release

### About Yole Développement

Founded in 1998, Yole Développement (Yole) has grown to become a group of companies providing marketing, technology and strategy consulting, media and corporate finance services, reverse engineering and reverse costing services and well as IP and patent analysis. With a strong focus on emerging applications using silicon and/or micro manufacturing, the Yole group of companies has expanded to include more than 80 collaborators worldwide... [More](#)

**For more information and images, please visit our website [i-Micronews](#)**

**###**