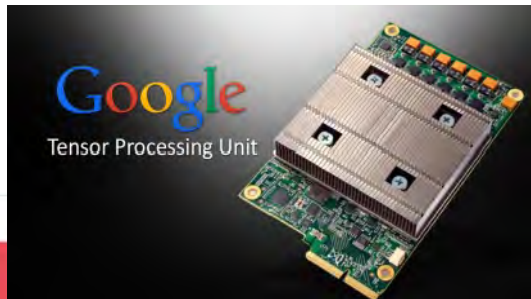


Antiferromagnets and

the internet of things
neuromorphics



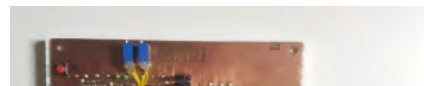
High performance computing (digital)



Now
149 USD
10-100 W

Now
5~50 USD
0.1-1 W

Internet of Things (both digital / analog)



Now empowered by AI algorithms
Reduced cloud dependence

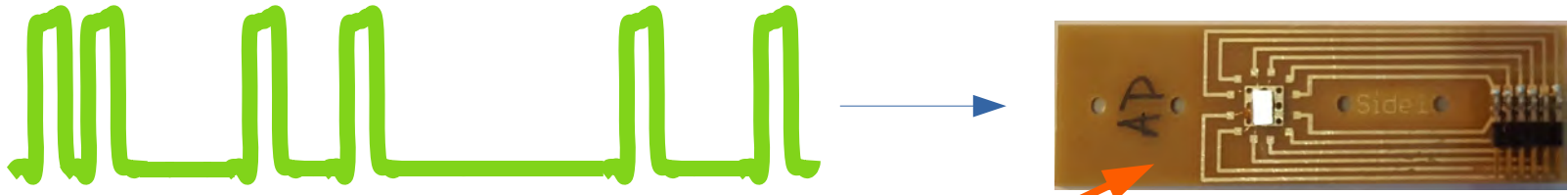


Bio-inspired
Negligible power consumption



Analog spiking neural networks

Let's go to the lab



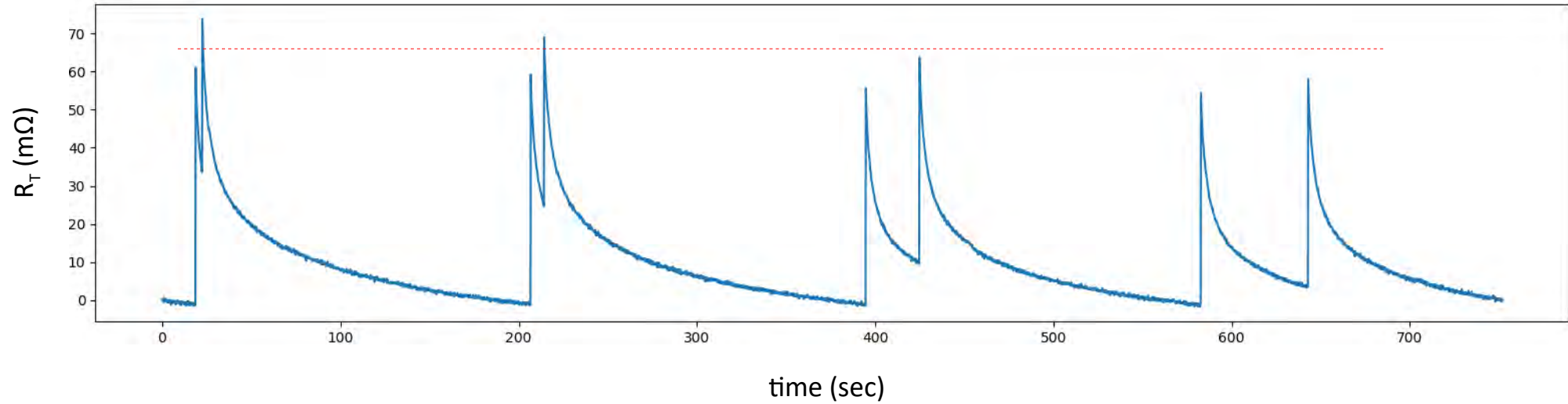
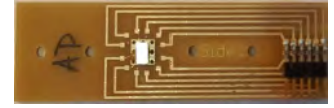
CuMnAs

ASPIN
ANTIFERROMAGNETIC SPINTRONICS

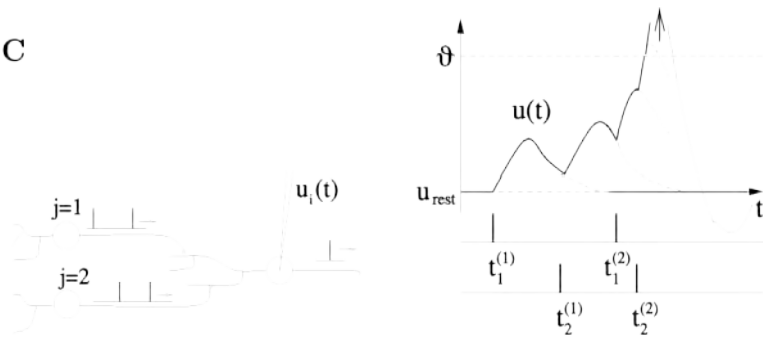


IGS research

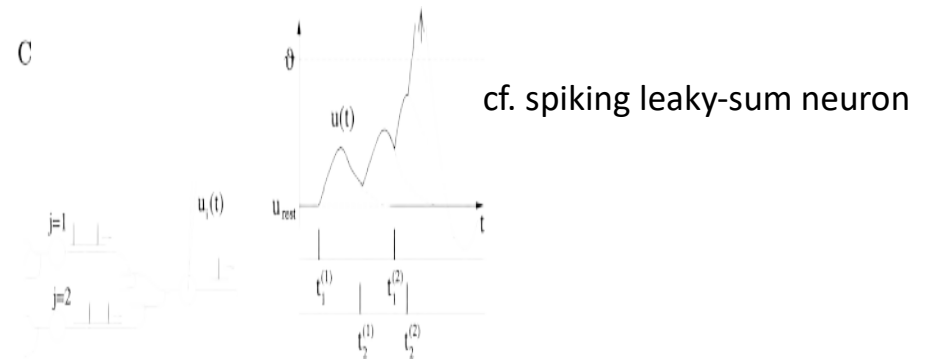
Leaky sum and fire



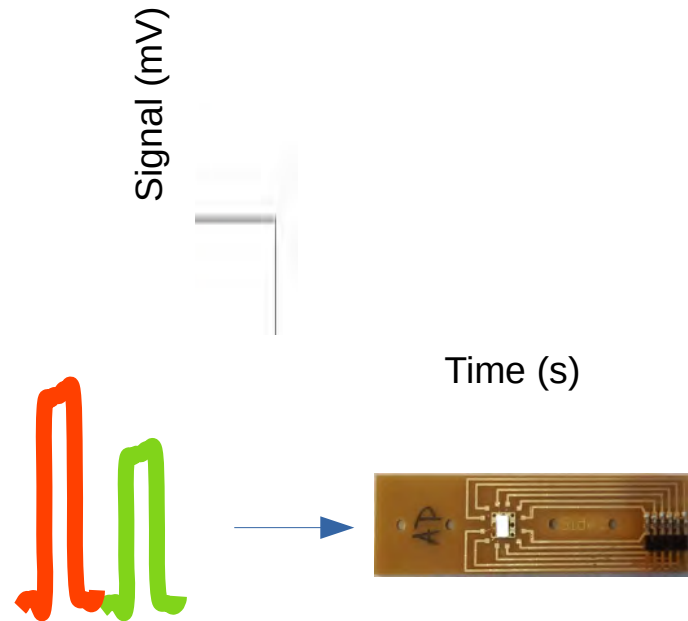
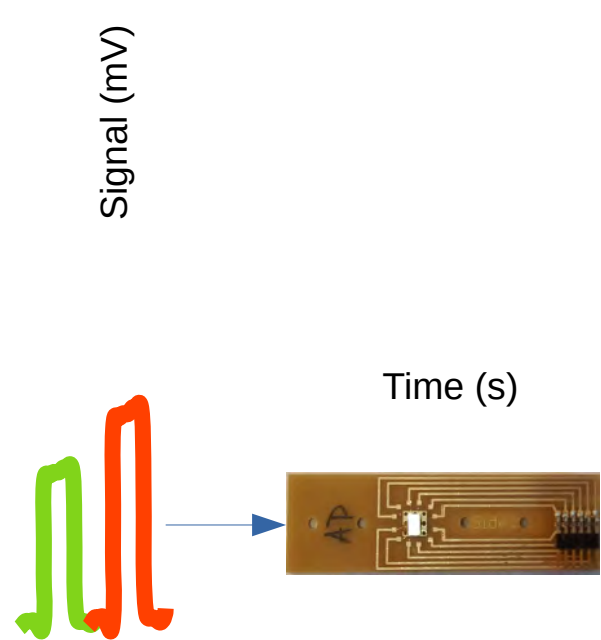
C



C



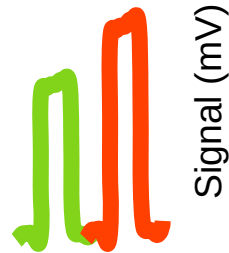
Which pulse was first?



Check direction of motion



Time (s)



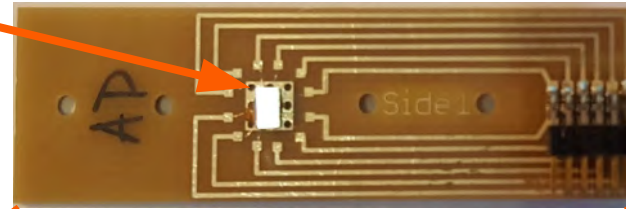
Time (s)

From lab to the streets

2019: All-Analog, pulses-in, pulses-out

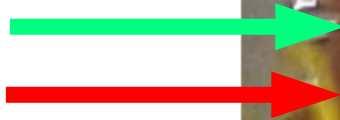


CuMnAs



all-ANALOG

Pulses in



Pulses out



Sum and fire > th

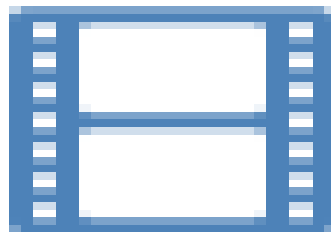
Falling edge > th



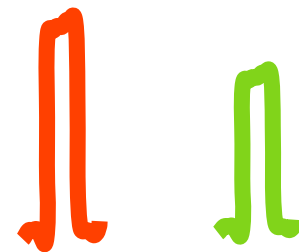
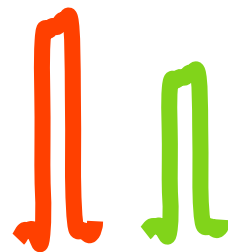
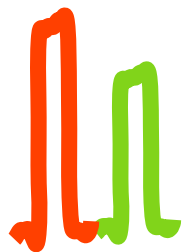
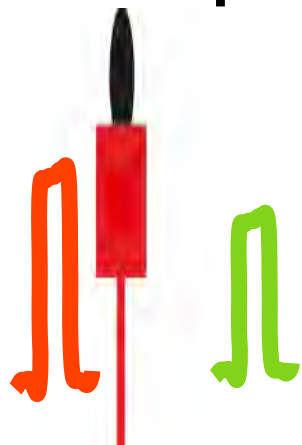
Can we check car direction?



IGS research



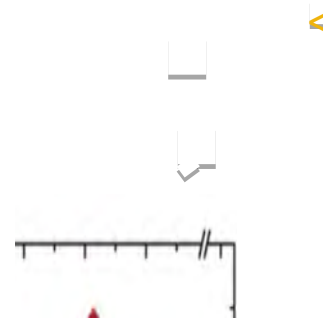
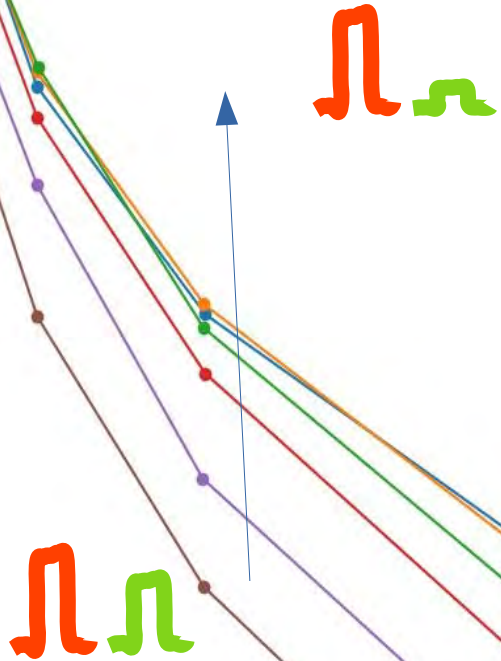
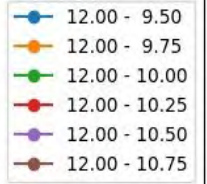
Can we measure speed?



Which pulse was first?

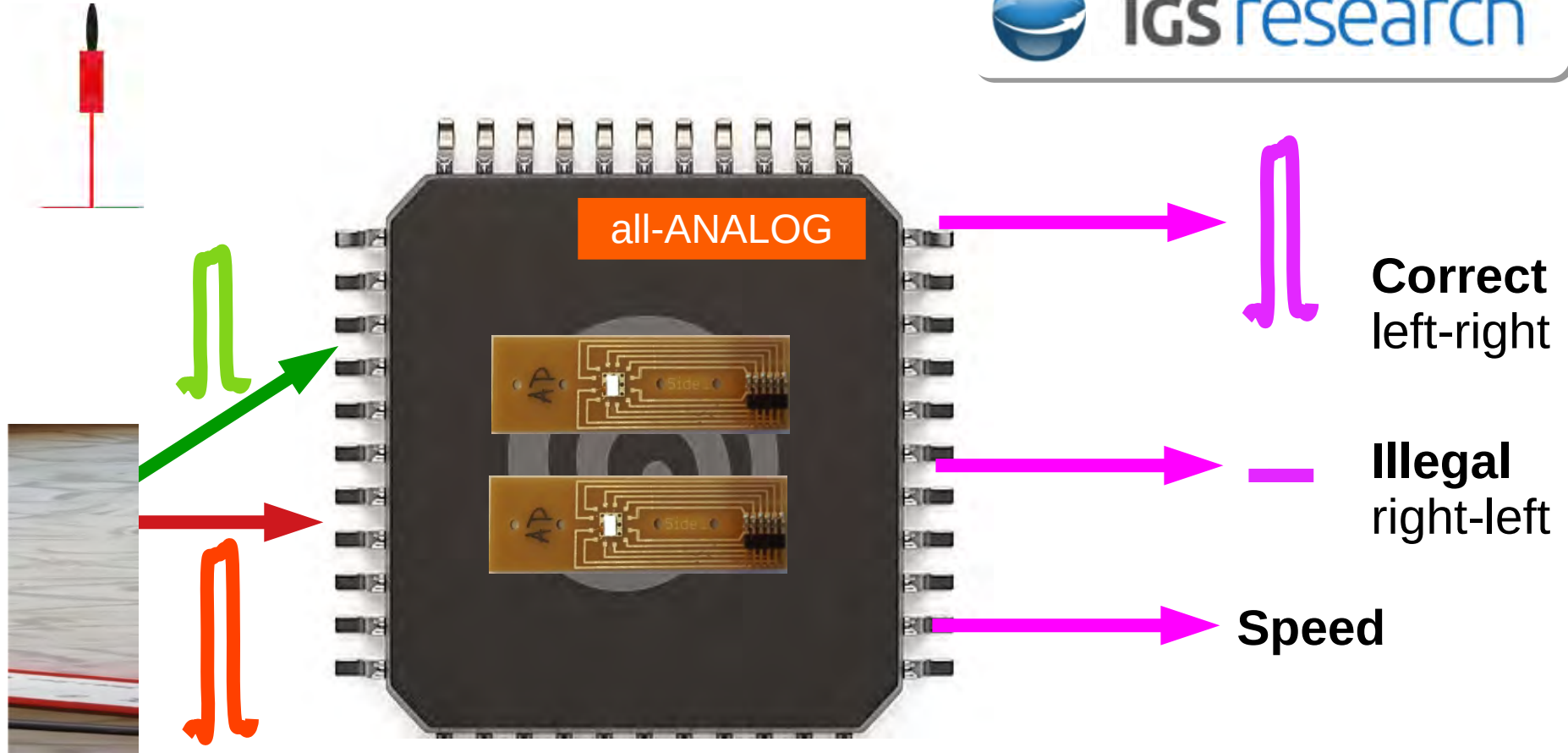
Amplitude & delay dependence

Signal drop (mV)



Time delay (s)

Emergent Hardware Turing's Test



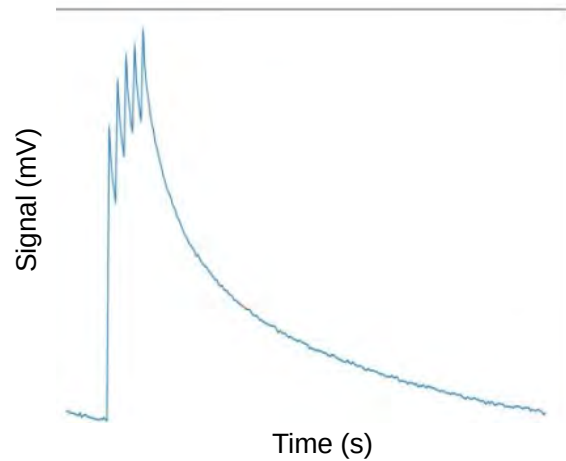
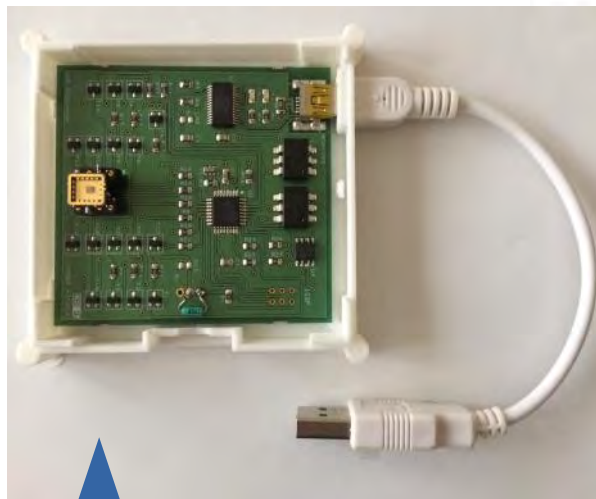
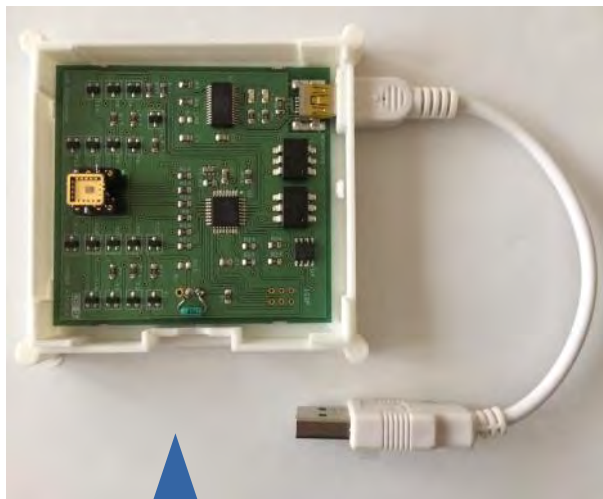
What's next?

2017: USB pulse *counter*

Antiferromagnetic CuMnAs multi-level memory cell with microelectronic compatibility

K. Olejník, V. Schuler, X. Marti, V. Novák, Z. Kašpar, P. Wadley, R. P. Campion, K. W. Edmonds, B. L. Gallagher, J. Garces, M. Baumgartner, P. Gambardella & T. Jungwirth

Nature Communications **8**, Article number: 15434 (2017) [Download Citation](#)

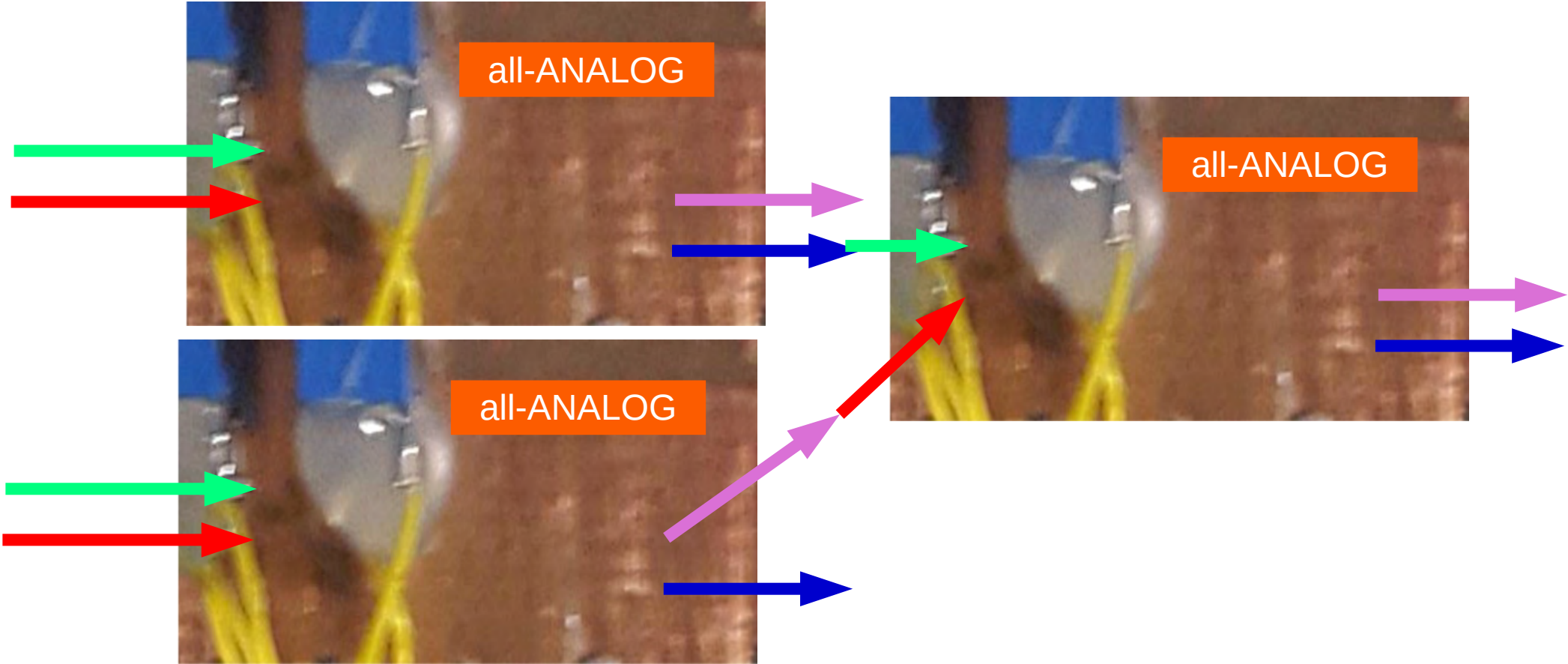


YouTube

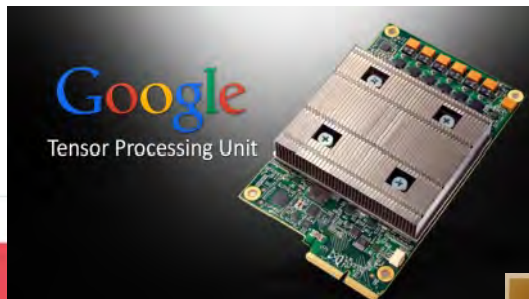


What's next?

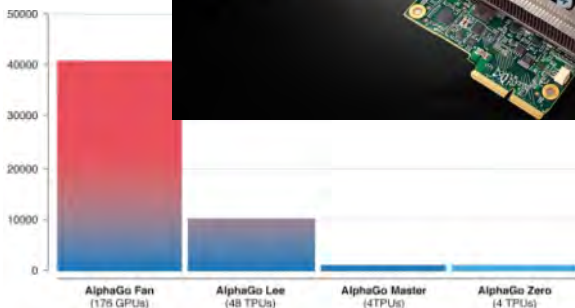
2019: All-analog CuMnAs



High performance computing (digital)

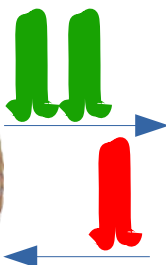
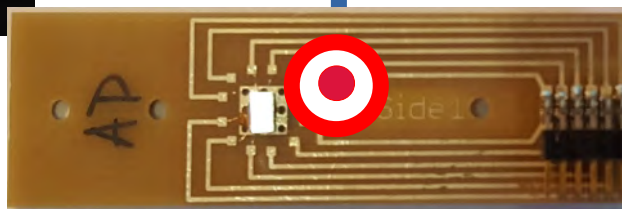


Google
Tensor Processing Unit



Now
149 USD
10-100 W

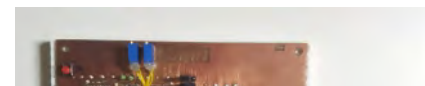
Now
5~50 USD
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Bio-inspired
Negligible power consumption

Analog spiking neural networks

Internet of Things (both digital / analog)



Now empowered by AI algorithms
Reduced cloud dependence





Thanks for your attention



igsresearch.com/mainz19.pdf

www.spice.uni-mainz.de

	
Xavi Marti - Spintronics from Nano to Geo 3K views • 3 years ago	Talks - Antiferromagnetic Spintronics - Xavi Marti,... 2.7K views • 2 years ago