CogniSight®, image recognition engine

Making sense of video and images…

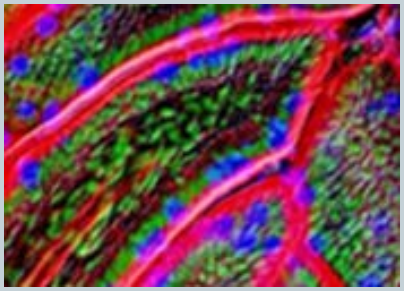
…Generating insights, meta data and decision

powered by NeuroMem® neural network,
Adaptive, Real-time trainable, High-speed, Low-power

Applications

Inspect, Sort

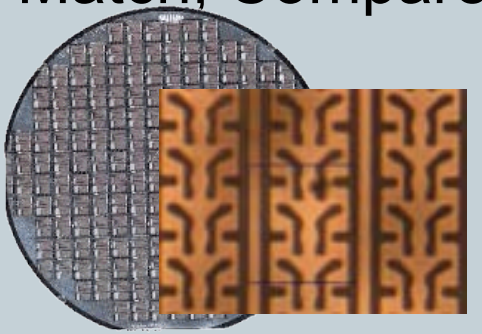
Identify, Track



Detect, Count

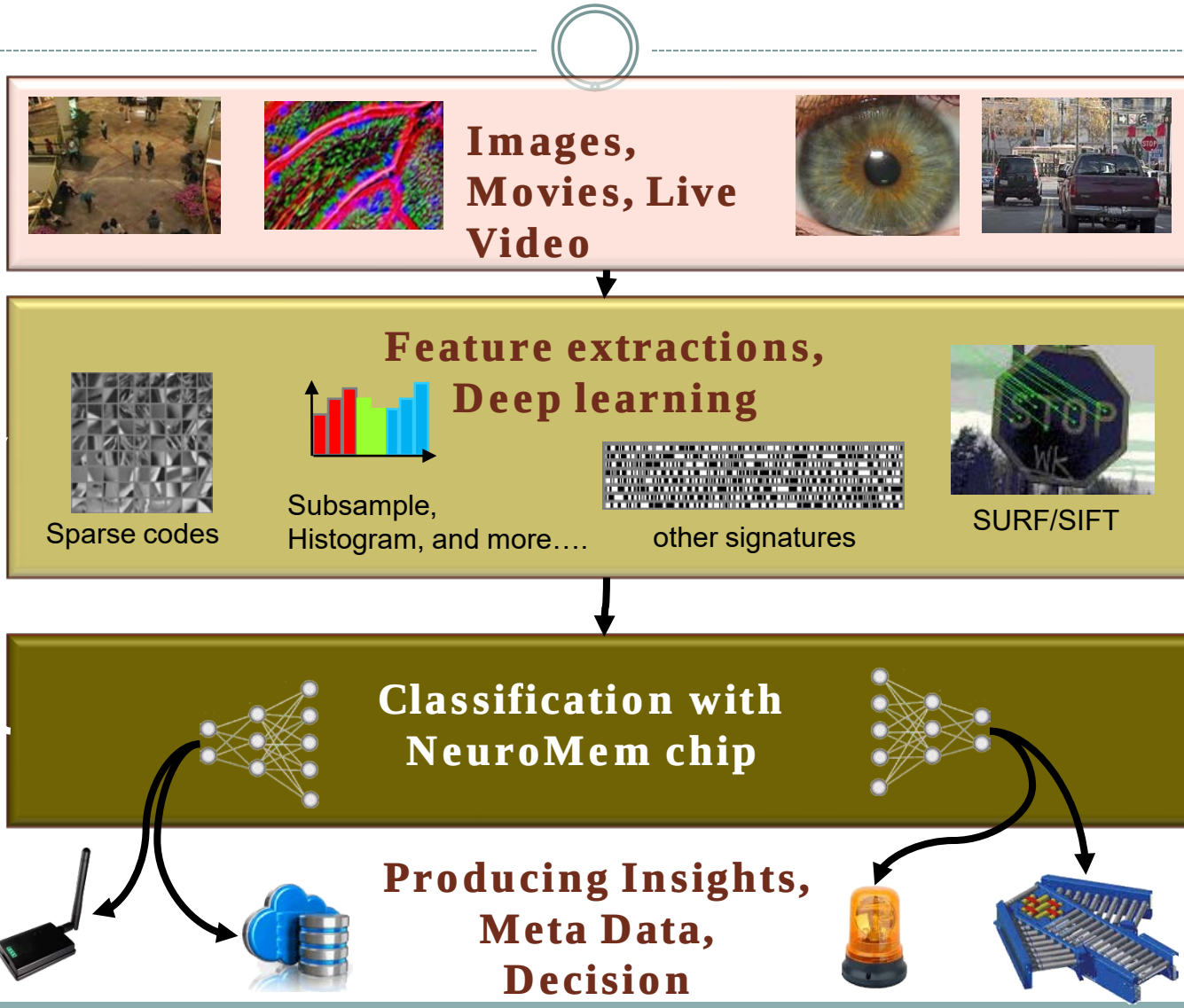
Search, Tag

Match, Compare



Find, Retrieve

The workflow



The NeuroMem value proposition

- Powerful non linear classifier
- Trainable by examples
- Recognition of a pattern in 10 usec regardless of the number of models stored in the neurons
  - No need to compromise with the number of examples to learn
  - Suitable for deep learning
- Contextual segmentation
  - Cascade classifiers
  - Multi sensor systems
  - Multiple expert systems
- Practical hardware solution
  - Small foot print
  - Low power
  - Scalable architecture

Application Deployment

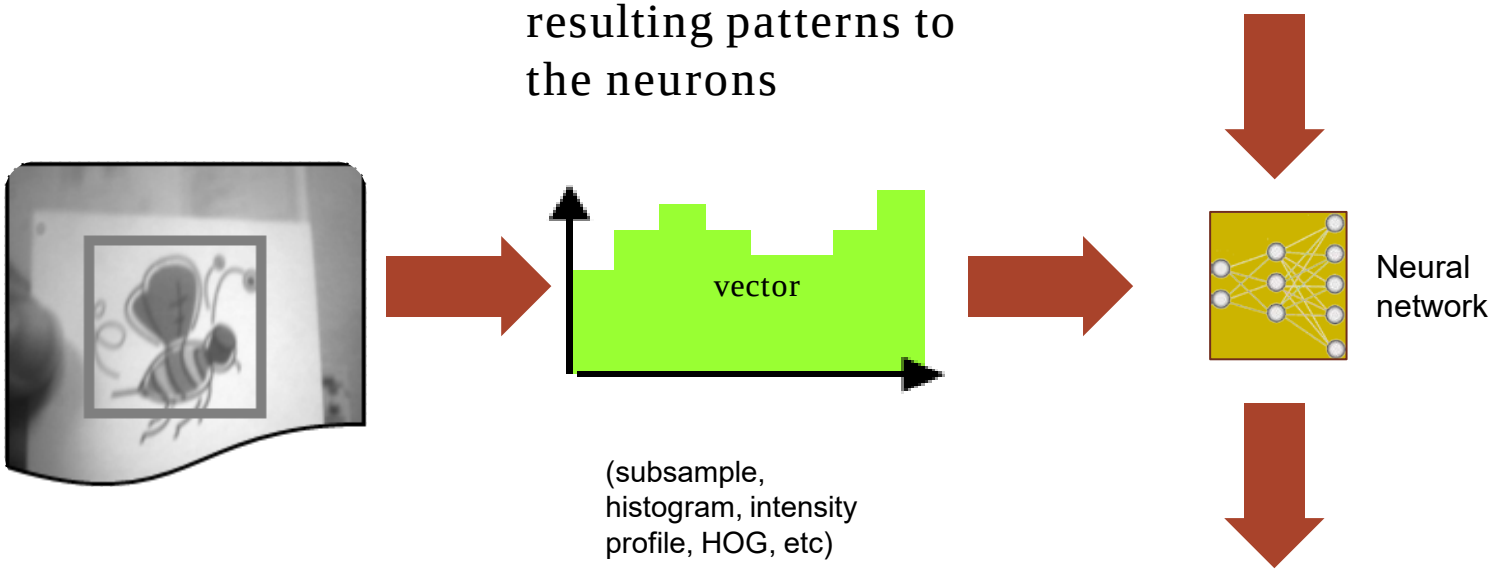
COLLECTION,
TRAINING,
VALIDATION,
RECOGNITION,
DECISION

From pixels to patterns...

1) Given a region of interest in an image...

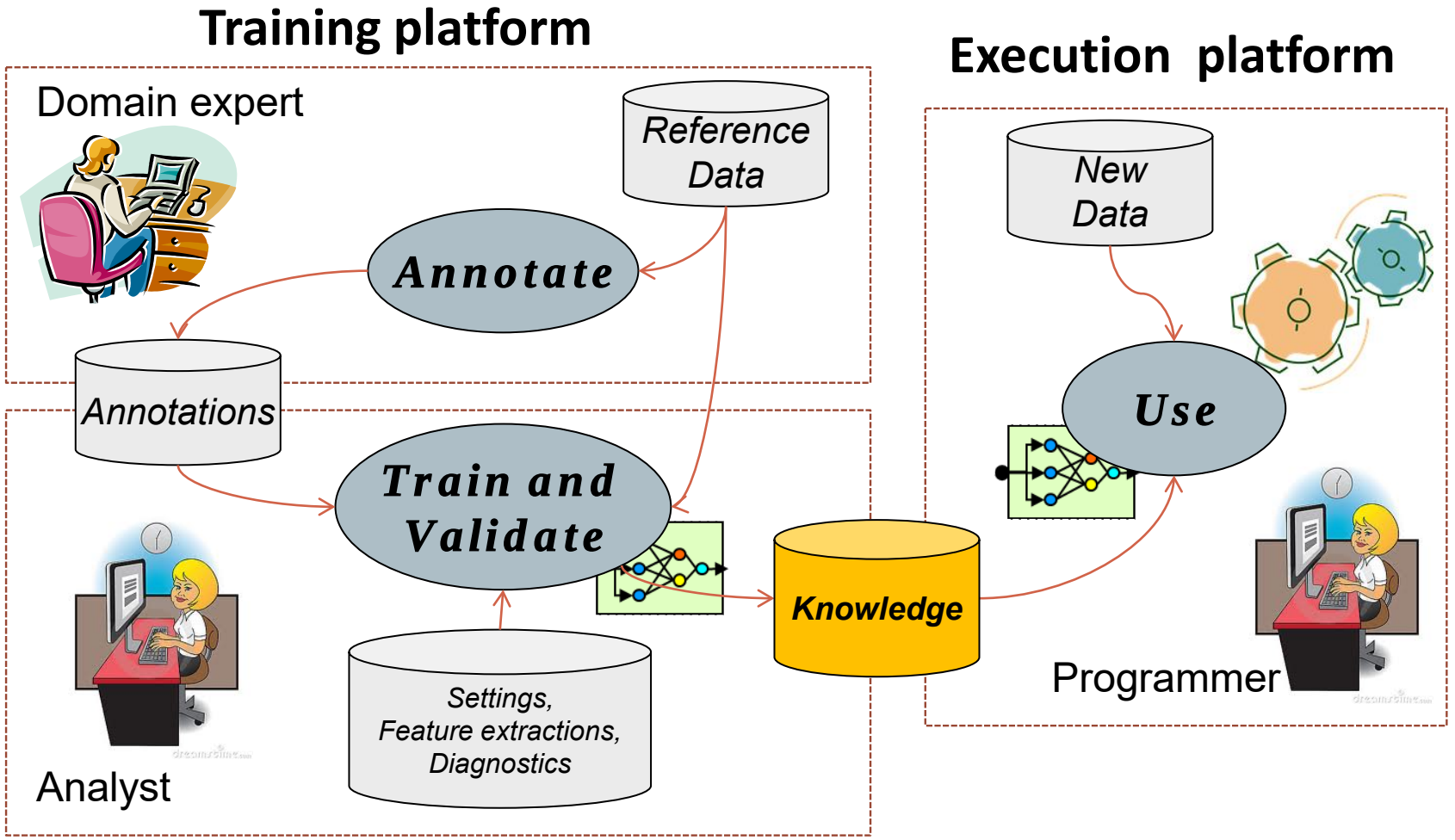
2) Extract one or more features and broadcast the resulting patterns to the neurons

3a) option to Learn: Assign a category to the vector



3b) option to Recognize: Read the category and/or the distance of the firing neurons

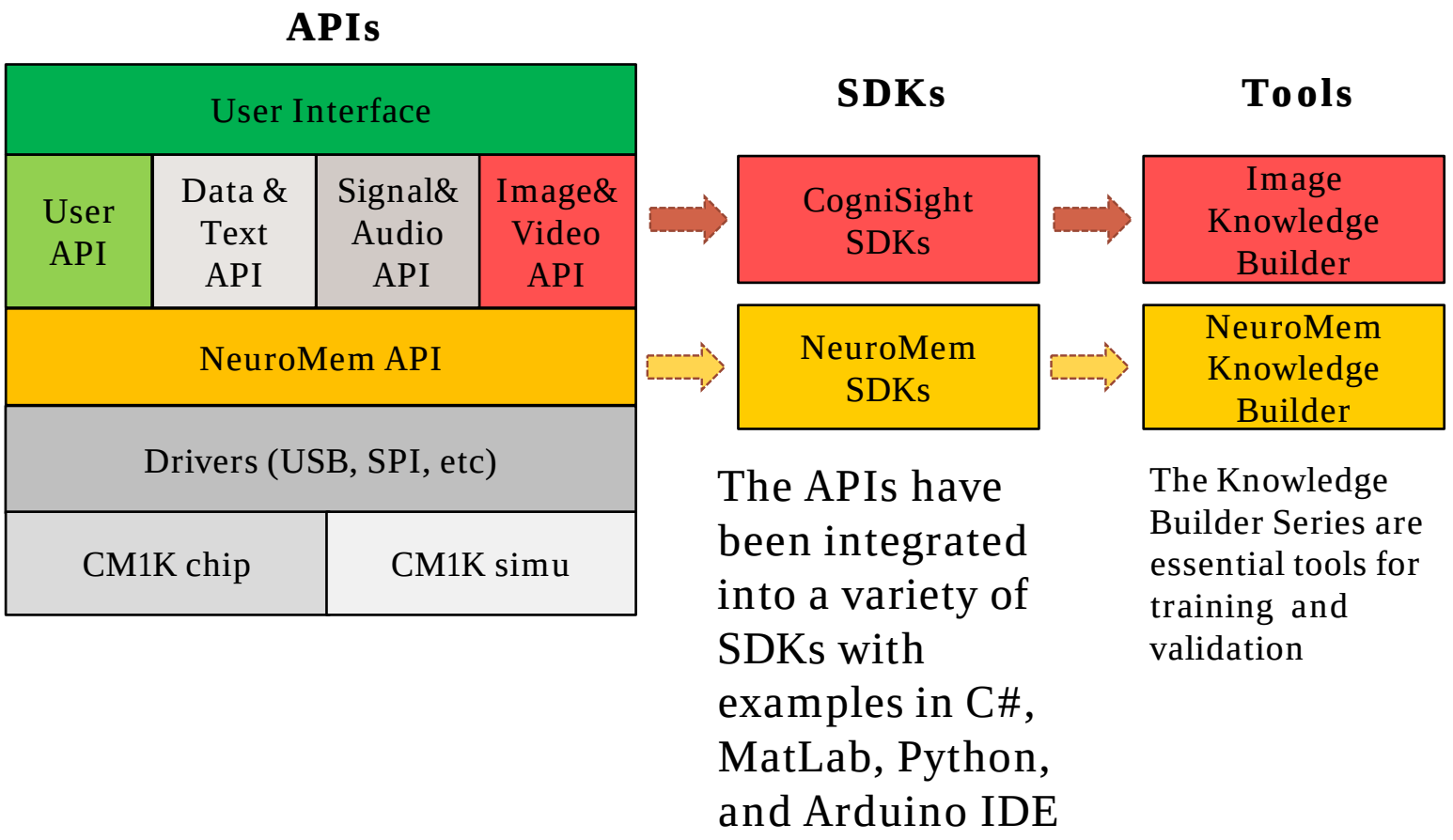
From image to Decision…



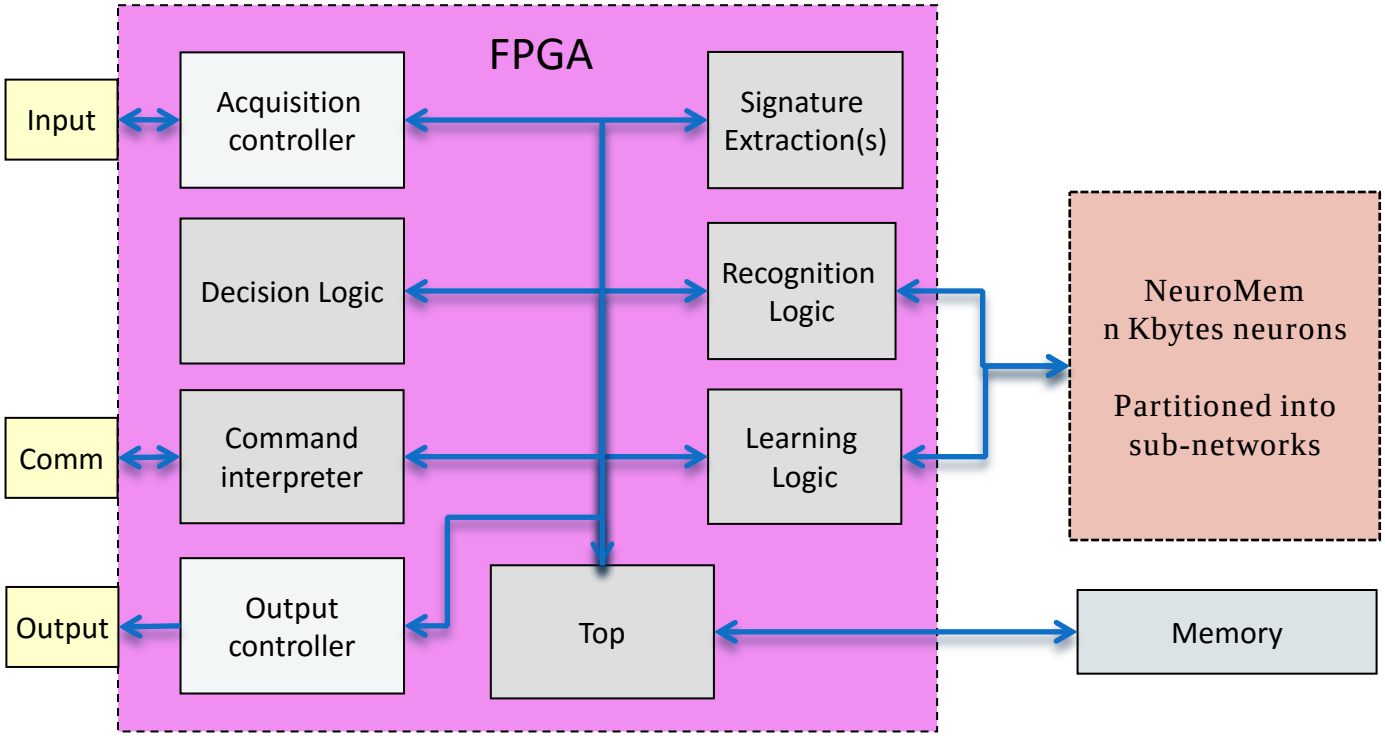
Application Development Milestones

Step1 **Data collection & Annotation**	**Step2** **Training and Validation Platform**	**Step3** **Execution Platform**
Collect samples illustrating the variability of the application and its constraints	Study discriminating features, define training and validation methods, Evaluate throughput and accuracy, specify final hardware	Choose existing or define new execution platform, UI and outputs
Tools (exhaustive list)		
Data capture and annotation Custom UI Custom hardware	Training and Validation software Evaluation boards API and drivers High-level or specific library development UI development	Reference Design System integration API and drivers FPGA library UI and software development CM1K chip supply IP License

NeuroMem Eco System



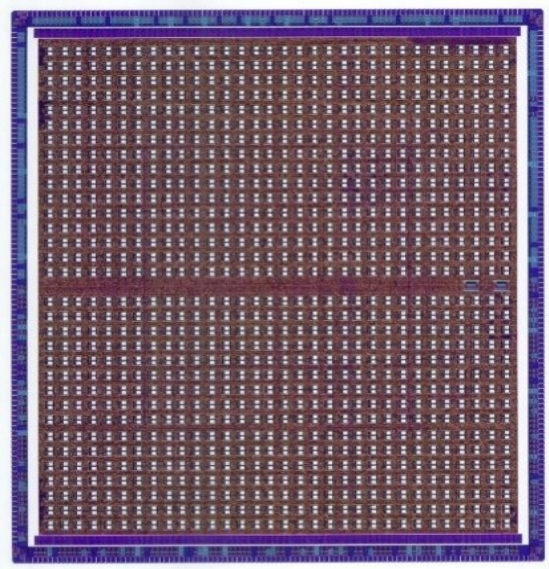
NeuroMem and FPGA companionship



How is NeuroMem different?

NeuroMem CM1K

- Pattern recognition chip:
  - Radial Basis Function and K-Nearest Neighbor
- Match 1 among N in 500 ns to 2.5 µsec
- Highly scalable due to natively parallel architecture

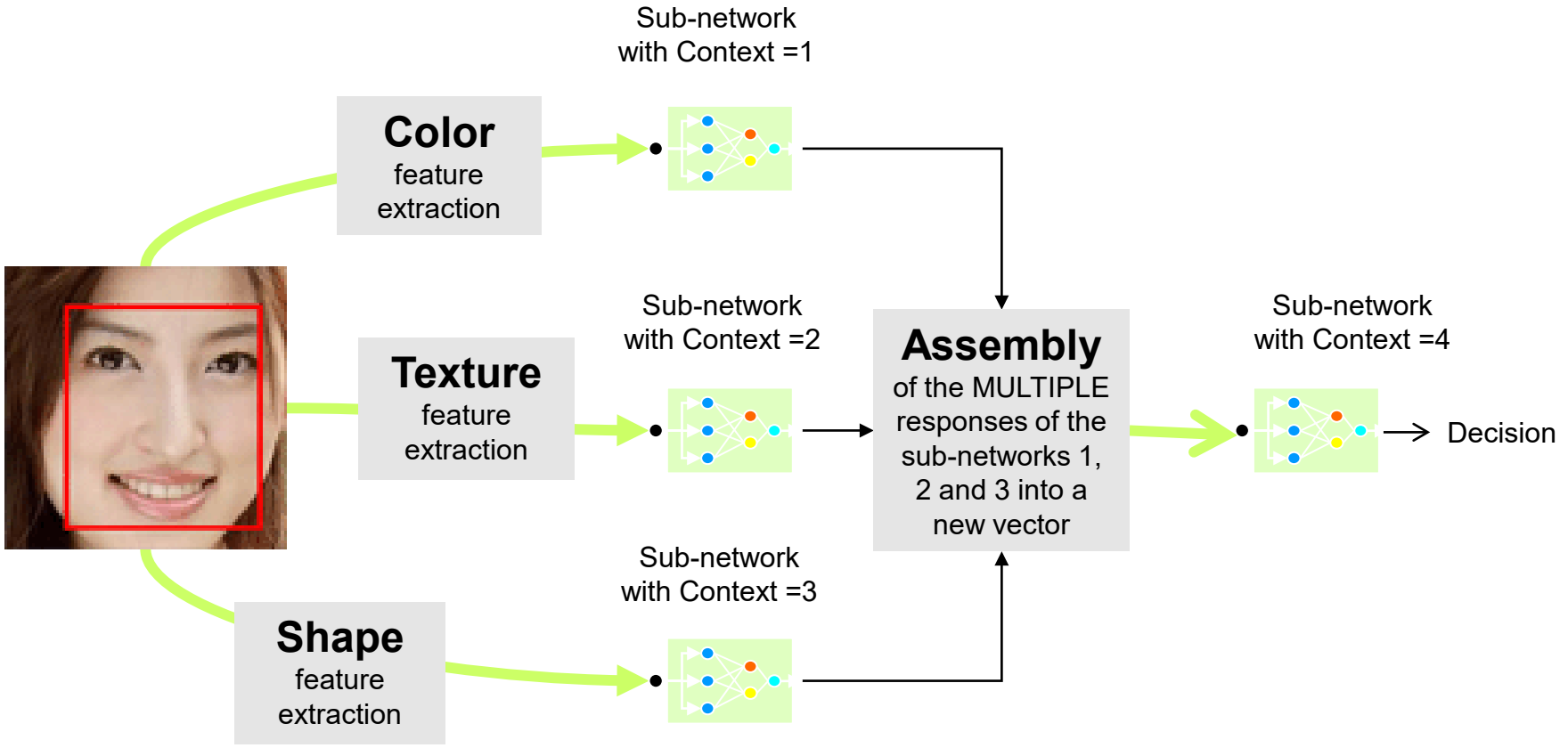


- Regular architecture, just neurons
- No fetch and decode
- Patented WTA bus (no cross bar)
- Low power (<0.5 watts)
- Self trainable
- Orthogonal inter-chip connectivity
- Commercially available (IC, Source and FPGA IP)

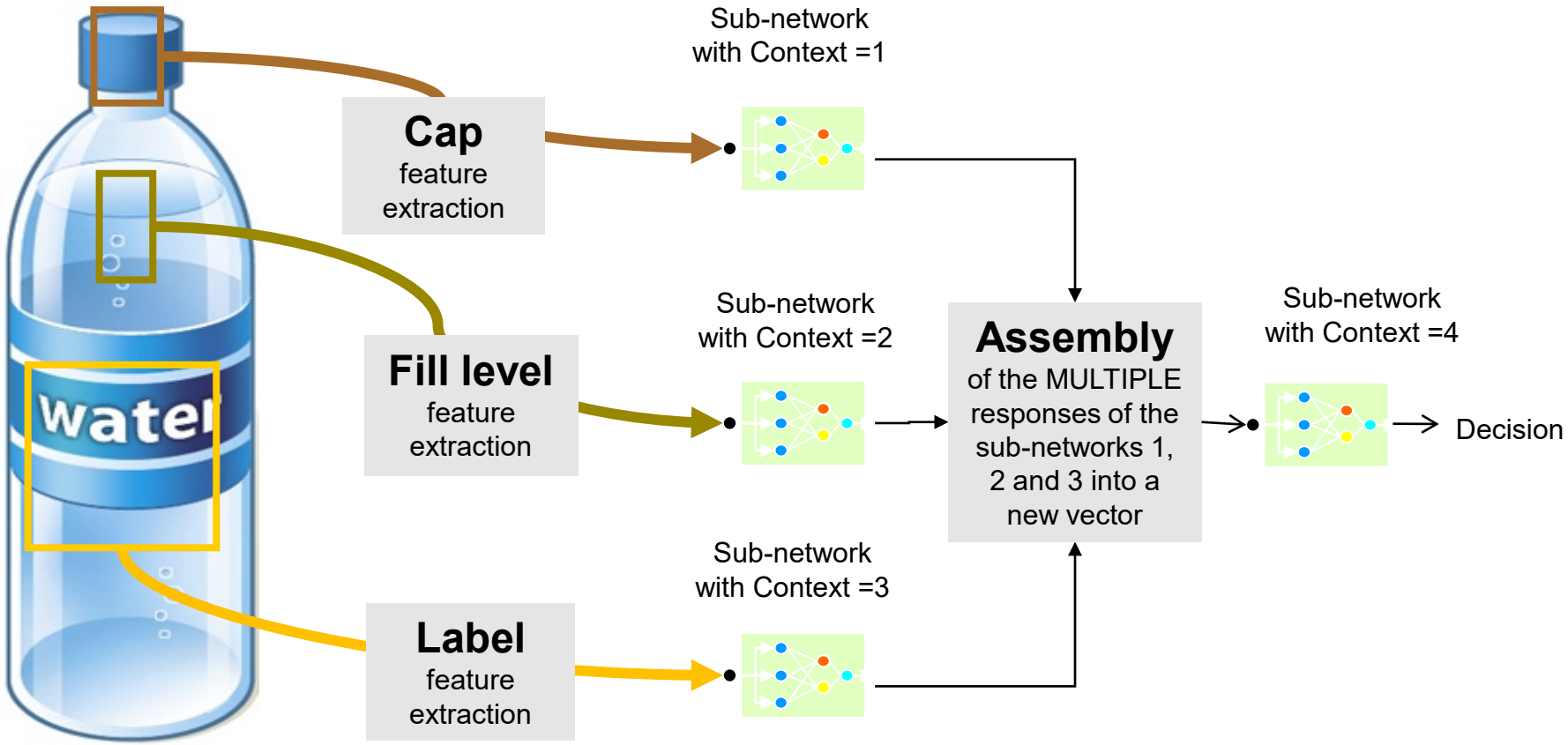
Multiple Expert Systems

CONTEXT SEGMENTATION
CONTEXT CONSOLIDATION
CONTEXT AWARENESS

Multiple networks for redundancy



Multiple networks from complementarity



Multiple networks= Robust decision

Sequential use of complementary recognition engine

Locate license plate

Read license plate number

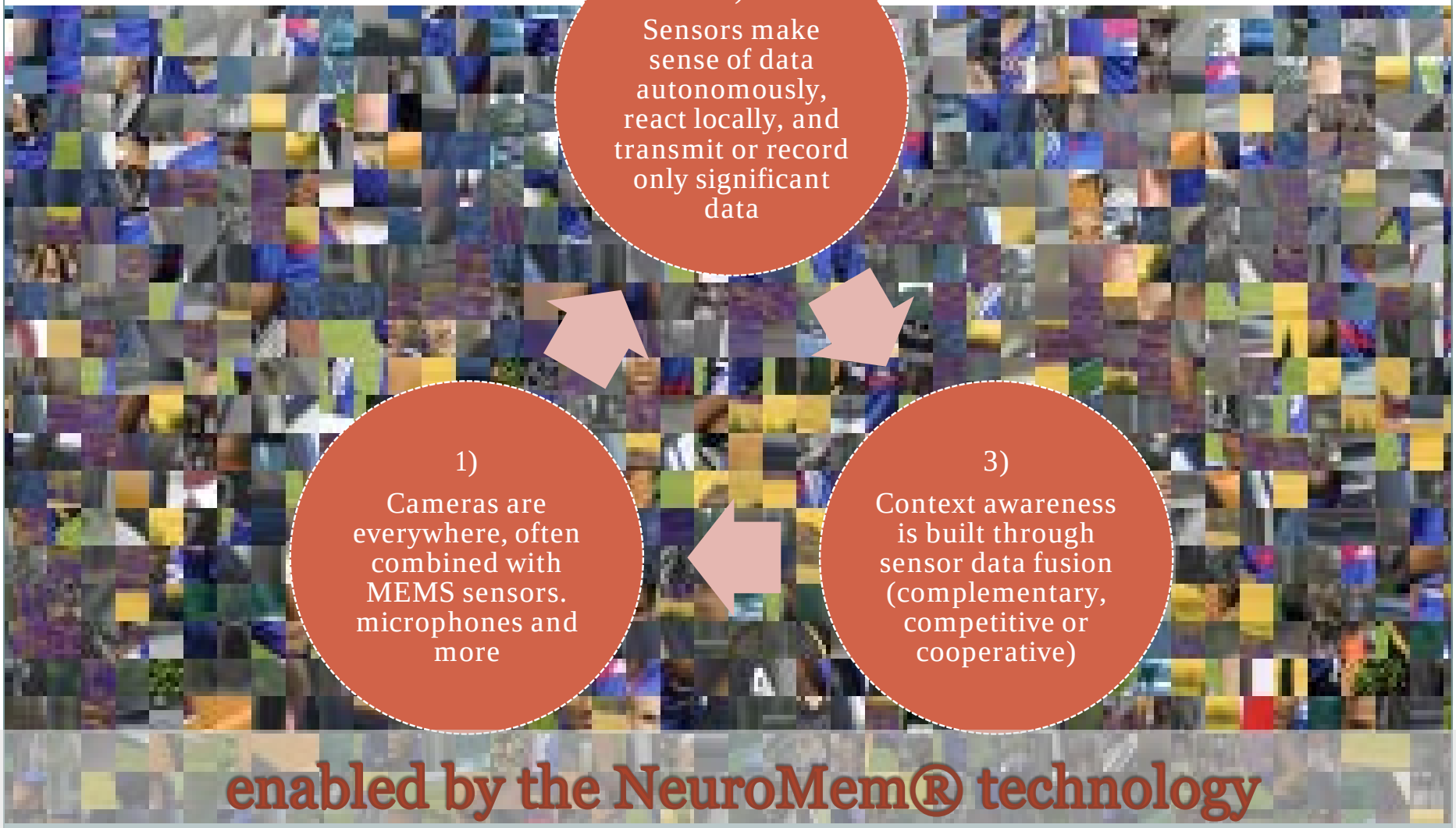
Match License plate number with owner

Parallel use of cooperative or competitive recognition engines

Detect new incoming person along edges

Track all detected persons

Image Analytics in 2016

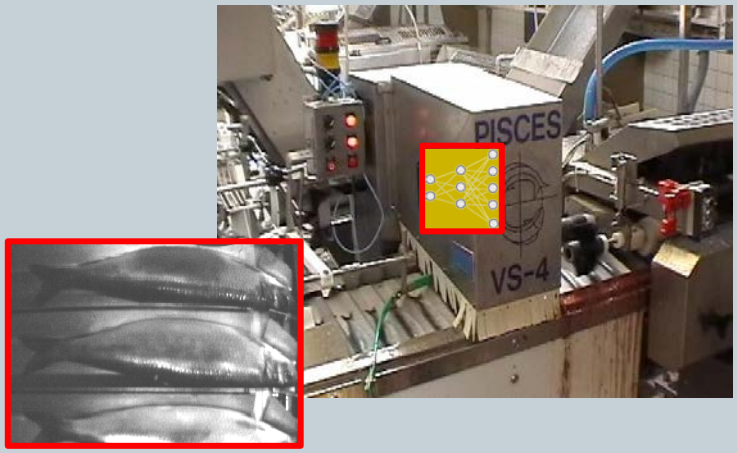


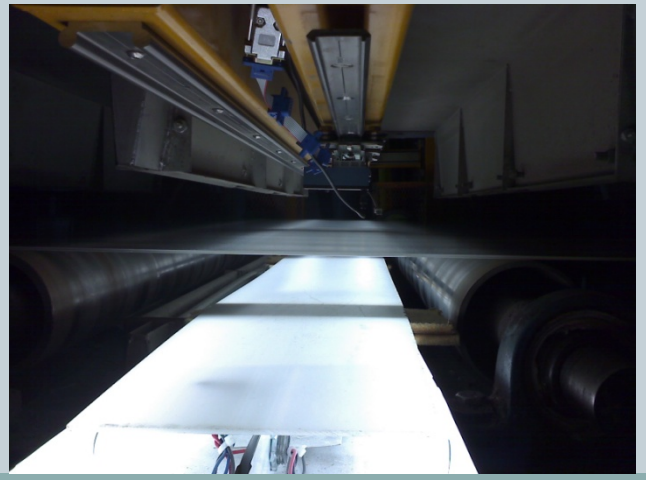
enabled by the NeuroMem® technology

Applications

Industrial Automation

- Powered by NeuroMem
  - Machine vision systems
  - Photocells
  - In-Line sensors
- Benefits
  - Small footprint
  - Trainable
  - Adaptive
  - Low power
- Functionalities
  - Discrete object recognition
  - Surface classification
  - Anomaly detection
  - Template matching



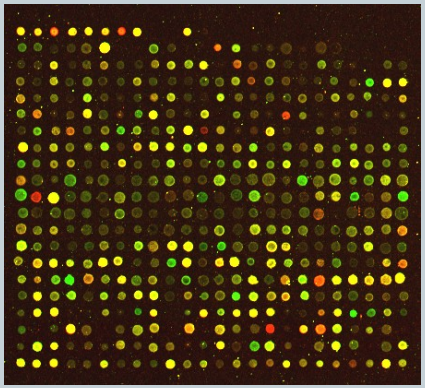


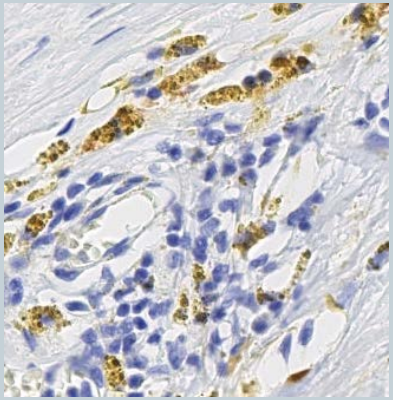
Building and Signage

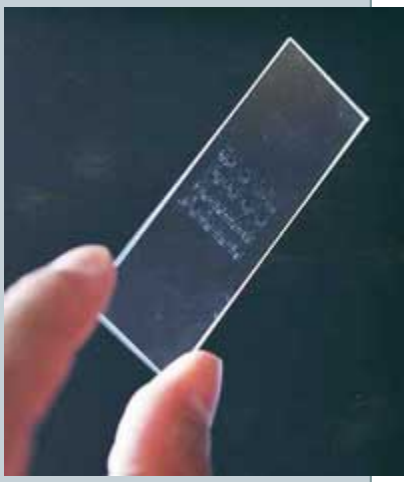
- Access control
- People counting and tracking
- People counting for energy saving
- Safety monitoring
- Smart door control
  - Detect incoming person and speed

BioMed Imaging Research

- Segmentation, Clustering
- Counting
- Anomaly/Novelty detection
- Lab on a chip







Automotive

- Looking outside:
  - Forward obstacle detection and distance evaluation, signage reading
- Looking inside:
  - Driver vigilance monitoring, gazing tracking
- Gesture recognition
  - Menu navigation, sound system control

Consumer and mobile devices

Array of sensors recognizing produces in self checkout

Phones and tablets
Eye detector, Gaze tracker, Face/Iris recognizer

Gesture and facial expression recognition in TV and gaming appliances