

TRAL

#### Faculté Polytechnique

TRUSTED AI LABS

**TRAIL Seminar** 



#### **Edge AI for Securing Railway sites**

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# **Context : PhD M. Benkedadra**

#### Embedded/Explainable Deep learning for real time dangerous action detection/prediction



- **Objective 1 :** exploit 2D/3D images and videos captured from multiple cameras to train accurate models for dangerous action/situation detection and prediction.
- **Objective 2 :** Optimize and continuously deploy the models on Edge AI resources.
- Applications : generic/adaptive for appliaction on different situations :
  - Actions recognition/danger prediction in railway stations, construction sites, etc.
  - Process optimization/securing in the context of Industry 4.0

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#### Introduction

- II. Hardware presentation
- III. InfraSecure : Rule-based Approach for 3D Danger Detection
- **IV.** Edge Deployed Al Solution
- V. Experimental Results : Demos and Performance

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## Introduction

Infrabel wants to leverage artificial intelligence to improve safety on construction sites

ILIA and ISIA have a strong expertise in computer vision and artificial intelligence

#### Many Dangers Exist in a Construction site :





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### **Hardware Presentation**



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Conclusion

VI.

V. Experimental Results : Demos and Performance

## **Rule-based Approach**



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## **Required Hardware**



### **InfraSecure Deployment Options**

InfraSecure 2.0 : computation on Edge devices

- The rule-based and deep-based solutions of InfraSecure are fully deployed on embedded resources « Edge AI » with a real time treatment with the Jetson Orin card using one camera
- Tested successfully on laptops, tablets, and high performance servers



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### **InfraSecure Deployment Testing**

Device	CPU	GPU	Memory	OS	Examples of Usage	
[EDGE] NVIDIA Jetson Orin	12-core A78AE Armv8.2 64-bit 2048-core Ampere 3MB L2 64 Tensor Cores 6MB L3		64GB 256-bit LPDDR5 Jetpack 5.1 204.8GB/s		Embedded Systems Distributed Systems Compact Solutions	
[EDGE] NVIDIA Jetson Xavier	8-core Carmel Armv8.2 64-bit 8MB L2 4MB L3	armel 32 64-bit 512-core Volta 256 L2 64 Tensor cores LPD L3 136.5		Jetpack 4.6	Embedded Systems Distributed Systems Compact Solutions	
[LAPTOP] Lenovo T15g Gen2	Intel© i7-11850H 8 Cores x2.5GHz	GeForce RTX 3070 8GB Max-Q	16GB DDR4 3200MHz	Ubuntu 20.04	Smart Home Servers Workstations Gaming Systems	
[TABLET] DT340T RUGGED 2-IN-1 TABLET	Intel® i5-8250U 4 Cores x1.6GHz	GeForce GTX 1050 4GB	8GB DDR4 2400MHz	Windows 10	Portable Solutions On-Site Testing	









**EDGE RESSOURCES & Servers** 

### **InfraSecure Deployment Testing**

#### Frame rate Results for Testing

Device	Realtime	Realtime	Offline	Offline	
Device	(1  Cam)	(2  Cams)	(1  SVO file)	(2  SVO file)	
[EDGE]	30	14	18	8	
INVIDIA Jetson Orm			-		
[EDGE]	11	/	10	4	
NVIDIA Jetson Xavier		<u> </u>			
[LAPTOP]	20	10	15	8	
Lenovo T15g Gen2	20	10	15		
[TABLET]	0	1	0	3	
DT340T RUGGED 2-IN-1	0	/	9		







**EDGE RESSOURCES & Servers** 

## **Infrasecure Demo**



### **InfraSecure on Edge AI**

#### **DEPLOYMENT ON EDGE RESSOURCES**



## Conclusion

- Workers' safety using AI and Computer vision
- Danger detection : compute distance between 3D detected objects
- High accuracy of the provided solution : around 90%
- Infrasecure deployed on Edge AI : Jetson Xavier and Jetson Orin
- Models' compression : reduce memory size : 5x less
- Models' compression : accelerate computation : speedup of 2x

#### **Future Works**

- Multiple camera fusion
- Continuous & multimodal learning





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