CMOS pixel sensors with on-chip Neural Network: A new horizon for embedded systems?

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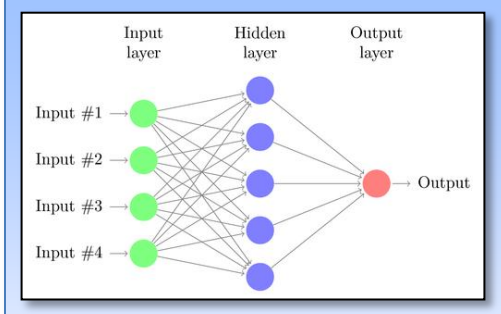
Introduction : Toward Integration of Neural Networks

- Steady progress in CMOS pixelated sensor technology
  - ➢ Smaller feature size ⇨Steady enhanced signal treatment density in the chip & in the pixel
- Neural Network (NN) algorithms
  - ➢ Extensively used in embedded systems, image processing, subatomic physics, etc.
  - ➢ Ready to bridge the gap between CPU based NN and in sensors NN.

⇨ Challenges addressed: limitation in terms of integration (CPU, read-out speed, robustness, footprint, power consumption, etc.)

The Idea/Concept: Integration of a neural network in the chip



Neural Network

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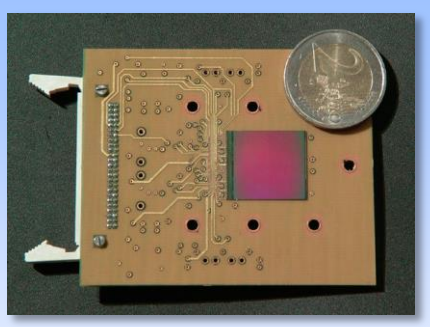

CMOS pixel sensor

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OUTPUT
⇨ Identified object

Expected added value

- ⇨ **Reduced footprint & increased robustness for embedded systems**
- ⇨ **Reduced power consumption**
- ⇨ **Analog signal access & treatment**
- ⇨ **Reduced data flow and real time processed output**

Potential Impact, Applications

Subatomic physics: charged particles, X-rays, etc.

- ➢ 3D information in 2D sensors (tracking, vertexing, pattern recognition)
- ➢ Particle identification (dosimetry, etc.)

Visible light in embedded systems

- ➢ Real time object recognition (faces, vehicles, obstacles, etc.)
- ➢ Automatized decisions (micro-robotics, etc.)