





## Automatic Pavement Distress Detection using Artificial Intelligence-based algorithms (II)

Saúl Cano-Ortiz Ph.D. candidate in Civil Engineering | Ms.C. Data Science | Bs.C. Physics

#### **Research progress**

(I) Projects Description (+4): <u>MAPSIA</u>, <u>LIAISON</u>, PEMISIA, XR-CAPTURE

(II) Articles

- Congress (+3): DSPS23, TRA24, CILA24
- Review (+1): Automation in Construction
- Full-length research paper (+4): Construction & Building Materials, Developments in the Built Environment (DIBE), Engineering Applications of Artificial Intelligence & DIBE (under review)

#### (III) Defense:

- Date: June 2024 (expected).
- Type: Full-length.
- Minor: International

(IV) International Research stay

- Place: +1 (Institute für straβenwesen, Aachen, DE: 01/03/2024 – 31/05/2024)

(V) Others

- Courses (+80h), Seminars (+10), EIDEIC (2), etc.



## A.1 Motivation: Current solutions vs. our approach





### A.2 Data collection device and benchmark dataset











(a) First vehicle-mounted image collection device.







(b) Second vehicle-mounted image collection device.



(j) D10





(c) Third vehicle-mounted image collection device.







(k) D11



(I) D12 (m) D13

# A.3 Improved deep learning-based object detection: GenAI





Article I. End-to-end computer vision system YOLOv5, ↓ 20.5% *FP*, ASPDI, Scenarios, Generalization

"Poor detection less-frequent distress types"



Article II. Class-conditional denoising difusión probabilistic model (generative system)

"Improved YOLOv5"





Article III. Class-conditional attention-guided generative adversarial networks (generative system)

"Improved YOLOv8 & pavement management software"

**Article IV.** Semantic difusion synthesis (generative system)

"Improved YOLOv8, LinkNet and ASPDI"

## A.4 Results & Discussion





#### Conclusions

- (I) Cost-effective, efficient, and automated end-to-end deep learning-based computer vision system for pavement distress detection: road administrations and companies.
- (II) Improved deep learning object detection and segmentation architectures with generative model augmentation.
- (III) Pavement condition index and management software.
- (IV) Duration: December 2021 June 2024.



(1) Pavement condition index calculus (2) Information deployment to software (ASPDI)

intelligent road maintenance



ThisworkwassupportedbytheMCN/AEI/10,13039/501100011033and "European UnionNextGenerationEU/PRTR"underGrant[TED2021-129749B-I00]





This work was supported by the the Horizon Europe Research and Innovation Framework program of the European Union under the project LIAISON [101103698].





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