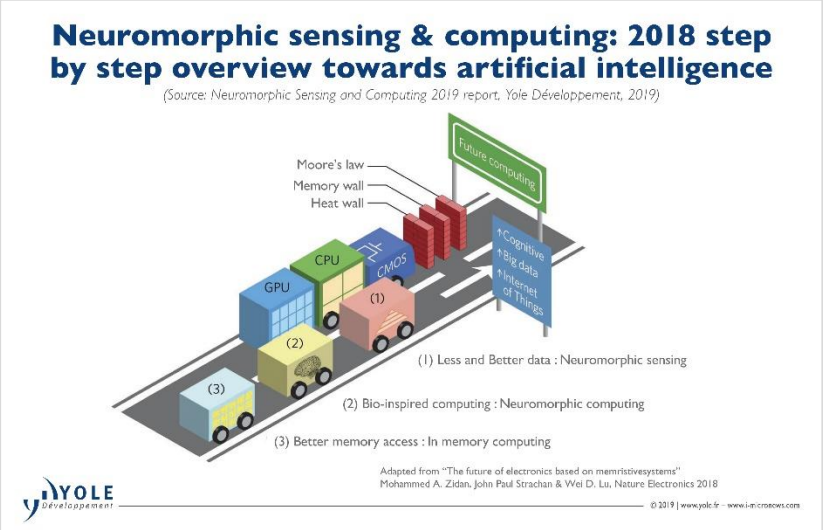
FOR IMMEDIATE RELEASE:

Neuromorphic: a step towards AI[1]?

Extracted from: Neuromorphic Sensing & Computing report, Yole Développement, 2019
As well as: Hardware and Software for AI – Consumer focus report and Artificial Intelligence Computing for Automotive report from Yole Développement

LYON, France – October 1st, 2019: Today, the neuromorphic approach still occupies the "curio cabinet". *"Many are prophesying the advent of neuromorphic approaches in the same way deep learning techniques were wrongfully dismissed – until they ended up reigning"*, explains **Pierre Cambou, Principal Analyst, Imaging at Yole Développement (Yole).** And he adds: *"Many similarities point to the idea that such a paradigm shift could happen quickly."*



Several years ago, the biggest obstacle preventing the DNN[2] approach from performing its best was the lack of suitable hardware to support DNN's innovative software advances. Today, the same is true for neuromorphic technology – but as the first SNN[3] chips roll out, the first beachhead markets are ready to fuel growth. The initial markets are industrial and mobile, mainly for robotic revolution and real-time perception. Within the next decade, the availability of hybrid in-memory computing chips should unlock the automotive market, which is desperate for a mass-market AD[4] technology.

Neuromorphic sensing and computing could be the magic bullet for these markets, solving most of AI's current issues while opening new perspectives in the decades to come…

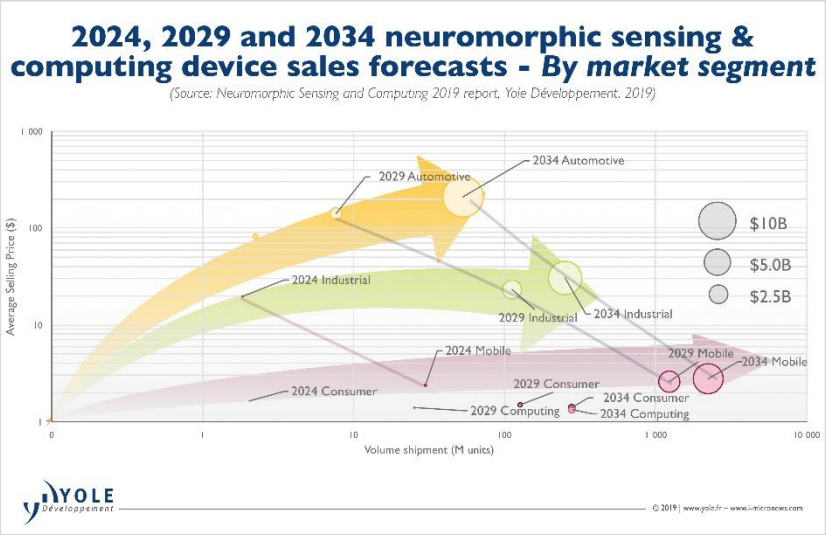
Yole explores today the computing and deep learning world with an imaging focus. The new report, Neuromorphic Sensing & Computing delivers an in-depth understanding of the neuromorphic landscape with key technology trends, competitive landscape, market dynamics and segmentation per application. It presents key technical insights and analysis regarding future technology trends and challenges. This

[1] AI : Artificial Intelligence
[2] DNN : Deep Neural Network
[3] SNN : Spiking Neural Network
[4] AD : Autonomous Driving

analysis is at the cross road of two industries covered by Yole's analysts: imaging and software & computing.
How will this industry evolve? Who are the companies to watch? What is the status of their development? Yole proposes you today an overview of the neuromorphic sensing ecosystem.

Since 2012, deep learning techniques have proven their superiority in the AI space. These techniques have spurred a giant leap in performance, and have been widely adopted by the industry.

"Recently, we have witnessed a race for development of new chips specialized for deep-learning training and inference, either for high-performance computing, servers, or edge applications", asserts **Yohann Tschudi, Technology & Market Analyst, Computing & Software at Yole**. *"These chips use the existing semiconductor paradigm based on Moore's Law. And while it is technically possible to manufacture chips capable of performing hundreds of Tops*[5] *to serve today's AI application space, the desired computing power is still well below expectations."*
Consequently, an arms race is ongoing, centering on the use of "brute force computing" to address computing power requirements. The technology node currently used is already at 7nm, and full wafer chips have emerged. Room for improvement appears small, and relying solely on the Moore's Law paradigm is creating several uncertainties.



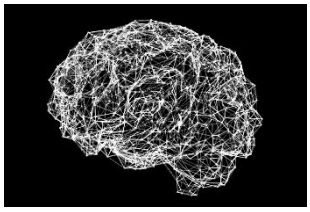
Current deep-learning techniques and associated hardware face three main hurdles: first, the economics of Moore's Law make it very difficult for a start-up to compete in the AI space and therefore is limiting competition. Second, data overflow makes current memory technologies a limiting factor. And third, the exponential increase in computing power requirements has created a "heat wall" for each application. Meanwhile, the market is demanding more performance for real-time speech recognition and translation, real-time video understanding, and real-time perception for robots and cars, and there are hundreds of other applications asking for more intelligence that combines sensing and computing.

[5] Tops : Tera operations per second

Given these significant hurdles, the time is ripe for disruption: a new technology paradigm in which start-ups can differentiate themselves, and which could utilize the benefits derived from emerging memory technologies and drastically improve data, bandwidth, and power efficiencies. Many foresee this new paradigm to be the neuromorphic approach, some would call it the event-based approach where computation happens only if needed instead of being done at each clock step. This method allows a tremendous energy saving essential to run these greedy and intensive AI algorithms. This is the probable next step in AI technology.

Neuromorphic Sensing & Computing report from Yole represents a window into a possible future where AI uses neuromorphic approaches for sensing and computing. A detailed description of this report and other computing & software reports is available on i-Micronews.com.

ABOUT THE REPORTS:



Neuromorphic Sensing and Computing

Facing huge hurdles in data bandwidth and computational efficiencies, computing and sensing must reinvent themselves by mimicking neurobiological architectures. - Performed by Yole Développement (Yole).

Companies cited:

4DS, ABR, Adesto, Agent, aiCTx, aiStorm, Allgovision, Alibaba.com, Anotherbrain, Apple, arm, aws, Axis, Axxonsoft, Azure, Baidu, Brainchip, Canon, Celepixel, Ceva, Crossbar, Dahua, Flir, Geovision, General Vision, Google, Gorilla, Grai Matter Lab, Groq, Hikvision, HPLabs, Huawei, IBM, iFlytek, Imasenic, Inivation, Intel, Ironyun, JD.com, Kalray, Knowm, Knuedge, Megvii... and more

As well as:

Hardware and Software for AI – Consumer focus

How will AI impact the semiconductor market through consumer applications – Performed by Yole Développement (Yole).

Artificial Intelligence Computing for Automotive

Artificial Intelligence for automotive: why you should care – Performed by Yole Développement (Yole).

Authors of the report:

- In 1999 **Pierre Cambou** joined the imaging industry. He had earned an Engineering degree from Université de Technologie de Compiègne in parallel to a Master of Science from Virginia Tech in 1998. More recently he graduated from Grenoble Ecole de Management's MBA. Pierre took several positions at Thomson TCS which became Atmel Grenoble in 2001 and e2v Semiconductors in 2006. In 2012 he founded the start-up Vence Innovation (now called Irlynx) in order to bring to market a disruptive Man to Machine interaction technology. He joined Yole Développement, the market research and strategy consulting company, as Principal Analyst, Technology & Market, Imaging, in 2014.
  Pierre Cambou is also regularly involved in international conferences, giving presentations, delivering keynotes, as well as organizing committees.
- As a Software & Market Analyst, **Yohann Tschudi**, PhD is a member of the Semiconductor & Software division at Yole Développement (Yole). Yohann is daily working with his team, to identify, understand and analyze the role of the software and computing parts within any semiconductor products, from the machine code to the highest level of algorithms. After his thesis at CERN (Geneva, Switzerland), Yohann developed a dedicated software for fluid mechanics and thermodynamics applications. Afterwards, he served during 2 years at the University of Miami (FL, UnitedStates) as an AI scientist. Yohann has a PhD in High Energy Physics and a master degree in Physical Sciences from Claude Bernard University (Lyon, France).
- **Simone Bertolazzi** is a technology and market analyst at Yole Développement, working within the Semiconductor and Software Division. He is also a member of Yole's memory team and contributes to the daily analysis of non-volatile memory technologies and their related materials and fabrication processes. In 2015, Simone obtained a PhD in Physics from Ecole Polytechnique Fédérale de Lausanne in Switzerland, where he developed a novel flash memory cell based on heterostructures of 2D materials and high-k dielectrics.

ABOUT YOLE DEVELOPPEMENT

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 covering MEMS & Sensors - Imaging - Medical Technologies - Compound Semiconductors - RF Electronics - Solid State Lighting - Displays - Photonics - Power Electronics - Batteries & Energy Management - Advanced Packaging - Semiconductor Manufacturing - Software & Computing - Memory and more...

The "More than Moore" market research, technology and strategy consulting company Yole Développement, along with its partners System Plus Consulting, PISEO and KnowMade, support industrial companies, investors

and R&D organizations worldwide to help them understand markets and follow technology trends to grow their business. . For more information, visit www.yole.fr and follow Yole on LinkedIn and Twitter.

- Consulting & Financial Services: Jean-Christophe Eloy (eloy@yole.fr)
- Reports: David Jourdan (jourdan@yole.fr)

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