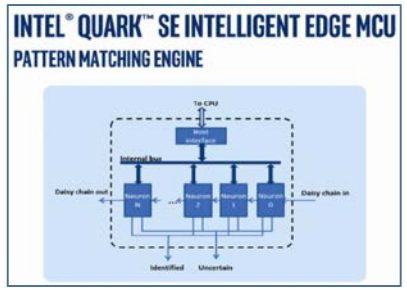
NeuroMem® Smart!

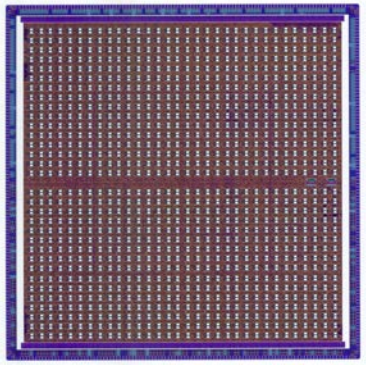
A technology in high demand	With numerous applications	Across many industries
Artificial Intelligence	Video analytics	Environment
Machine learning	Image recognition	Health & Fitness
Edge Intelligence	Signal analytics	Automotive
Data Analytics	Audio recognition	Robotics
Predictive maintenance	Voice recognition	Home & Building Automation
Failure analysis	Biosensing	Aerospace & Defense
Novelty and anomaly detection	Text analytics	Industry
	Network security	Services

GENERALVISION

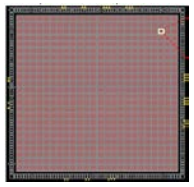
- Inventor of NeuroMem® technology (ZISC originally in 1993)
- Supplying neuromorphic chips since 1999
- Ecosystem (boards, drivers, tools)
- Owner of the NeuroMem® IP for ASIC and FPGA
- Designer of 2 NeuroMem® chips
- Licensed to Intel in 2011



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



NM500 (2017)
576 neurons
110 nm technology
Mfg nepes



2003, Pulnix ZiCAM
(312 neurons)

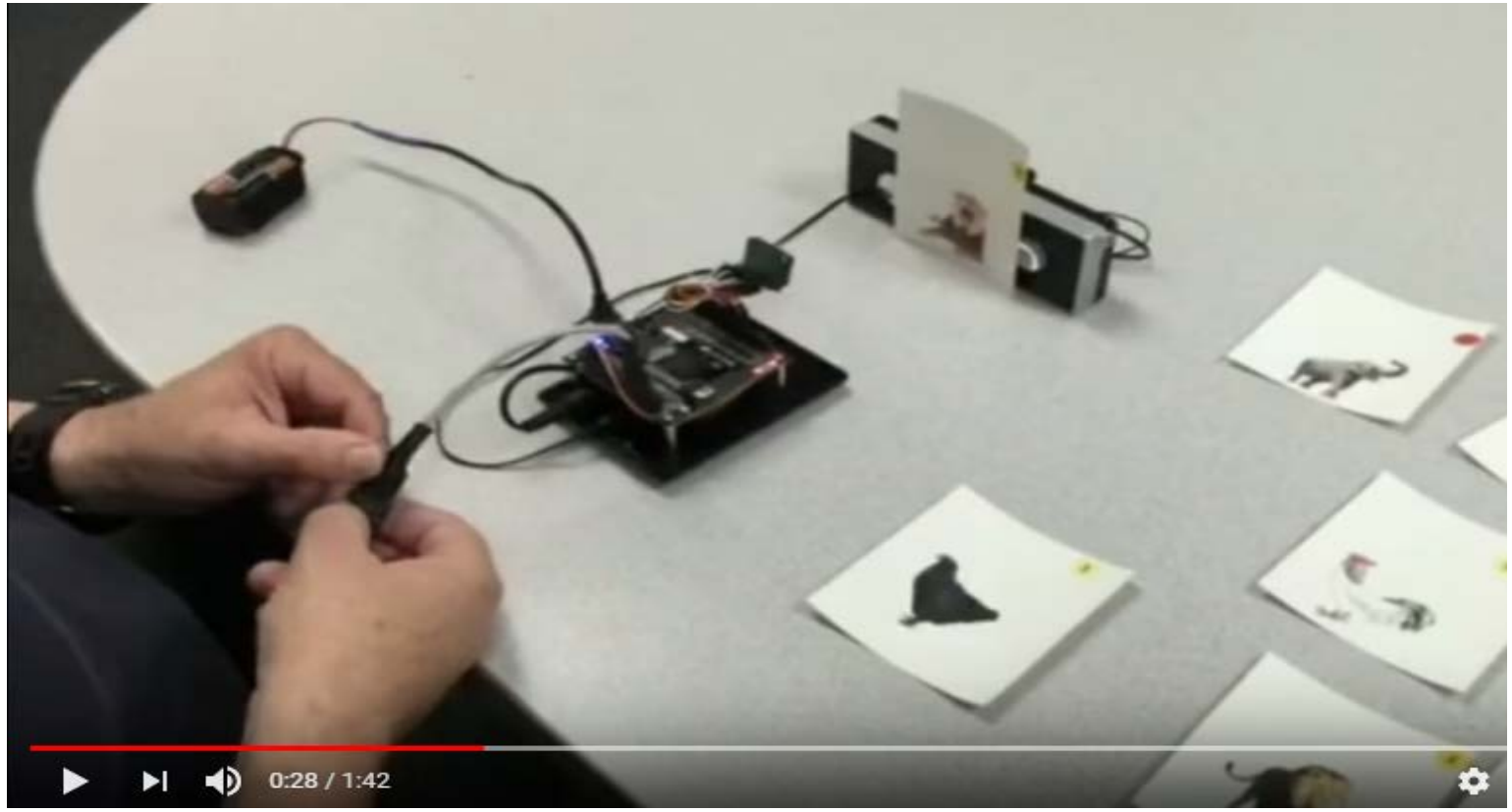
- 50 systems, in continuous operation, saving US$2M per boat,
- Trained in deep sea waters by Nordic fishermen
- No cloud access

A Field Proven Technology

NeuroMem

- Always-On pattern recognition at low-power
  - Classification, Confidence factors
  - Anomaly and Novelty detection
- Capable of life long learning on the chip
  - Essential for adaptivity and practicality
  - Easily and highly scalable
  - Accountability: traceability and confidentiality of the knowledge
- Unique Performances
  - Deterministic latency (µsecs regardless of the size of the network)
  - Low power consumption (Mhz clock)

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



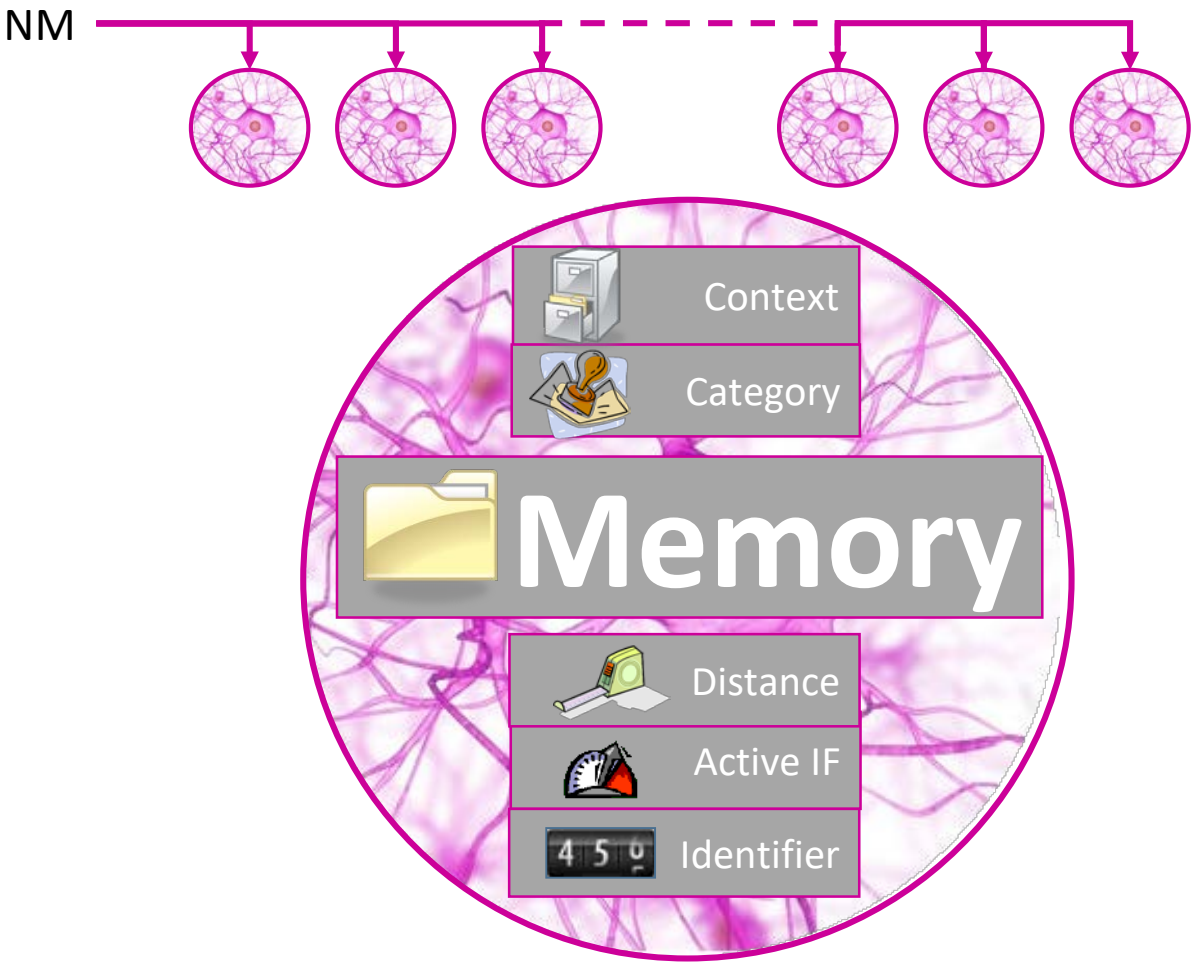
Associative Memories

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

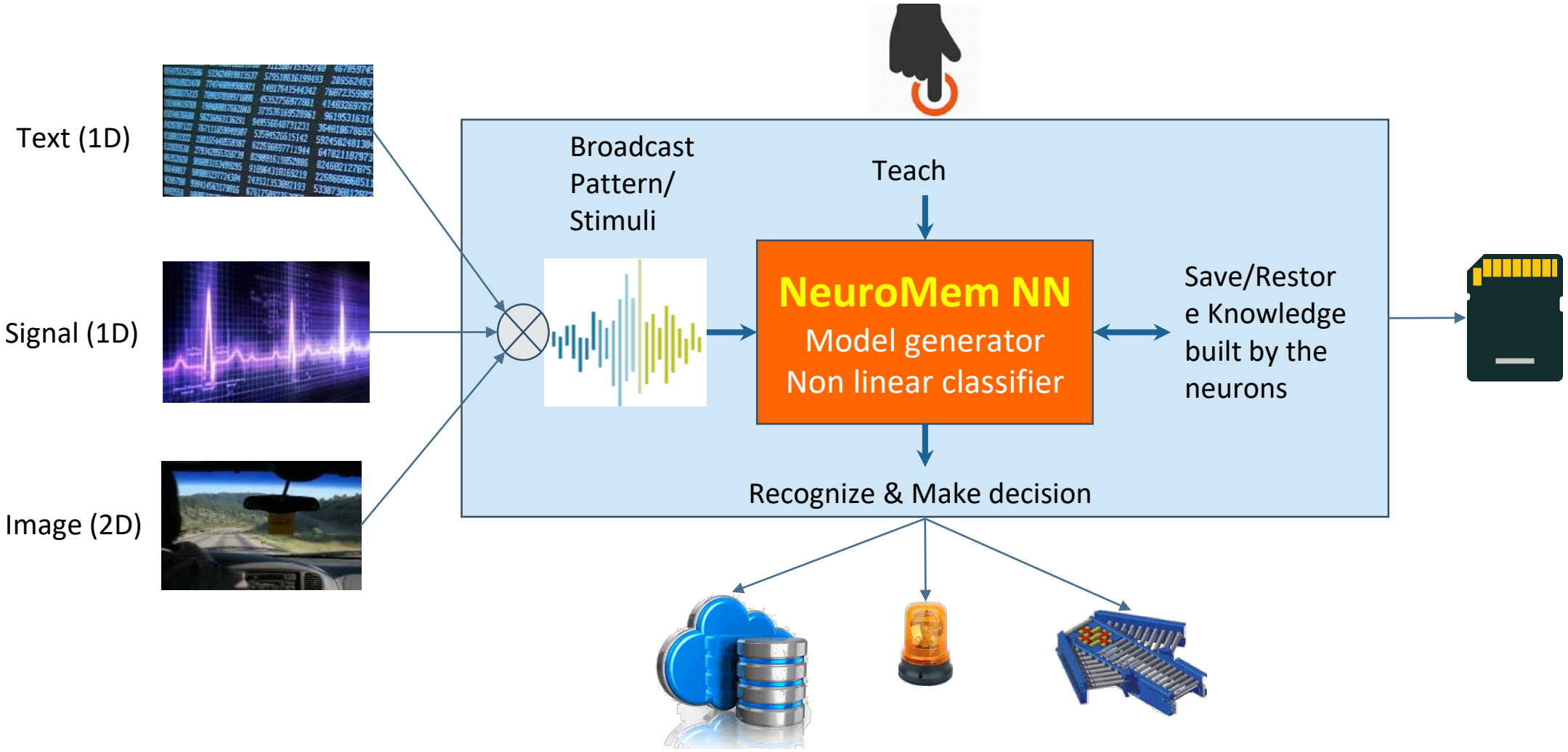
+ Trainable ANN

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

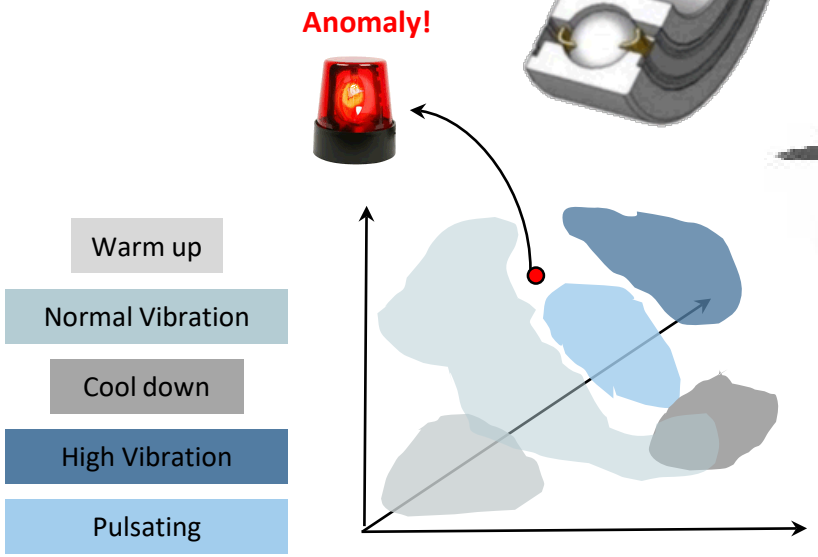
A chain of identical neuromorphic memory cells



- 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)
Broadcast
Pattern/
Stimuli
Teach
NeuroMem NN
Model generator
Non linear classifier
Save/Restor
e Knowledge
built by the
neurons
Recognize & Make decision

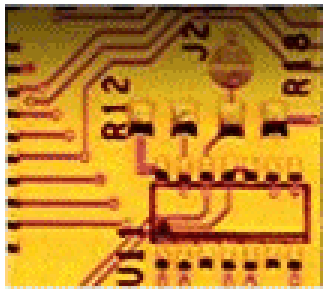
Simple I/Os



- 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

Signal Monitoring & Predictive Maintenance

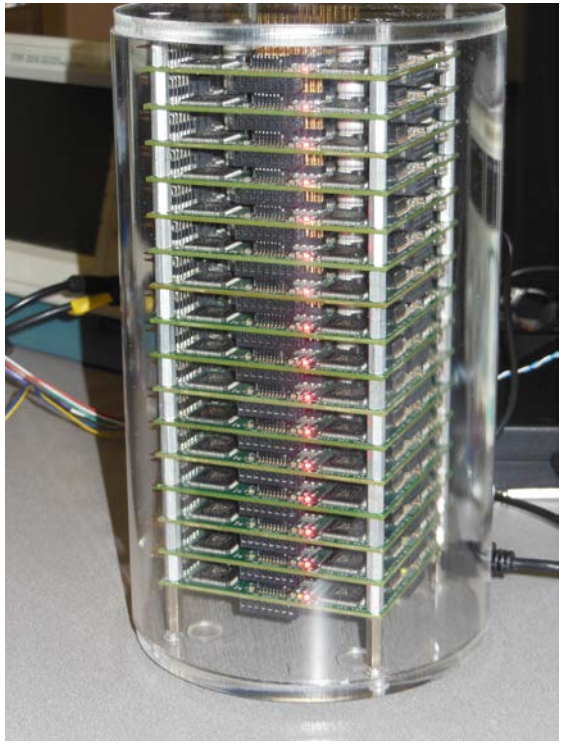
Trainable photocells & industrial cameras



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

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

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Commoditization of NeuroMem Smart secure IT

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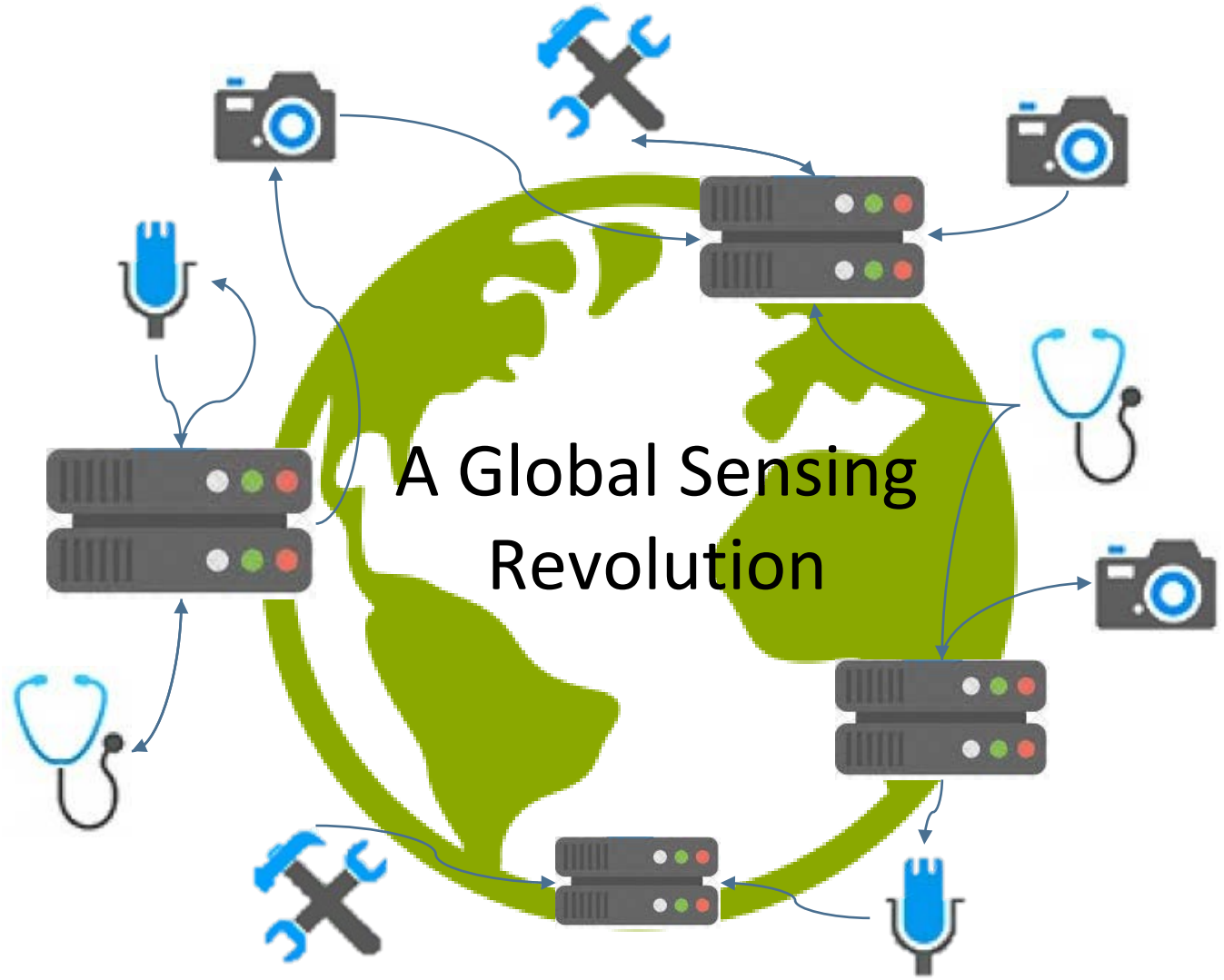
NeuroMem Smart data centers with distributed low-power search engines



Thank you

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