

IMAGE SIGNAL PROCESSOR AND VISION PROCESSOR MARKET AND TECHNOLOGY TRENDS 2019

Market & Technology Report - June 2019

Artificial intelligence-powered newcomers are reshuffling the pack.

REPORT KEY FEATURES

- Intellectual property and silicon business models description and market dynamics
- Image signal processor and vision processor market dynamics
- Technology trends and future outlook
- Descriptions of ecosystem and applications
- Image processing pipeline and deep learning descriptions

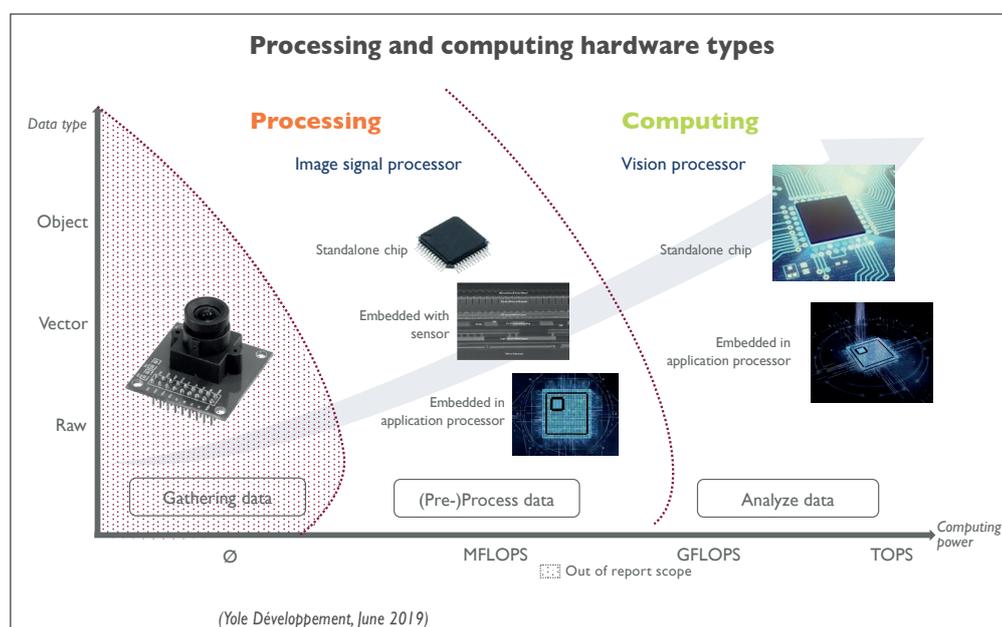
WHAT ARE WE TALKING ABOUT?

The report focuses on describing the markets related to hardware needed for image processing. Behind a camera, there may be several ways to process raw data depending on the purpose. The alternatives usually break down into viewing or analyzing the image to understand the environment around the module or system containing the camera. Each of these purposes, however, requires a different type of hardware.

For visualization, the algorithms needed to transform the raw data into a visible image by the human eye have existed for a long time and are optimized in terms of performance or quality. The hardware has evolved in parallel, and today is embodied in Image Signal Processors (ISPs), allowing processing from the pixels of the image. For analysis, however, new algorithms require

computing power to achieve the precision sought in understanding the surrounding environment. That's especially true for algorithms derived from artificial intelligence techniques such as deep learning. This is where the Vision Processor (VP) comes in. Its goal is to analyze a complete frame, not just the pixel level.

In this report, Yole Développement will segment processing and computing respectively according to their association with the image signal processor and vision processor. At the business level, segmentation is quite simple. Some companies offer a license and royalties for a design, which is known as intellectual property (IP) business. Other companies sell the chips, which we call the silicon business.



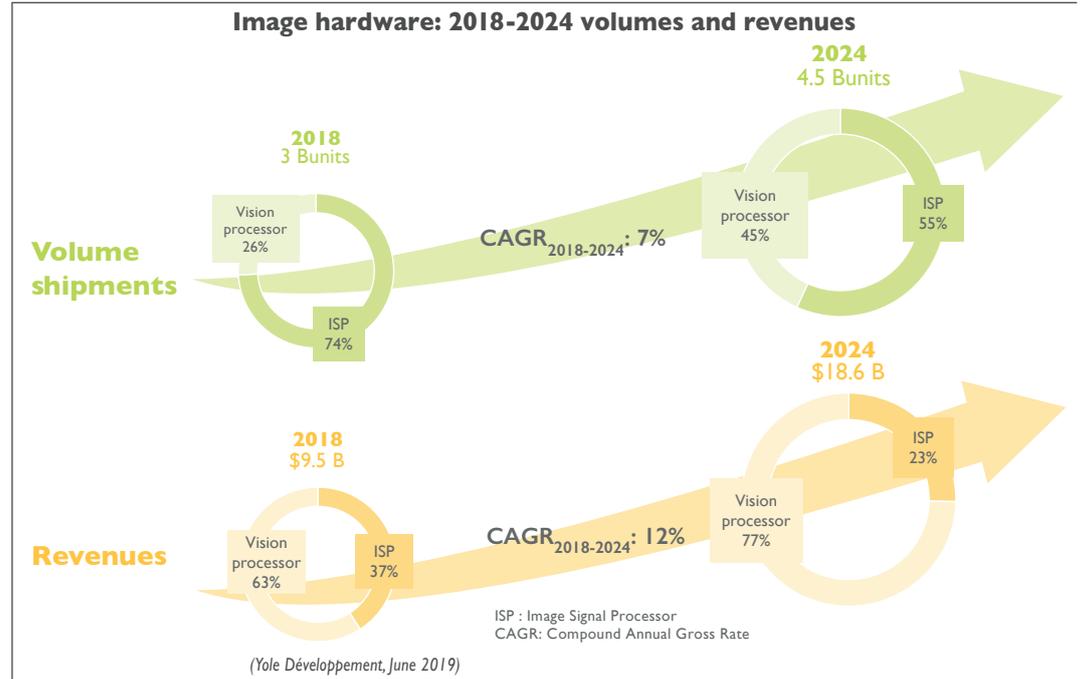
WHAT ARE THE MARKET DYNAMICS?

AI has completely disrupted hardware in vision systems, and has had an impact on entire segments, as Mobileye has in automotive, for example. Image analysis adds a lot of value. Image sensor builders are therefore increasingly interested in integrating a software layer to their system in order to capture it. Today, image

sensors must go beyond taking images – they must be able to analyze them.

However, to run these types of software, high power computing and memory are necessary, which led to the creation and development of vision processors. The ISP market offers a steady compound annual growth rate (CAGR) from

2018 to 2024 of 3%, making the total market worth \$4.2B in 2024. Meanwhile, the vision processor market is exploding, with a 18% CAGR from 2018 to 2024, making the market worth \$14.5B in 2024!

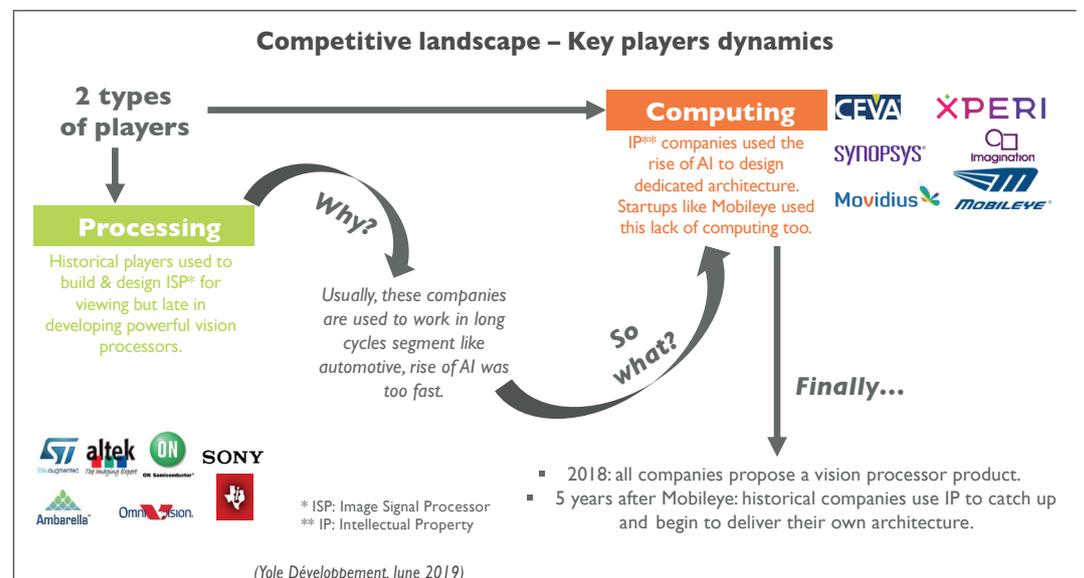


A UNUSUAL ECOSYSTEM HAS BEEN CREATED

Processing and computing hardware for the imaging market has been divided into two different business models. IP companies don't have physical products, but silicon companies sell the physical processors. The leaders are easy to identify for each category. ARM and Synopsys lead the IP segment and OmniVision, Mobileye and ON Semiconductor lead the silicon segment.

The main goal of this report is to understand what is happening with the emergence of AI. Even if it is not a new technology, thanks to technological factors AI has made a spectacular entry into vision systems. It opens new perspectives in mobile device, automotive, computing and surveillance industries. The applications include biometry and photography, autonomous driving, behavioral recognition, human identification and tracking.

It is important to note that historical players have struggled to react to AI's arrival. That has allowed other companies to get into the business, including smartphone companies like Apple and Huawei, startups like Mobileye, and companies in other segments, like NVIDIA in automotive applications. However, because the trend is towards low-power, low-consumption, always-on computing hardware, the historical players are coming back into the game. AI technologies promise a bright future in many areas, with rapid software and hardware progress. This is very exciting for the entire area of vision systems. This report tries to show why it is important to understand the technologies and their impacts, and how to react.



REPORT OBJECTIVES

Provide a clear understanding of the image processor and vision processor technologies and market.

- Ecosystem identification and analysis:
 - Determine market dynamics
 - Technical market description
 - Economic requirements by segment
 - Key players by market: analysis
 - Market size and market forecast in \$M
- Analysis and description of the market and technologies involved:
 - Major players on a global basis
 - Technology identification for different devices and processes
 - Competing technologies
 - Main technical challenges
 - Future directions

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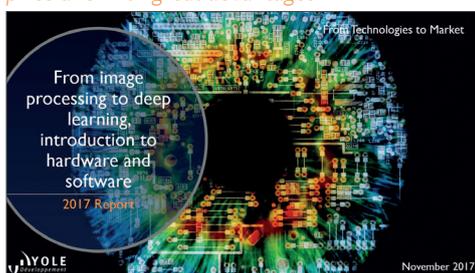


AUTHOR

As a Technology & Market Analyst, **Yohann Tschudi, PhD** is a member of the Semiconductor & Software division at Yole Développement (Yole). Yohann is daily working with Yole’s analysts to identify, understand and analyze the role of the software parts within any semiconductor products, from the machine code to the highest level of algorithms. Market segments especially analyzed by Yohann include big data analysis algorithms, deep/machine learning, genetic algorithms, all coming from Artificial Intelligence (IA) technologies. After his thesis at CERN (Geneva, Switzerland) in particle physics, Yohann developed a dedicated software for fluid mechanics and thermodynamics applications. Afterwards, he served during 2 years at the University of Miami (FL, United-States) as a research scientist in the radiation oncology department. He was involved in cancer auto-detection and characterization projects using AI methods based on images from Magnetic Resonance Imaging (MRI). During his research career, Yohann has authored and co-authored more than 10 relevant papers. Yohann has a PhD in High Energy Physics and a master degree in Physical Sciences from Claude Bernard University (Lyon, France).

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