

WE GIVE INTELLIGENCE TO MACHINES



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## intelligence

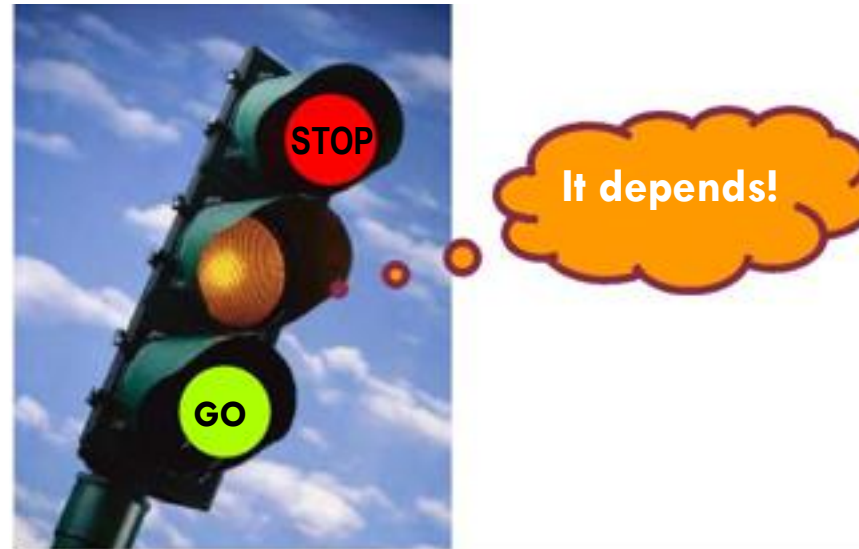
In 'tɛlɪdʒ(ə)ns/

*noun*

the ability to acquire and apply knowledge

# BRAIN-LIKE MACHINE LEARNING = NEURAL NETWORKS

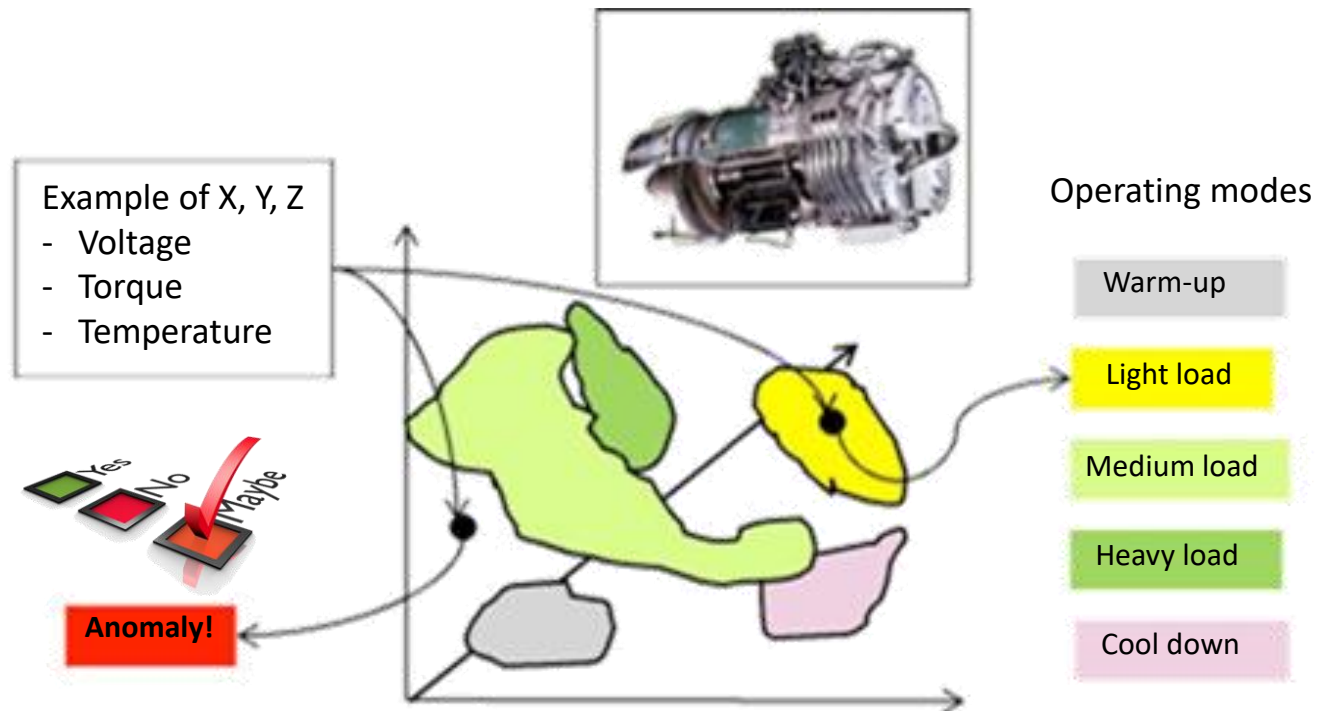
NEURAL NETWORKS CAN MODEL NON-LINEAR DECISION SPACES AND ADDRESS ILL-DEFINED PROBLEMS



An autonomous vehicle will have to adapt:  
What is my speed?  
What is in front of me and behind me?  
What are the road conditions?

# REAL LIFE IS COMPLEX: TEACHING BY EXAMPLE

Neural Networks enable modelling by machine learning of non-linear decision spaces



# REAL LIFE IS COMPLEX: LEARN BY EXAMPLE

## Cogito Instruments solution relies on an Adaptive Model Generator



### Learn by examples (supervised or unsupervised)

Learning by example is more practical than enumerating rules and equations



### Map decision spaces by aggregates, not hyperplanes

Cope with non-linear, convex, disjoints and embedded categories.

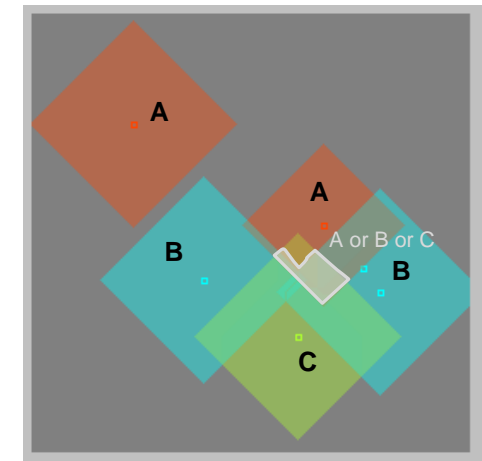
Modulations between conservative and liberal decisions with zones of uncertainties



### Save and restore the contents of neurons

Can append more training at any time – never stop learning

Learning = Building a  
**“decision space”**  
by teaching examples

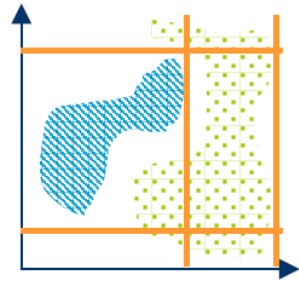




# HOW TO MODEL A DECISION SPACE?

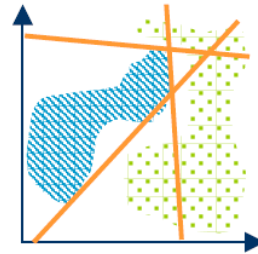
1960: Threshold method

Too simple and not non-linear



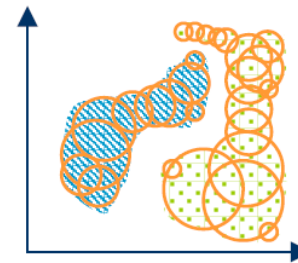
1980: Perceptron method

Too complex,  
and time consuming



1990: RBF

Map spaces of any shape  
with the relevant training set



# REAL LIFE IS COMPLEX: OPTIMAL DECISION

Cogito Instruments solution relies on an High Performance Classifier



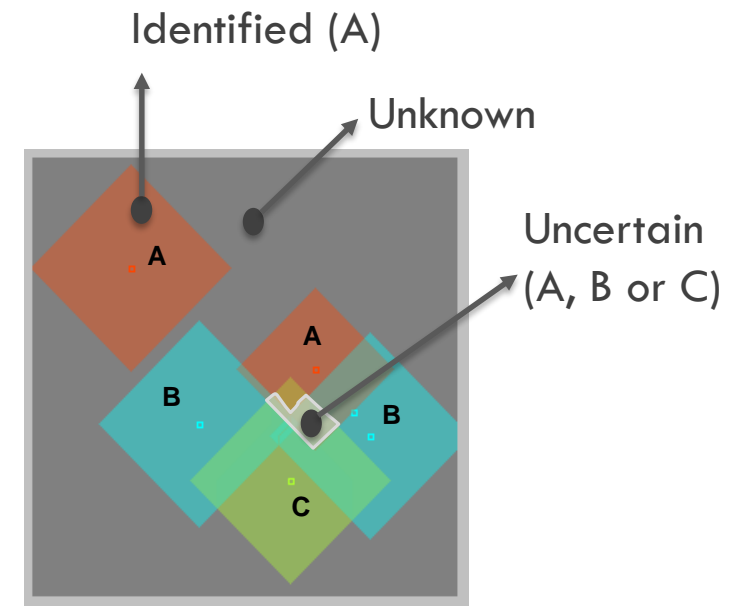
## Global response readout

- positively identified
- identified with uncertainty
- unknown



## Detailed response of all the firing neurons

- category and confidence level (or distance)
- retrieved per decreasing confidence



# DATA ANALYTICS WILL NOT BE DONE 100% IN THE CLOUD

- Latency
- Bandwidth
- Cost
- Privacy
- Security





# TWO MAIN APPROACHES TO NEURAL NETWORKS

## Neuromorphic RBF Hardware vs Deep Learning Software

Online vs Offline learning

Local vs Remote learning

Additive vs “forget and learn from scratch” learning

Constant vs Variable recognition latency

Easy Explainability vs Non Explainability (*Darpa XAI program*)

Reduced Size, Power and Cost vs Massive Processing requirements

# COGITO'S DIFFERENTIATING BENEFITS



## Fast Deterministic response time

Latency does not increase with the scaling up of the neural network, even for complex multi-dimensional classification.



## Real-time learning

Knowledge can be updated “on the job”. No need for off-line recompilation



## Knowledge and Decision embedded in the machine

Compact, Fast, Low-Power (better reliability and easier integration)



## Better than Humans

Fast upload/download enabling knowledge proliferation



## Secure and Reliable

Precious data stays local, ensuring its privacy

Results are reliable, reproducible and traceable



## Total Cost of Ownership

NI platform+Cogito solution offers much lower TCO compared to Industrial PC with GPU accelerators running software neural networks or compared to Cloud based solutions

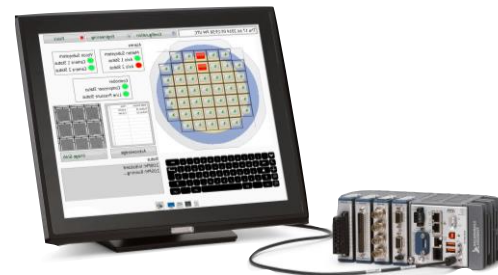
# TYPICAL APPLICATIONS

Cogito Instruments product are particularly well suited to **inspection, production testing, monitoring, predictive maintenance and robotics applications.**



Multiple Sensors  
up to 256 per CI cartridge

- Vision
- Vibration/Sound
- Temperature
- Inertial (accelerometer, gyro)
- Voltage/Current
- ...



Data Acquisition  
Feature Extraction  
Using NI platform  
and LabVIEW FPGA



COGITO  
INSTRUMENTS

Cogito Instruments  
Embedded Analytics  
Pattern Learning  
Pattern Recognition



**Classified results eg.**

Defect Categories in the  
case of testing or  
inspection

Warning categories in  
the case of monitoring or  
predictive maintenance

Actions in the case of  
robotics

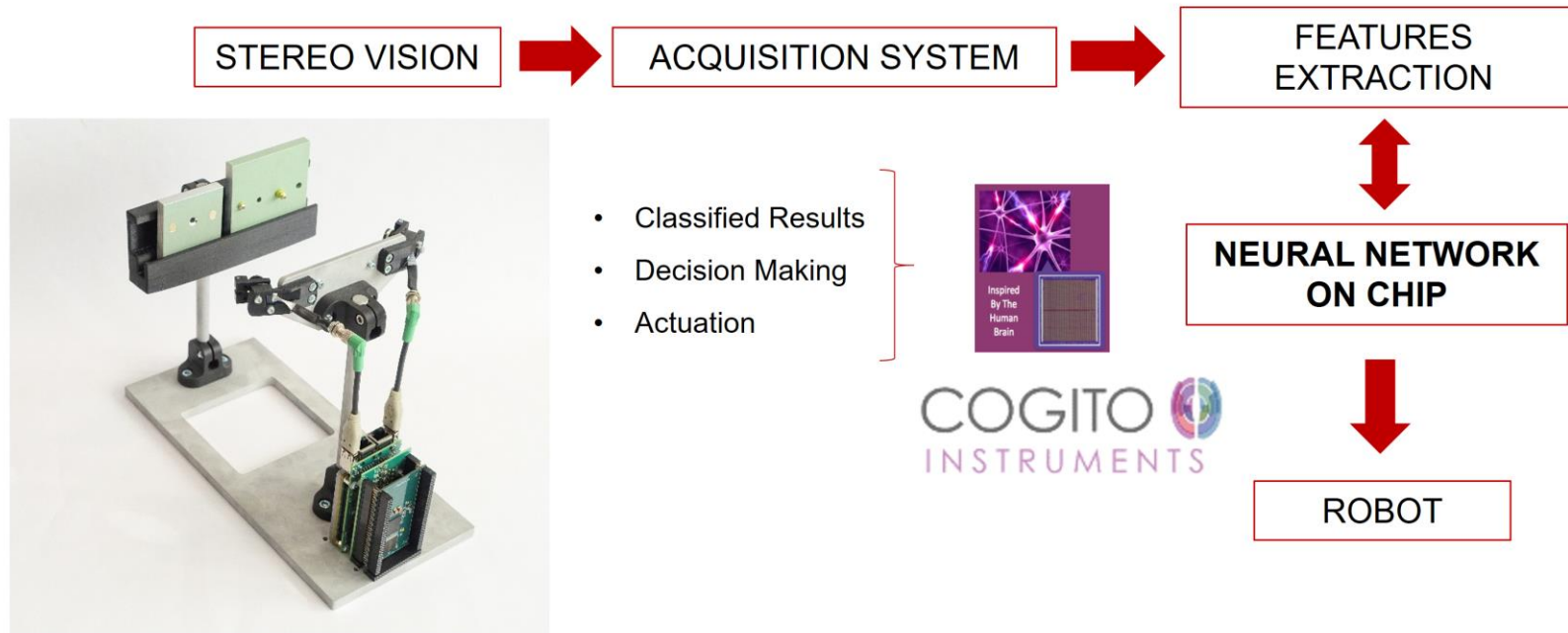
# APPLICATION EXAMPLE : GLASS INSPECTION



- High quality monochrome video sensor (725x480 pixels)
- Neural network with automatic model generator (learning by example) and high-speed non-linear classifier
- The knowledge built by the neurons can be saved and exported to other sensors, and later expanded with more teaching
- Adapts well to lighting fluctuation if taught so by showing examples taken under different conditions
- Detects anomalies as small as 2x2 pixels.
- Number of sensors : up to 50
- Material displacement : 9.53 mm/video frame
- Maximum supported velocity : 411 mm/s

# APPLICATION EXAMPLE : LOCCIONI ROBOTICS

Robust object recognition based on Machine Learning



# OTHER APPLICATION EXAMPLES

Machine Monitoring/Predictive Maintenance/Anomaly Detection

Inspection and Testing (not only visual)



# VALUE CHAIN POSITIONING

Cogito Instruments is providing subsystems to system integrators starting with National Instruments Alliance Partners



~1000 National Instruments  
Alliance Partners



>35000 National Instruments  
Customers

	IC/Component Suppliers	Platform & Subsystem Providers	System Integrators	End Customers OEM
Value per system	\$100	\$10,000	\$100,000	>\$1,000,000
Volumes	Millions	10's of Thousands	Hundreds to Thousands	Few factories
Companies	ST, NXP, Intel...	NI, Cogito, Beckhoff,...	Loccioni, UNISolutions	VW, Airbus, ...

# COGITO IS FULLY COMMITTED TO THE NI ECOSYSTEM

**Cogito was present at NI Week 2017 in Austin**

**Cogito will present at the following events:**

- NI Day Switzerland : on September 27th 2017 in Bern
- NI VIP Days Germany : on October 18th and 19th 2017 in Munich
- NI Day Korea : on October 27<sup>th</sup> in Seoul
- NI Day France : on November 7th 2017 in Paris
- NI Day Italy: on November 14th 2017 in Milano
- NI Day UK : on November 28th 2017 in London
- NI Day Israel : on December 4<sup>th</sup> in Tel Aviv
- SPS/IPC/Drives Exhibition : on November 28th and 29th 2017 in Nürnberg, Germany (Cogito will be on NI's booth)

# CONTACTS

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Thank you!