



**ARTIFICIAL
INTELLIGENCE**

MEETS SAFETY AND
HEALTH AT WORK

Person-vehicle collision prevention with embedded Artificial Intelligence

YUMAN

Michel PAINDAVOINE

<https://yumain.fr/en/home/>



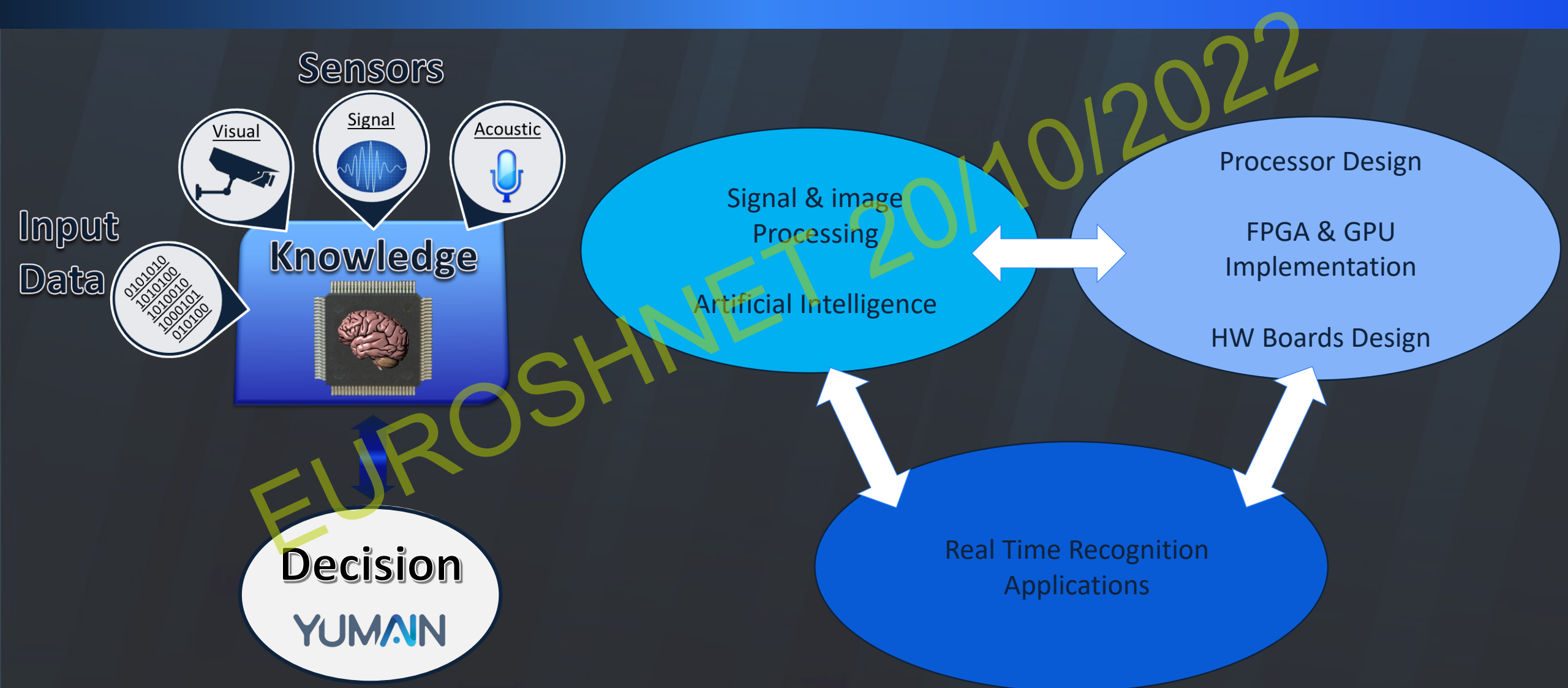
YUMAIN

Sensing & Predictive AI

**Smart Cameras
based on Embedded AI**

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YUMAIN TEAM SKILLS

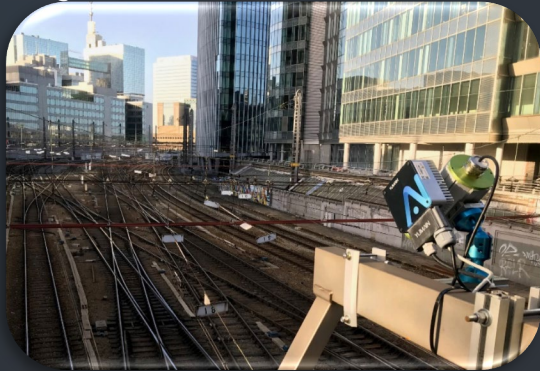


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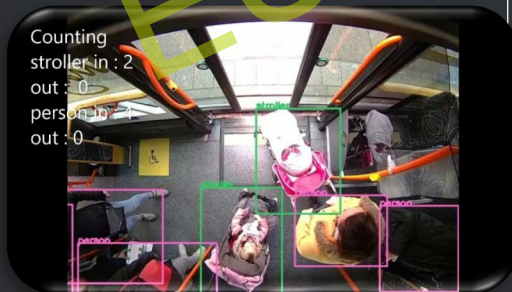
TARGET MARKETS

TRANSPORT

Predictive maintenance related to the safety of railway networks



Counting (bus and tramway)



INDUSTRY 4.0

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



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 ($398387.86 \times 498.07=?$)

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:

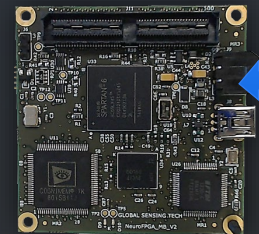
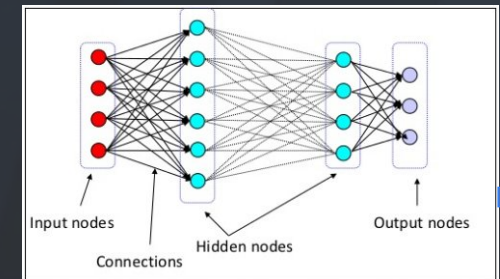
➔ Von Neuman (or Harvard) architectures

- ❖ Object recognition from natural images:

➔ Neuro-inspired Human intelligence

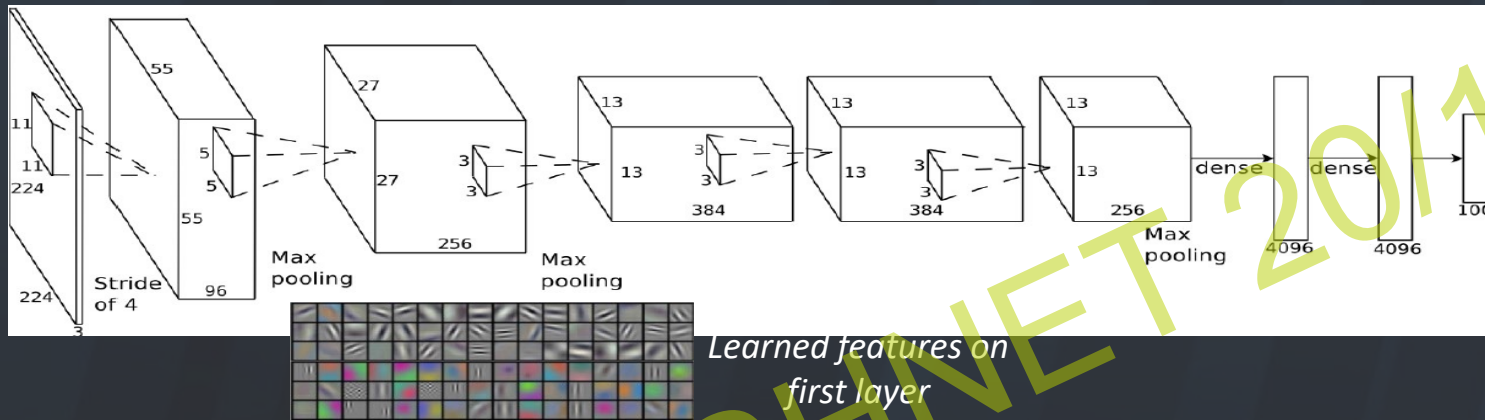
➤ Deep Neural Network (DNN) + Spike Neural Network (SNN) implemented on Embedded Systems

- ❖ Algorithm To Architecture Adequacy Methodology

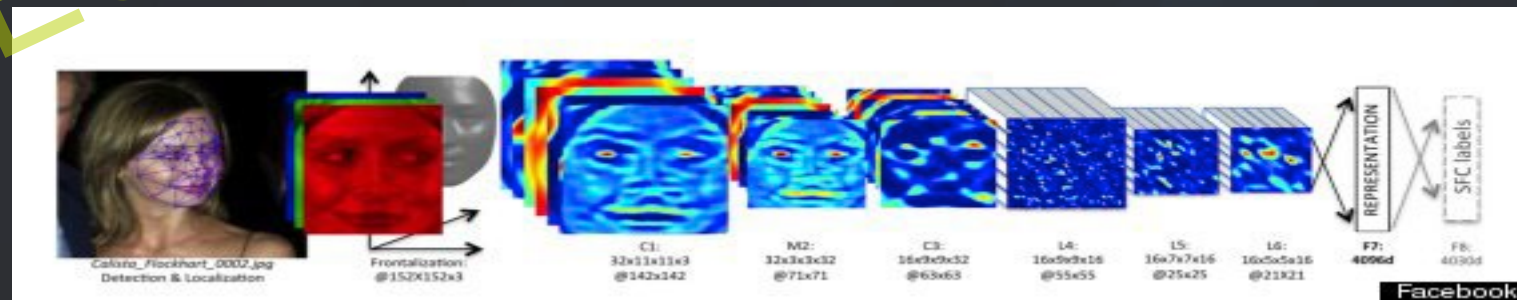


Deep Neural Network (DNN)

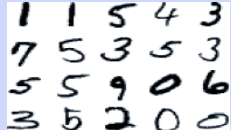





- ImageNet classification (Hinton's team, hired by Google)
 - 1.2 million high res images, 1,000 different classes
 - Top-5 17% error rate (huge improvement)



- 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

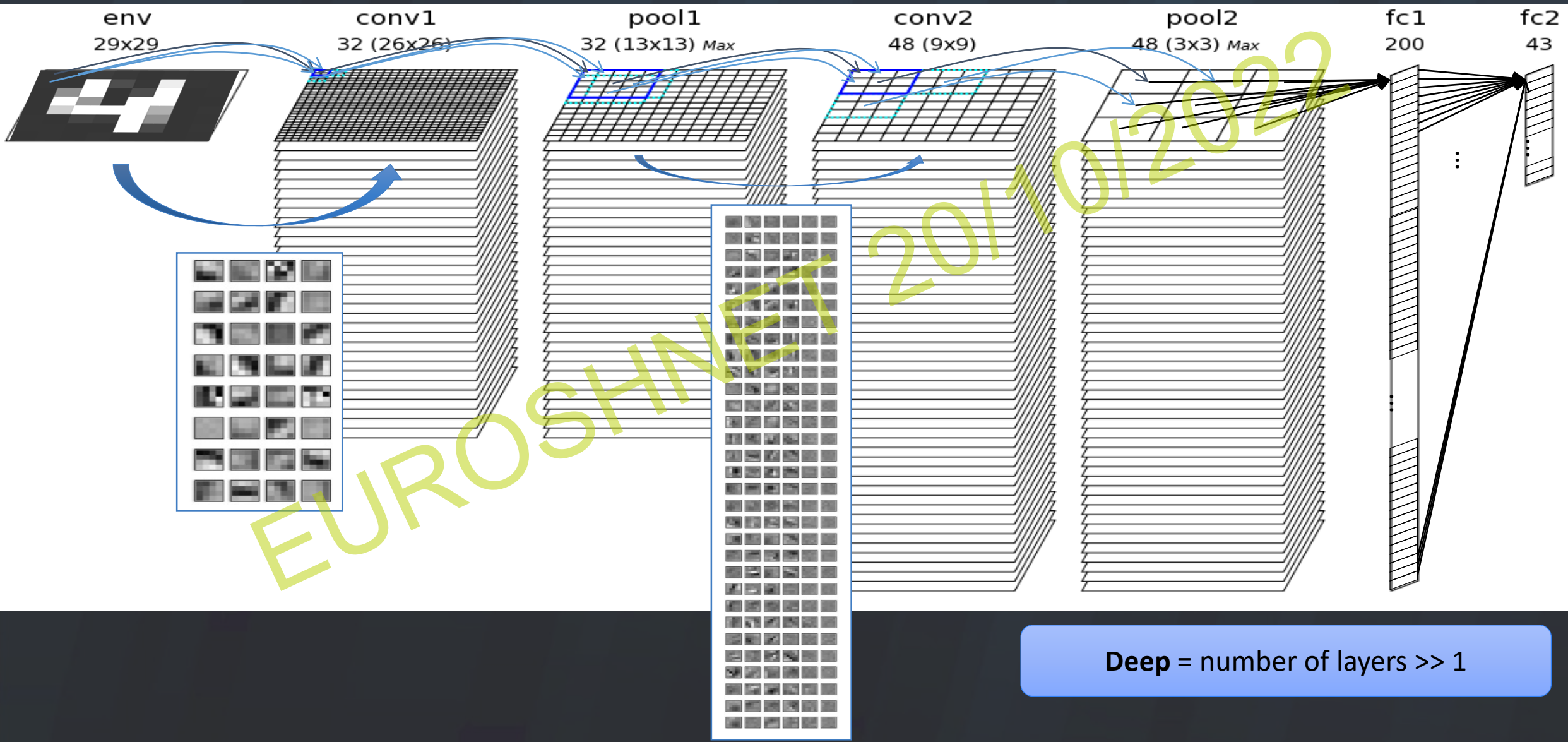
Database	# Images	# Classes	Best score
MNIST <i>Handwritten digits</i> 	60,000 + 10,000	10	99.79% [3]
GTSRB <i>Traffic sign</i> 	~ 50,000	43	99.46% [4]
CIFAR-10 <i>airplane, automobile, bird, cat, deer, dog, frog, horse, ship, truck</i> 	50,000 + 10,000	10	91.2% [5]
Caltech-101 	~ 50,000	101	86.5% [6]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

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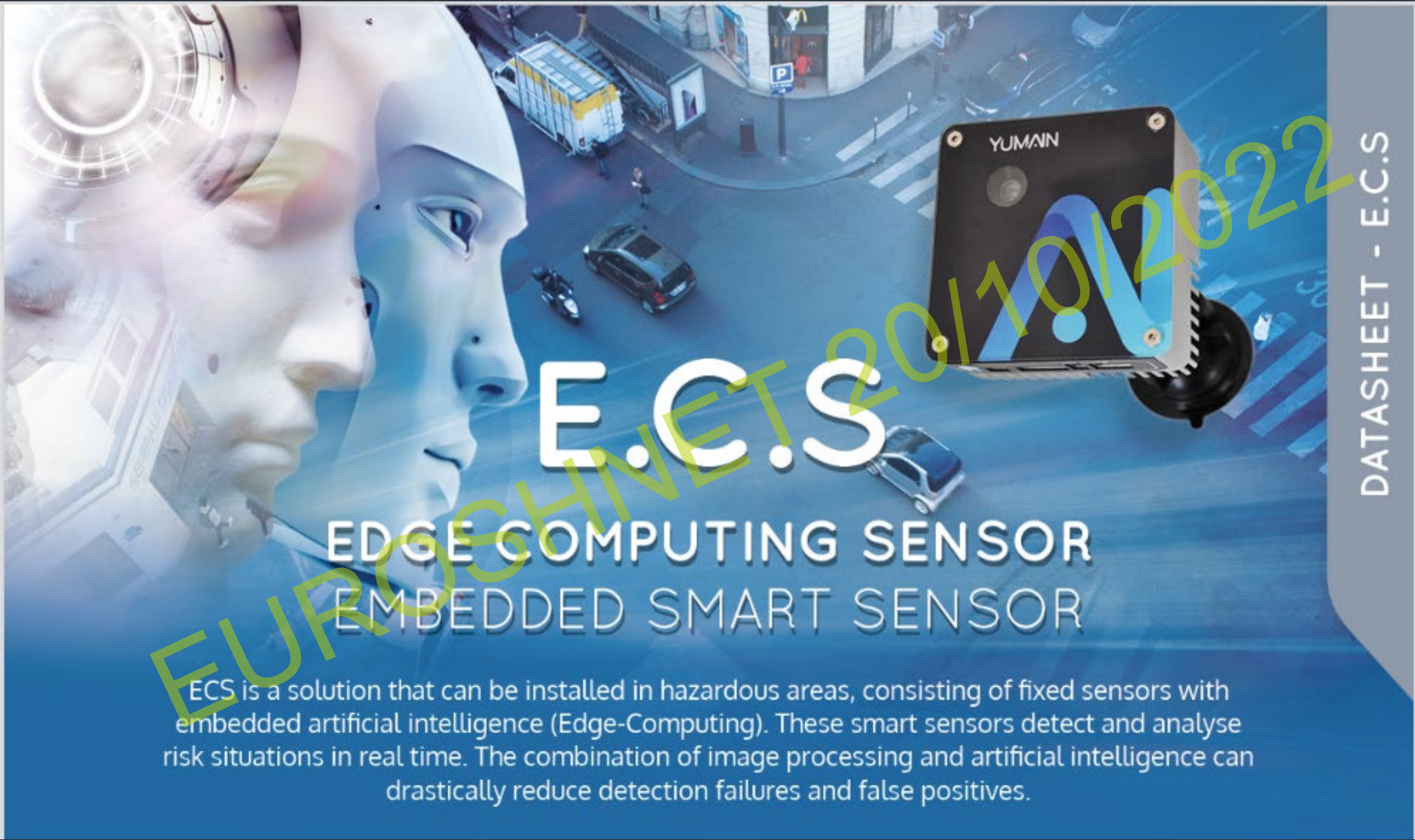
INCREASING COMPLEXITY

- 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

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.

DATASHEET - E.C.S

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Applications covered by YUMAIN SIL 2 certification



YUMAIN

INERIS

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-17294D - 20/01/2017
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1/1

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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 persons in a hazardous area

Detection of people and devices in a dangerous area

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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

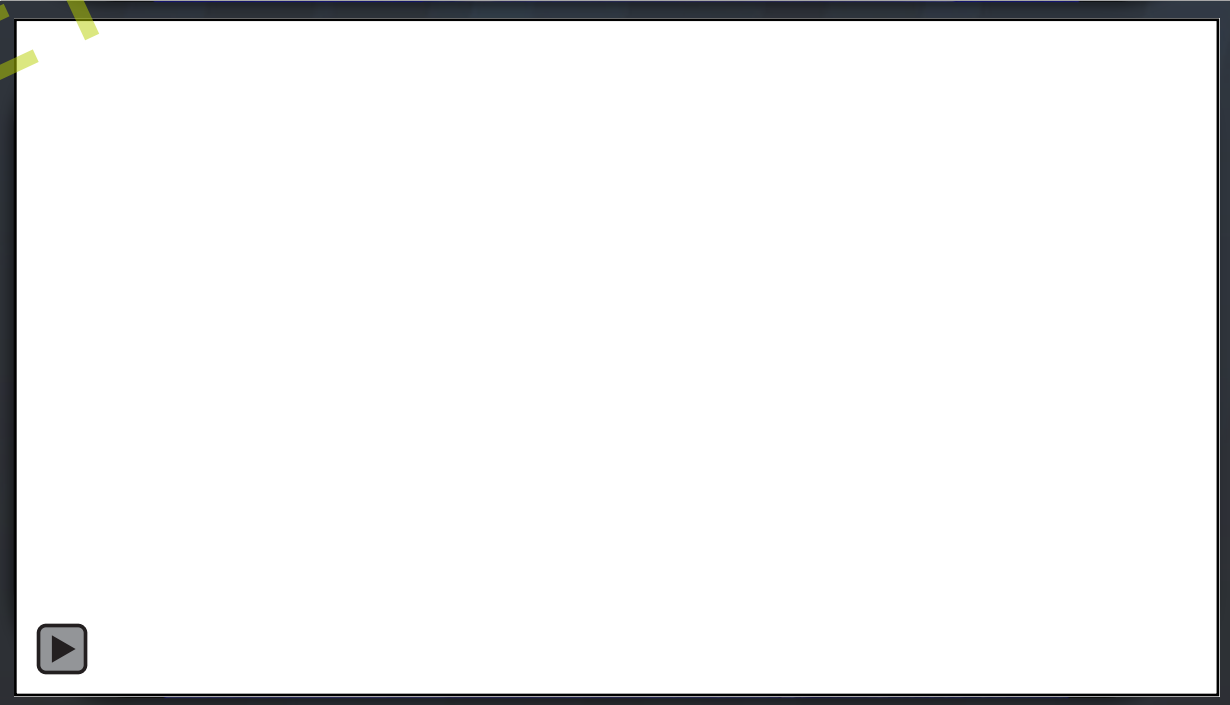
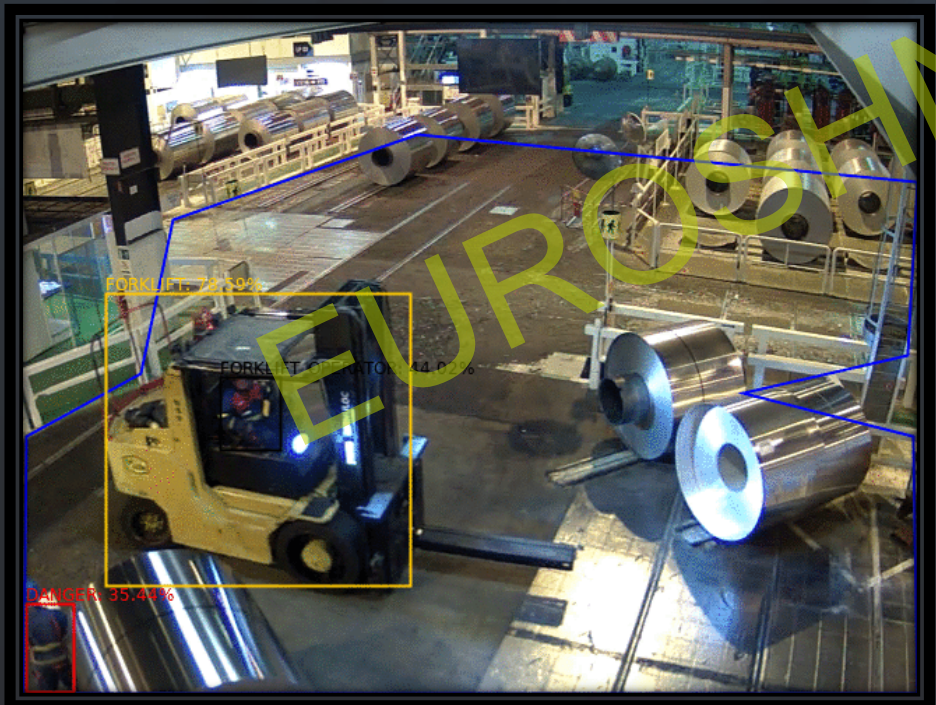
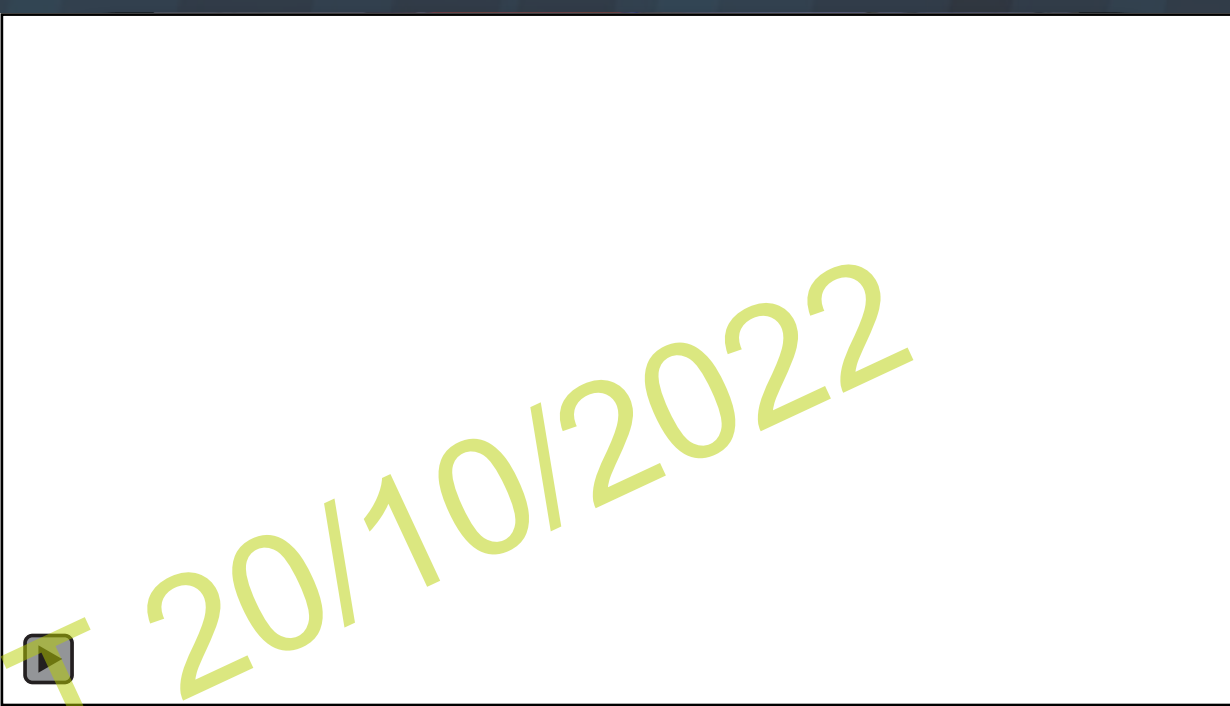
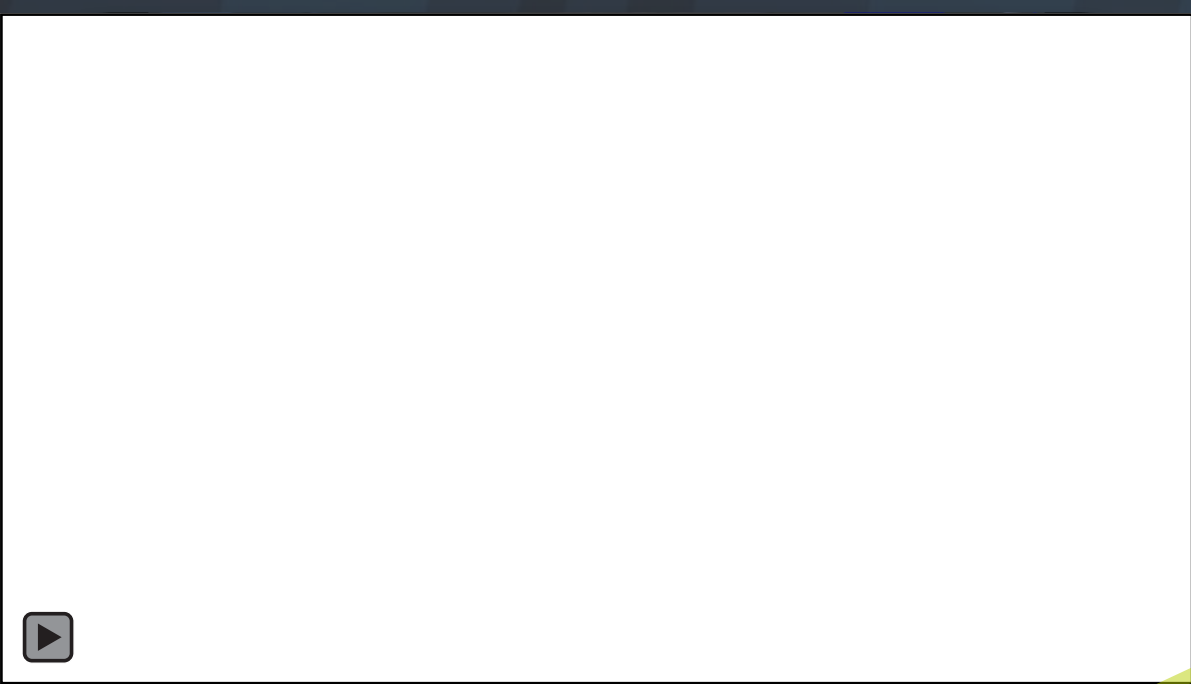
Securing the site and interacting in hazardous areas

Improve employee behavior through risk awareness



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APPLICATION YUMAIN - Peripheral Machine Protection -

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Protection -



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Thank you

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