

2003, Pulnix ZiCAM
(312 neurons)



- 50 systems, in continuous operation, saving US\$2M per boat,
 - trained in deep sea waters by Nordic fishermen
 - No cloud access



A Field Proven Technology

NeuroMem

Highly effective and unique neuromorphic technology

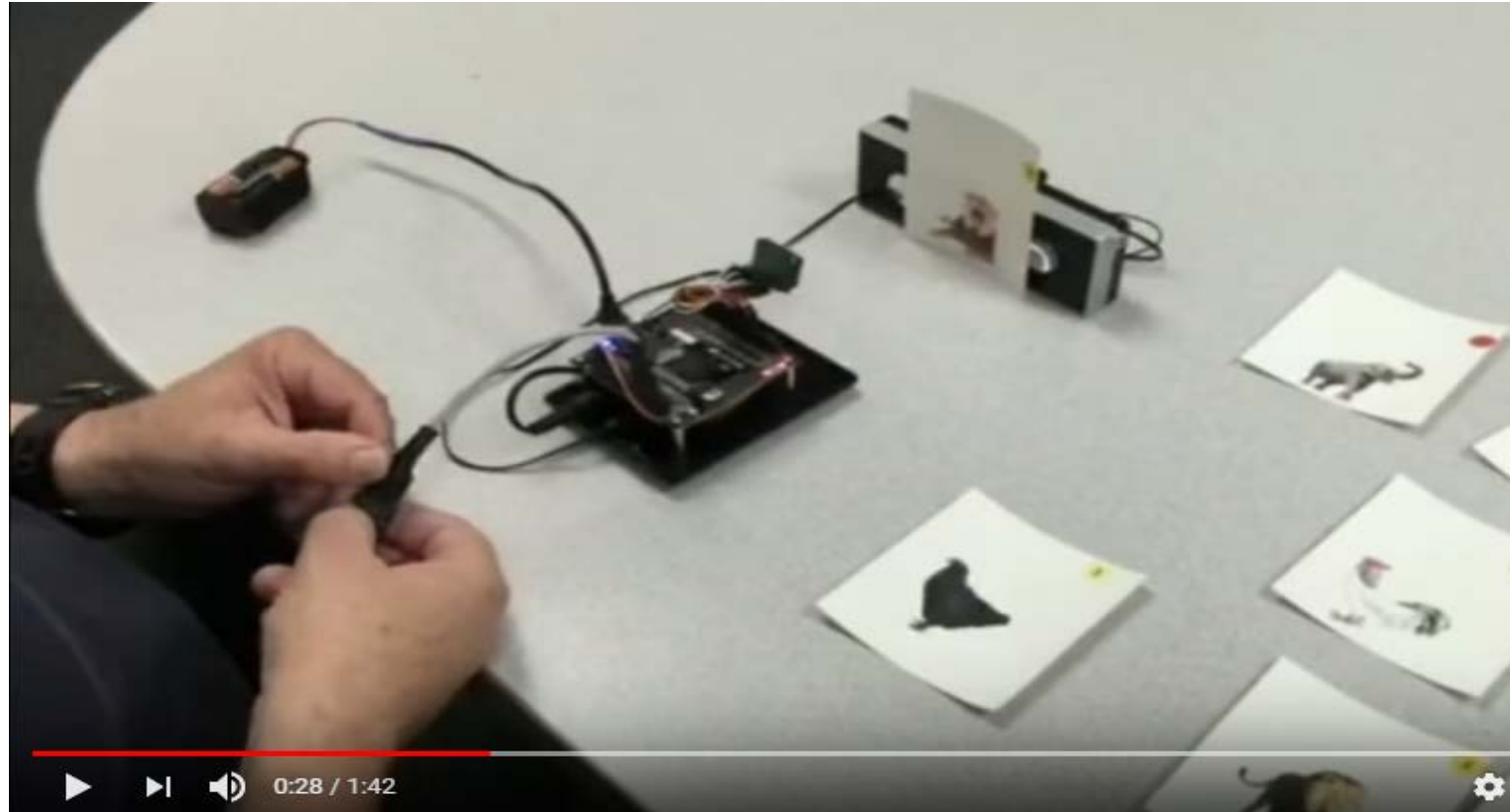
- Always-On pattern recognition at low-power
 - Identification
 - Classification with confidence factors
 - Anomaly and Novelty detection
- Capable of life long learning on the chip
 - Essential for adaptivity and practicality
 - No dependency to an external system (GPU, cloud, etc.)
 - Highly and easily scalable
- Deterministic latency (μ secs regardless of the size of the network)



More relevant than ever

NeuroMem

Image to Speech demo, battery operated, real-time learning of flash cards, no software



5/25/2018

AI chip for edge intelligence

NeuroMem

Associative Memories

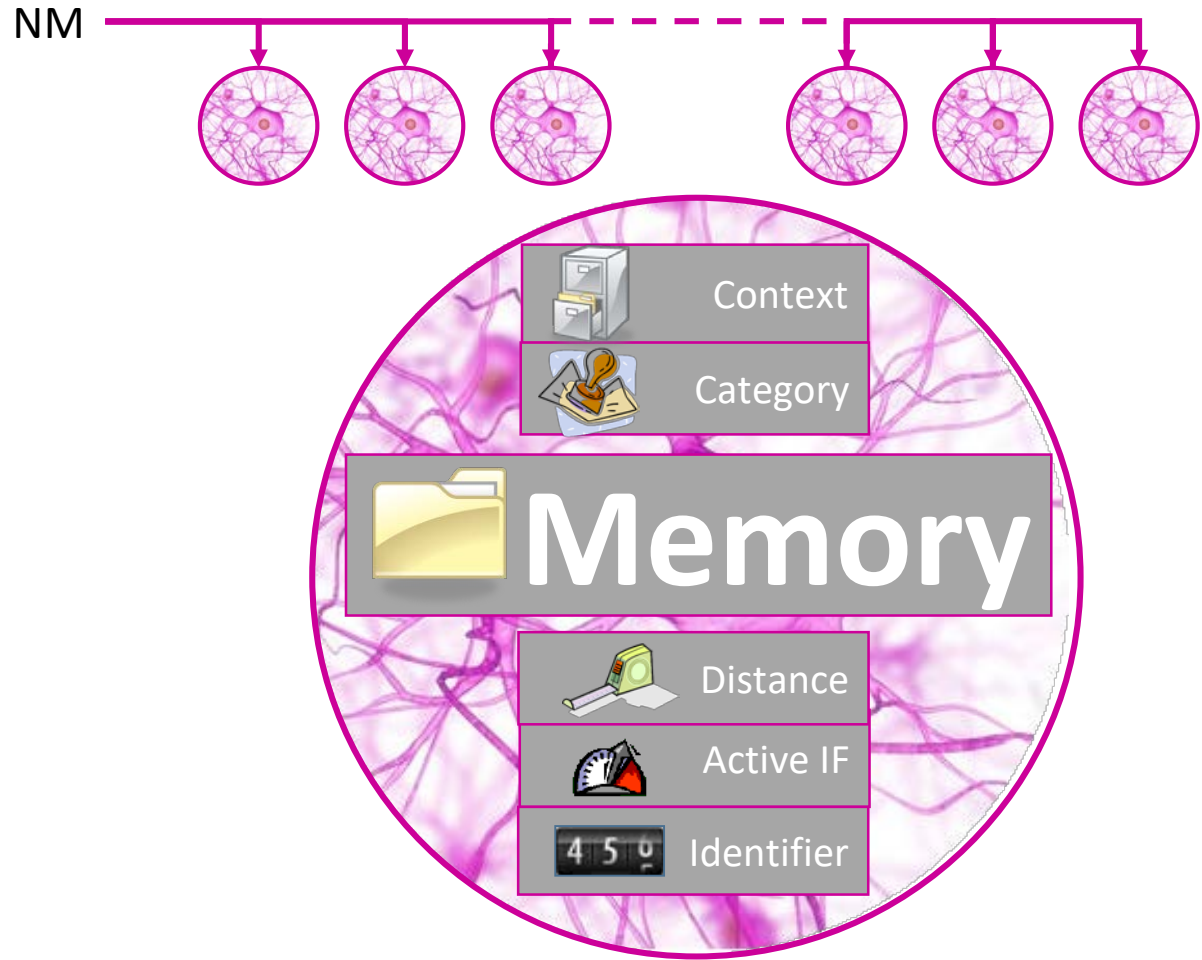
- Recognize by association
- Content reactive memories
- Exact and fuzzy match
- Notion of unknown
- Notion of uncertainty

+ Trainable ANN

- Learn by examples
- Adaptive model generator
- Intrinsic deduplication
- Supervised and unsupervised
- Knowledge Traceability
- Knowledge Portability



A chain of identical neuromorphic memory cells



- Memory and processing in a same cell
- Low clock frequency
- Deterministic latency
- Fixed bus width (intra & inter chip)
- Easy scalability
- No addresses and indexes
- No supervisor



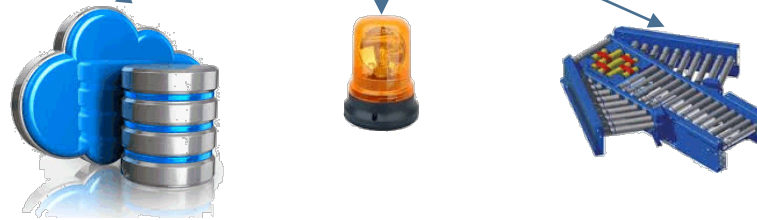
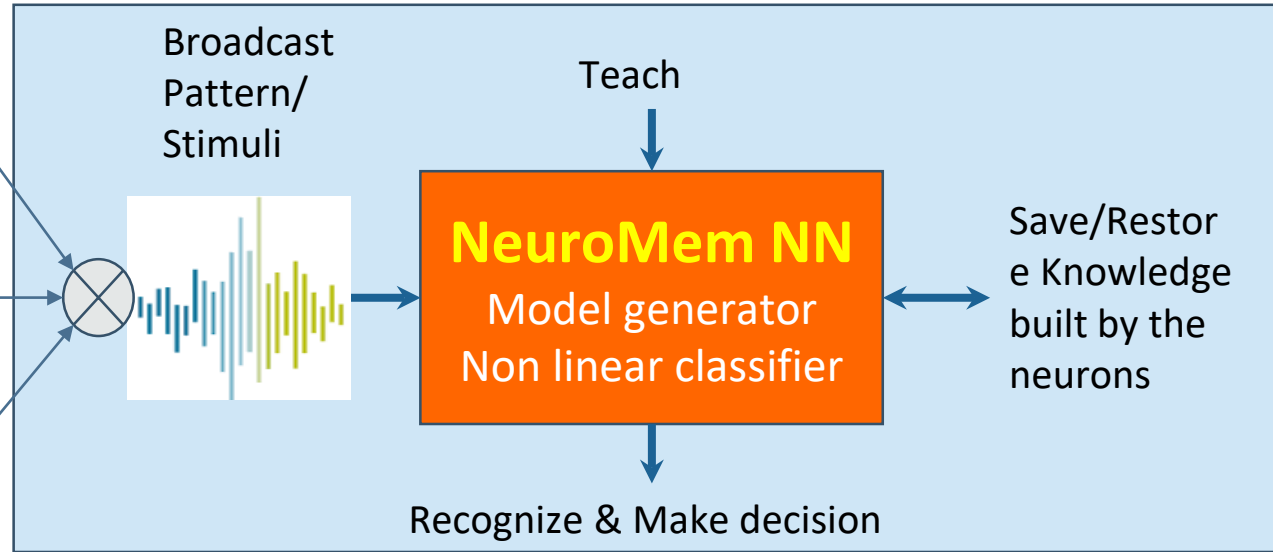
Text (1D)



Signal (1D)



Image (2D)

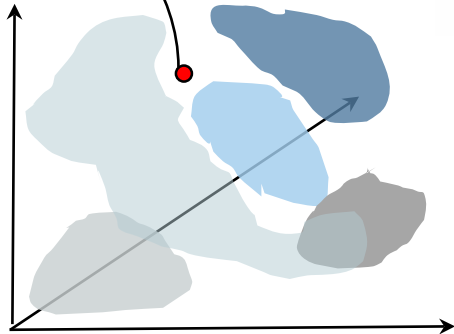
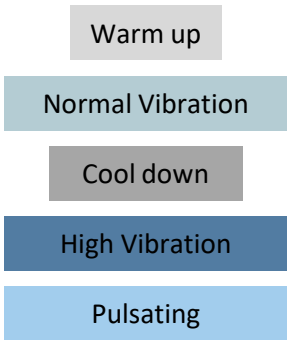


Simple Interface

NeuroMem



Anomaly!



- Stimuli
 - Voltage, Torque, Sound, Vibration
 - Angle, velocity
 - Temperature (human, ambient)
 - Biosensors
- Learning
 - Supervised learning of normal operations
 - Unsupervised learning of novelties
- Recognition
 - Sensors to transmit only information of interest: Events, drifts, novelties
 - Adaptive control

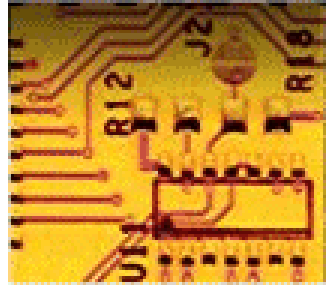


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Signal Monitoring & Predictive Maintenance

NeuroMem

Trainable
photocells &
industrial cameras



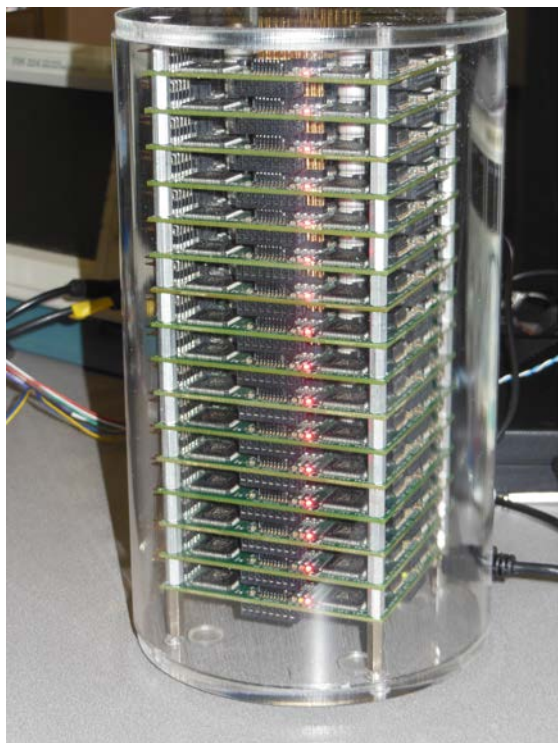
Industrial and
professional vision
systems

Embedded and
low-power
systems



- Stimuli
 - Live video
 - Images, movie files
 - Combined with audio, GPS, etc.
- Learning
 - Discrete objects
 - Colors, shapes, alignments
 - Textures and surfaces
- Recognition
 - Identification
 - Classification
 - Defect or novelty detection
 - Disparity localization





NeuroTube, 65536 neurons

40,000 pattern/second
= 2,684,354,560,000 ops/sec
= 2.68 Teraoperations/sec @ 12 Watts
= 223 Gigaoperations/sec/watt

Power efficiency @ 10 MHz:
12 Watts
(24 volts/0.5 Amp)
386 Mips per milliwatt



- Stimuli
 - Tweets
 - Documents
 - Computer logs, financial logs
 - Packet uplinks
- Learning
 - Dictionaries of words and expressions
 - Random encrypted lookups
- Recognition
 - Word spotting and counting
 - Exact matching
 - Clustering
 - Drift and anomaly detections
 - Trending and prediction



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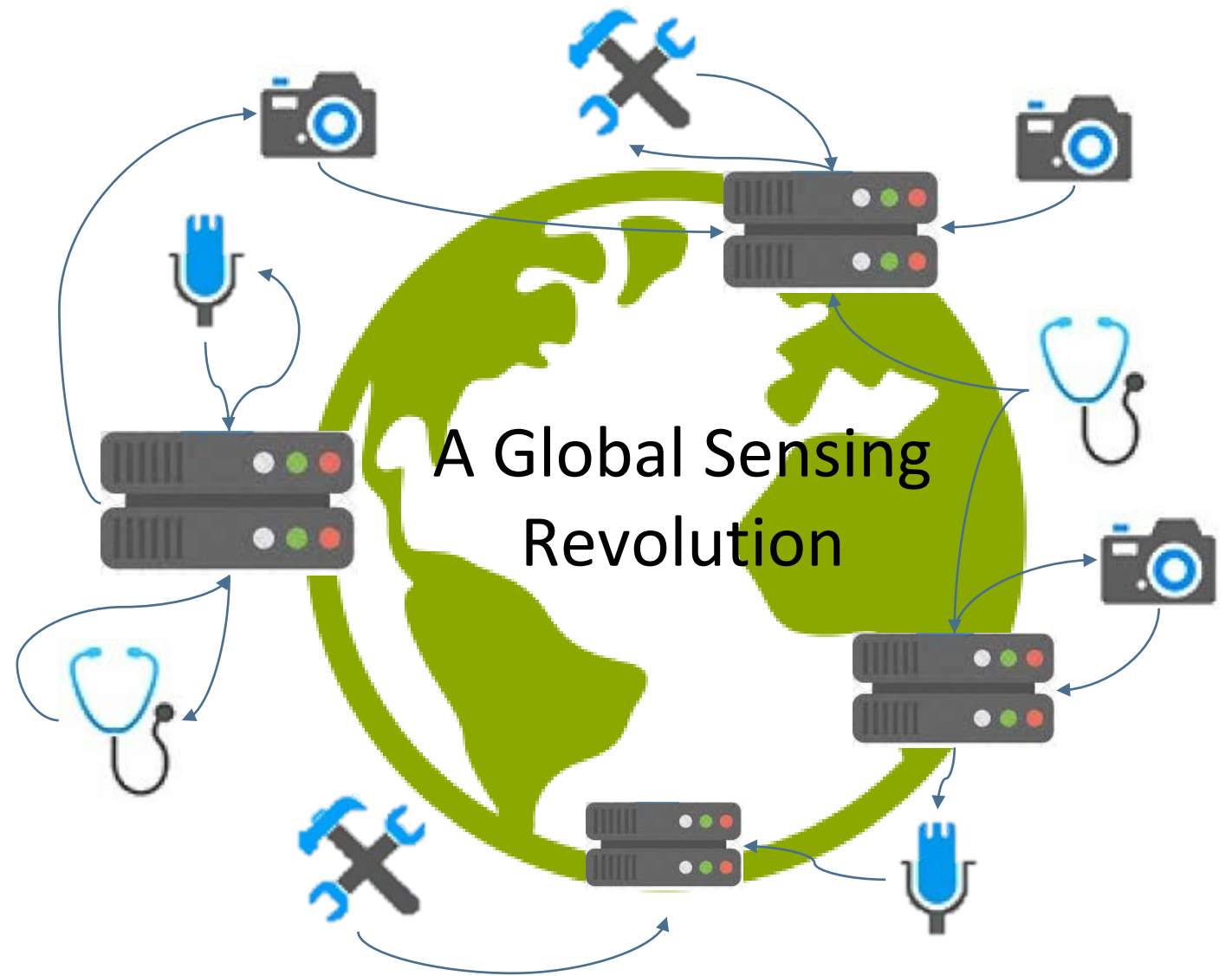
Analytics and Security in Text & Packets

NeuroMem

Proliferation of **NeuroMem smart** sensors for autonomous actuation, selective transmission and storage

Commoditization of **NeuroMem Smart** secure IT

NeuroMem Smart data centers with distributed low-power search engines



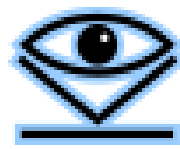
Empowering Global Sensing

NeuroMem

What is next for the NeuroMem technology?

- Become the de-facto IP / chip for embedded AI
- Get a chip into each sensor
- Get a chip into each device with secure communication
- Get the IP into each microcontroller, microprocessor and FPGA
- Get data centers powered by NeuroMem to drastically reduce their power consumption
- Get the chip into IntelliGlass

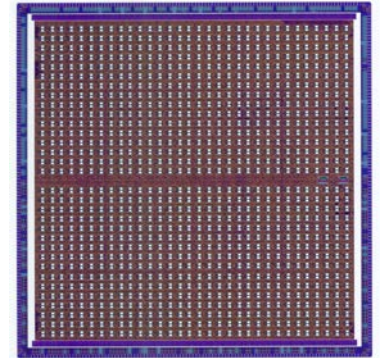




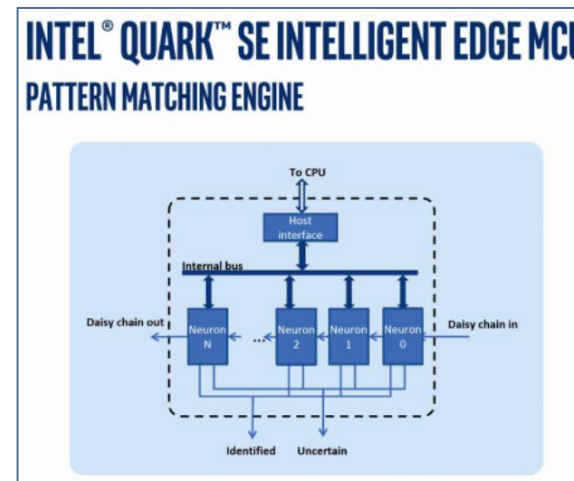
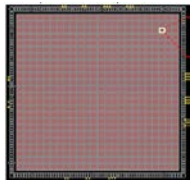
GENERAL VISION

- Inventor of NeuroMem[®] technology (ZISC originally in 1993)
- Supplying neuromorphic chips since 1999
- Ecosystem (boards, drivers, tools)
- Owner of the NeuroMem[®] IP for ASIC and FPGA
- Designer of 2 NeuroMem[®] chips
- Licensed to Intel in 2011

CM1K (2008)
 1024 neurons
 + video reco logic + I2C
 130 nm technology
 Mfg OKI Semiconductor



NM500 (2017)
 576 neurons
 110 nm technology
 Mfg nepes



A General Vision Technology

NeuroMem

Thank you

- www.general-vision.com
- <https://www.youtube.com/user/GeneralVisionTube>

