EUROSHNET

ARTIFICIAL INTELLIGENCE
MEETS SAFETY AND HEALTH AT WORK

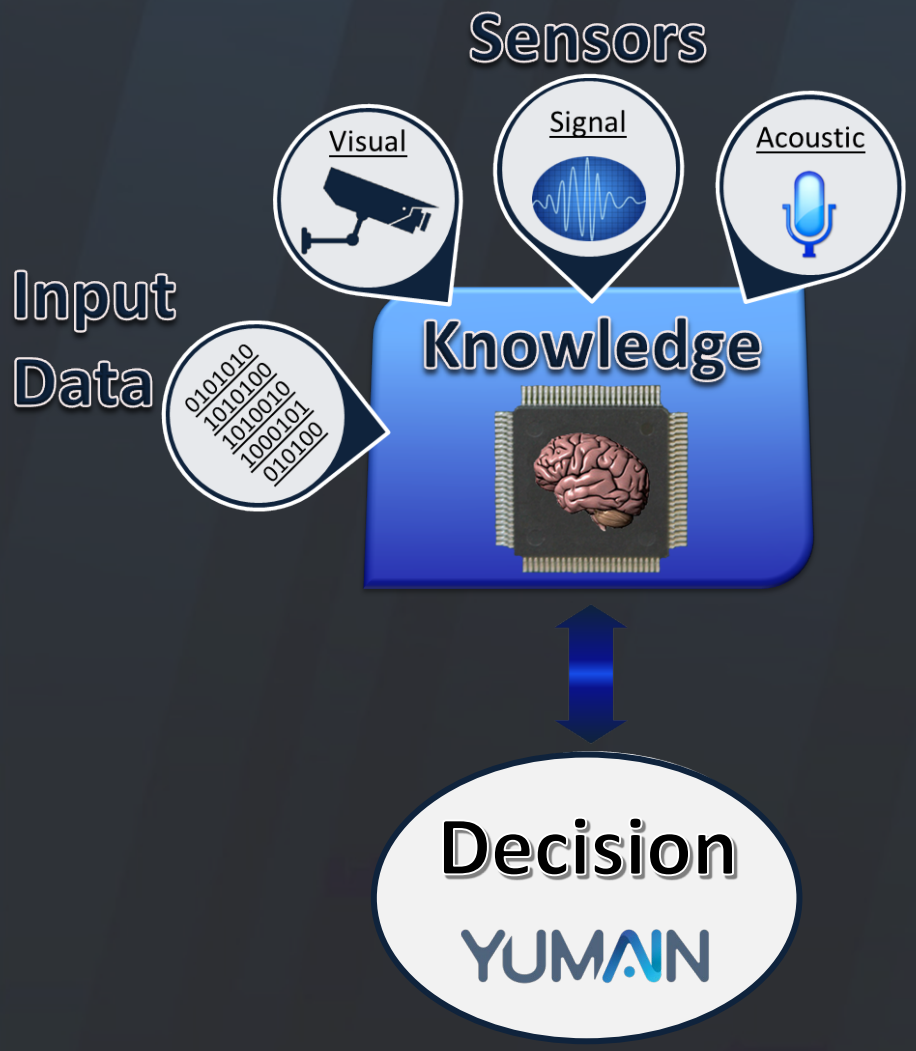
Person-vehicle collision prevention with embedded Artificial Intelligence

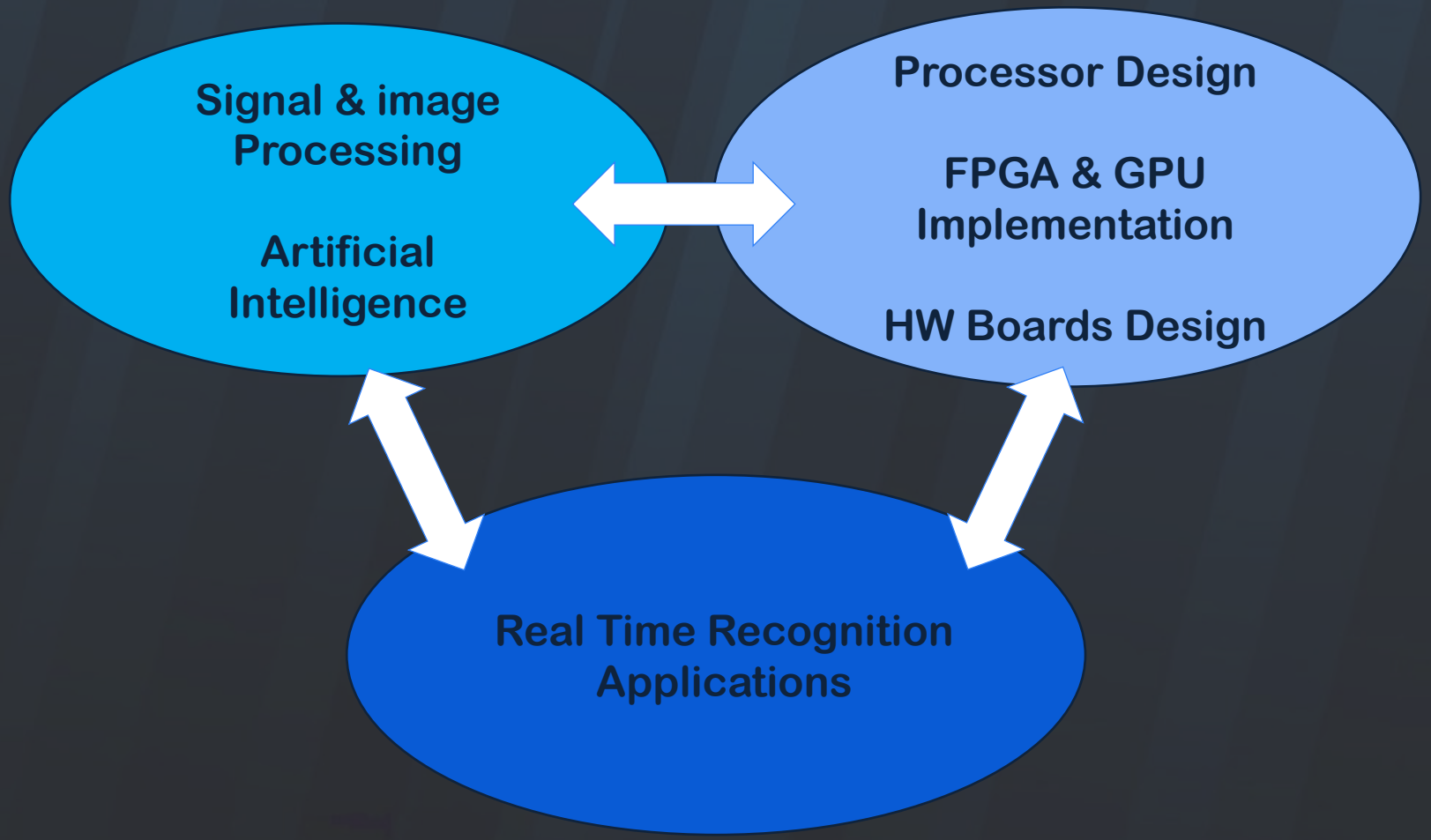
YUMAIN

Michel PAINDAVOINE
https://yumain.fr/en/home/

Michel Paindavoine michel.paindavoine@yumain.fr - https://yumain.fr/

YUMAIN TEAM SKILLS

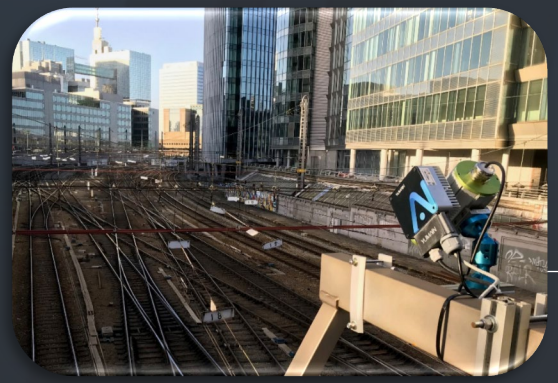




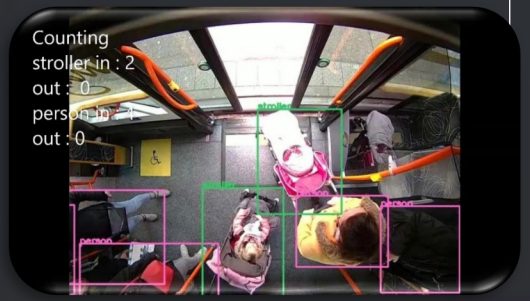
TARGET MARKETS

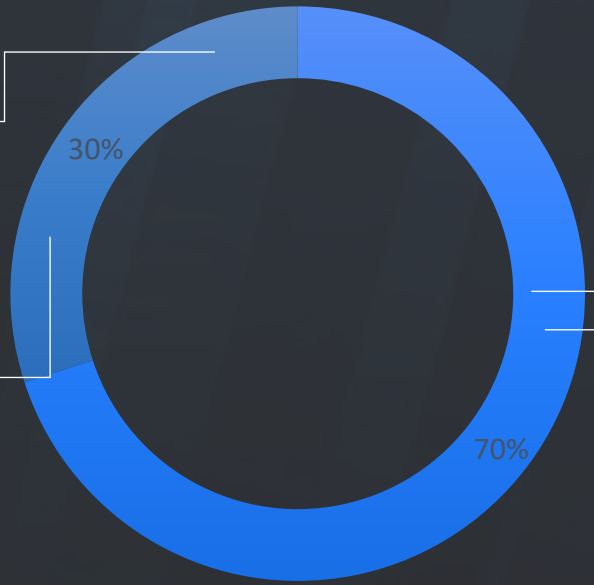
TRANSPORT

Predictive maintenance related to the safety of railway networks



Counting
(bus eand tramway)





INDUSTRY 4.0

Protection of goods and people :
* Peripheral machine protection
* Risk of collision detection Machine / pedestria

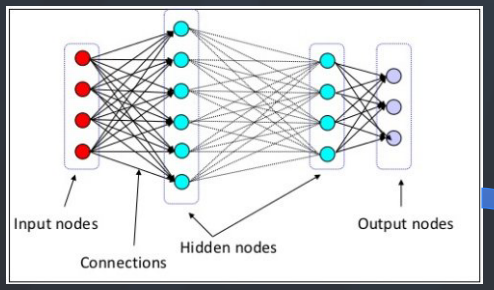
Surface inspection and
quality control

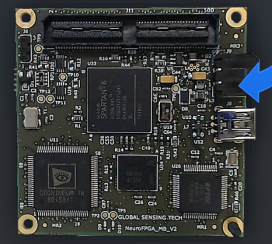
YUMAIN TECHNOLOGY CONCEPT

- **Simple Tasks with Human Brain vs Von Neuman Computer (like PC):**
  - Calculate in less than one second (398387.86 x 498.07=?)

  But recognize in less than one second this image:

- **Artificial vision model proposal : Deep Learning + Spike Neurons**
  - Arithmetic calculations used in image filtering for example:
    → Von Neuman (or Harvard) architectures
  - Object recognition from natural images:
    →Neuro-inspired Human intelligence

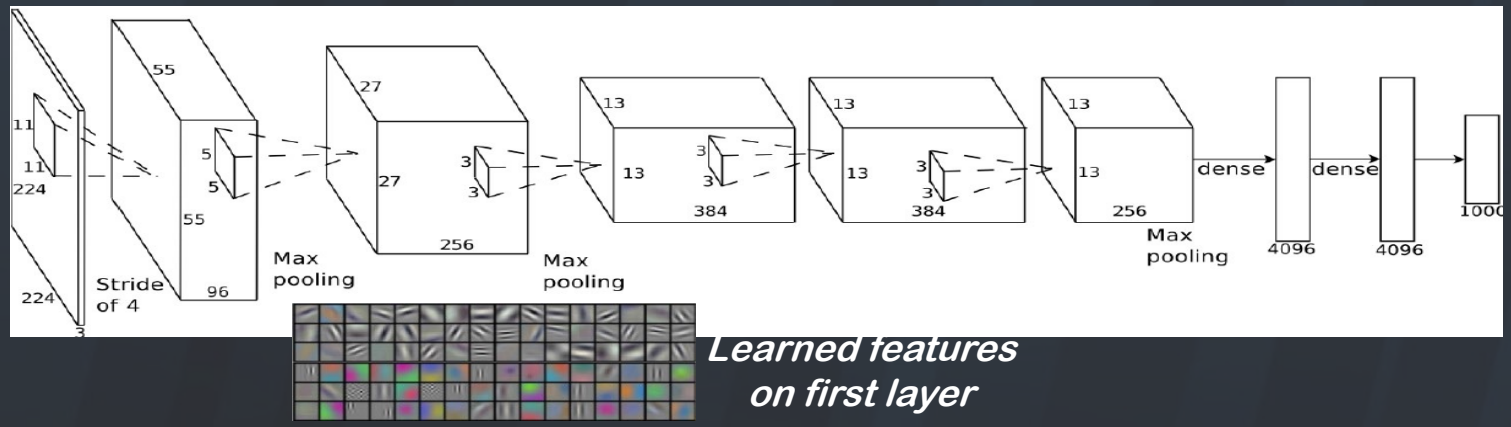




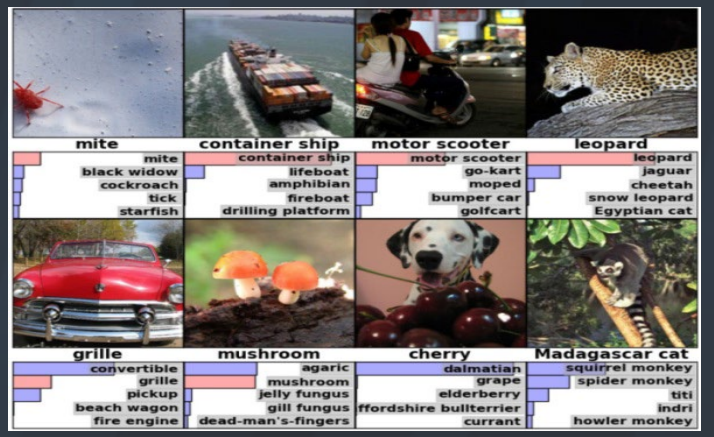
- **Deep Neural Network (DNN) + Spike Neural Network (SNN) implemented on Embedded Systems**
  - Algorithm To Architecture Adequacy Methodology

Deep Neural Network (DNN)

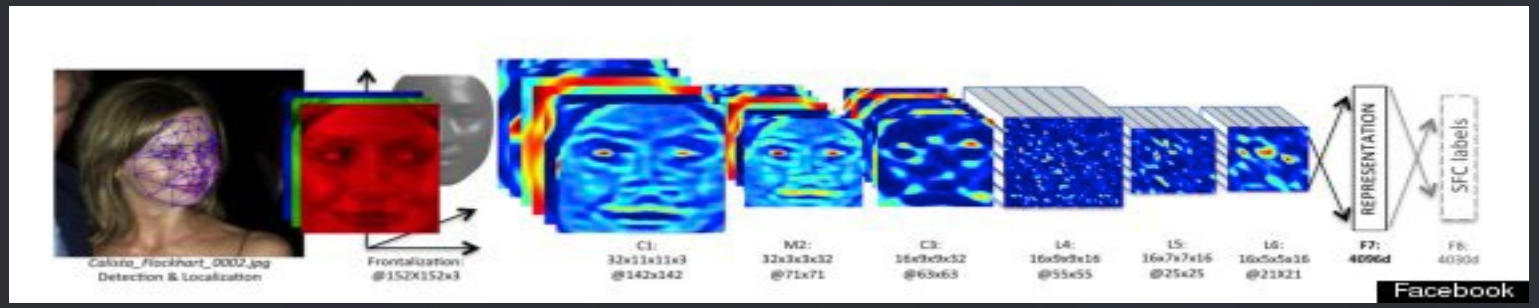
- ImageNet classification (Hinton's team, hired by Google)
  - 1.2 million high res images, 1,000 different classes
  - Top-5 17% error rate (huge improvement)



Learned features on first layer

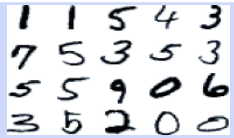


- Facebook's 'DeepFace' Program (labs head: Y. LeCun)
  - 4 million images, 4,000 identities
  - 97.25% accuracy, vs. 97.53% human performance



DNN: STATE-OF-THE-ART IN RECOGNITION

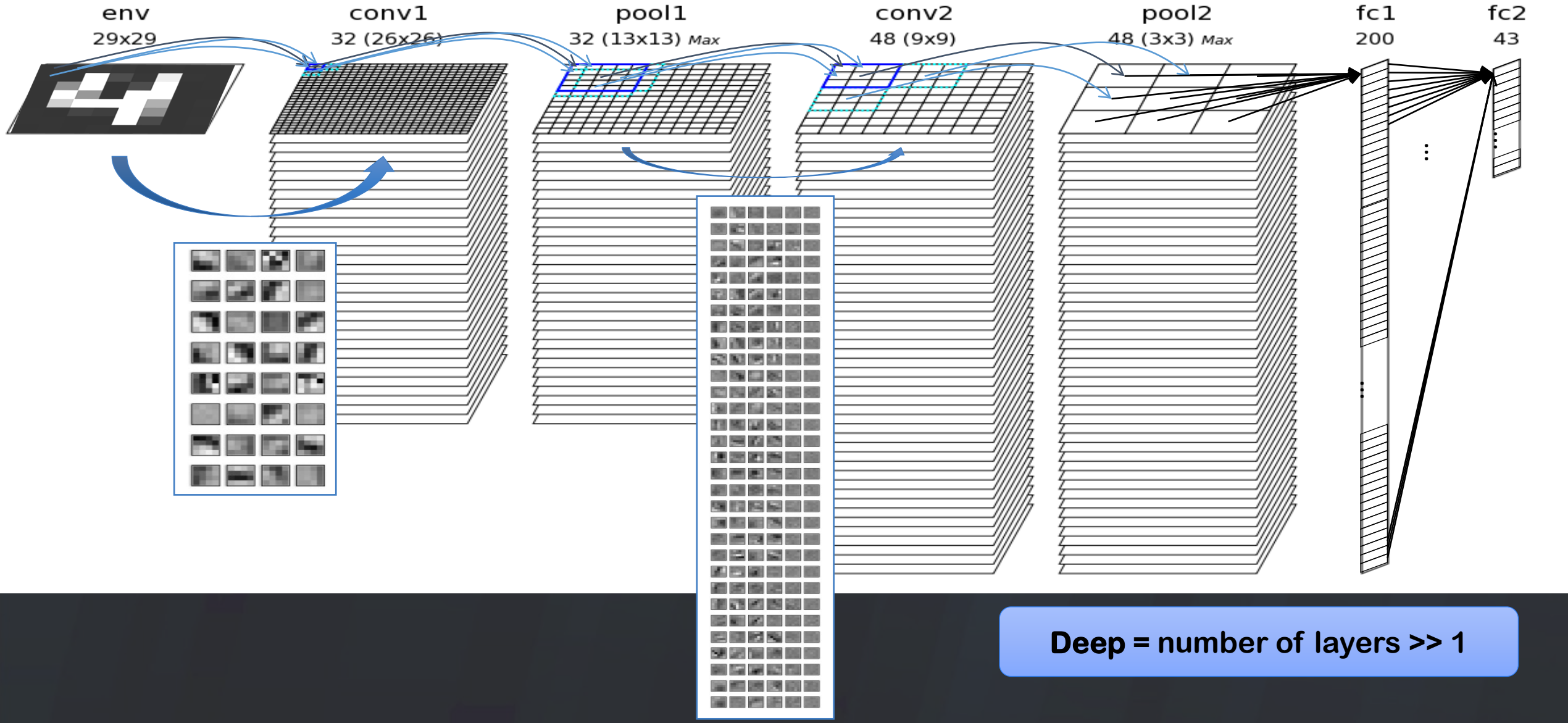
YUMAIN

Database	# Images	# Classes	Best score
MNIST *Handwritten digits* 	60,000 + 10,000	10	99.79% [3]
GTSRB *Traffic sign*	~ 50,000	43	99.46% [4]
CIFAR-10 *airplane, automobile, bird, cat, deer, dog, frog, horse, ship, truck*	50,000 + 10,000	10	91.2% [5]
Caltech-101	~ 50,000	101	86.5% [6]
ImageNet	~ 1,000,000	1,000	Top-5 83% [1]
DeepFace	~ 4,000,000	4,000	97.25% [2]

INCREASING COMPLEXITY

- State-of-the-art are Deep Neural Networks *every time*

Deep Learning based on ConvNets (CNNs)



Deep = number of layers >> 1

E.C.S

EDGE COMPUTING SENSOR

EMBEDDED SMART SENSOR

DATASHEET - E.C.S

ECS is a solution that can be installed in hazardous areas, consisting of fixed sensors with embedded artificial intelligence (Edge-Computing). These smart sensors detect and analyse risk situations in real time. The combination of image processing and artificial intelligence can drastically reduce detection failures and false positives.

Applications covered by YUMAIN SIL 2 certification

Detection of persons in a hazardous area

Certificate of compliance
In accordance with IEC 61508

N° 175362 / 2022A

The National Institute for Industrial Environment & Risks (INERIS - Institut National de l'Environnement Industriel et des Risques), a public organization, established by decree No.90-1089 of 7 December 1990, and accredited by COFRAC under number 5-0045 for certification of products and services (scope of accreditation available on the website www.cofrac.fr) issues a certificate of compliance related to IEC 61508 standards for the following product:

Denomination:	E.C.S. Safety
Type:	Sensor with an AI algorithm embedded
Manufacturer:	Yumain
Applicant of the certificate:	Yumain Dijon, France
Description:	The product is an industrial smart vision sensor that detects pedestrian and/or industrial vehicles in a defined area with the use of an AI algorithm in order to secure hazardous areas.

Certification procedures are available under www.ineris.fr

IM-1729AD - 20/01/2017
Only the entire document may be reprinted.

1/1

Parc Technologique Alata BP 2 F-60550 Verneuil-en-Halatte
tél +33(0)3 44 55 66 77 fax +33(0)3 44 55 66 99 internet www.ineris.fr
Institut national de l'environnement industriel et des risques
Etablissement public à caractère industriel et commercial - RCS Compiègne B 381 984 921 - Siret 381 984 921 00019 - APE 7120B

Detection of people and devices in a dangerous area

APPLICATION YUMAIN - COLLISION -

PREVENTION OF COLLISIONS BETWEEN PEDESTRIANS AND FORKLIFTS IN REAL TIME

The main reasons that motivate company managers to install this type of solution:

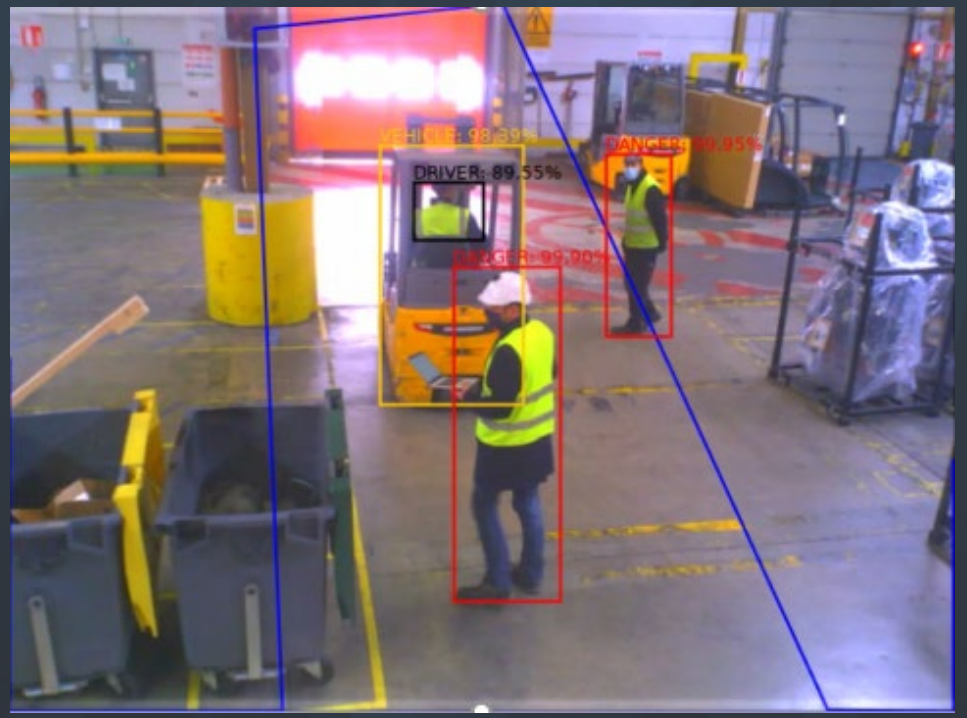
Ensure the protection of human beings in the company's environment

Securing the site and interacting in hazardous areas

Improve employee behavior through risk awareness

FENWICK

VEHICLE: 92.87%

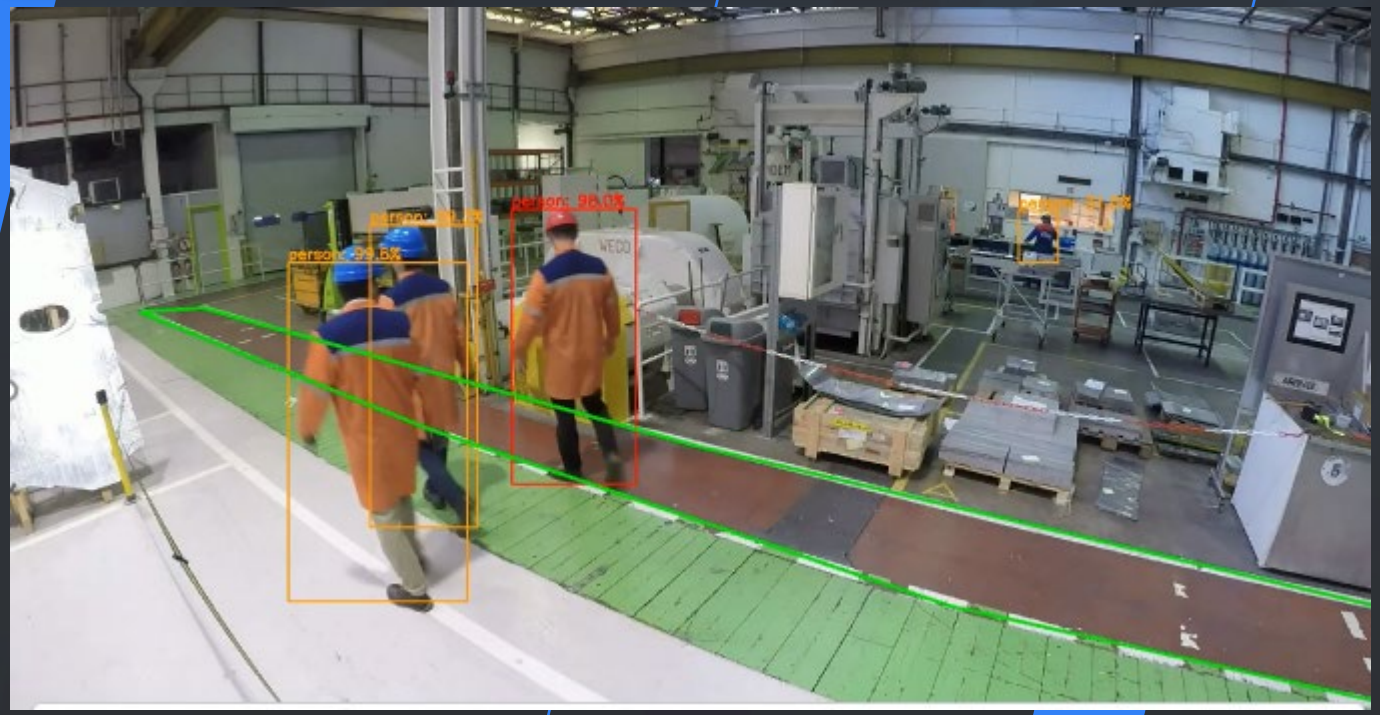

DRIVER: 89.55%

FORKLIFT: 61.06%

DANGER: 100.00%

Safety Integrity Level
SIL2
IEC 61508

APPLICATION YUMAIN
- Peripheral Machine Protection -



APPLICATION YUMAIN
- Peripheral Machine Protection -

Thank you

YUMAIN

www.yumain.fr