Proactive risk mapping and infrastructure safety management - IVORY

Júlia Alves Porto

IVORY PhD Candidate & Researcher

Together with
George Yannis & Apostolos Ziakopoulos

Department of Transportation Planning and Engineering
National Technical University of Athens

Artificial Intelligence for Road Safety and Mobility Workshop

8th UN Global Road Safety Week

Athens, 15 May 2025

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The IVORY project

- IVORY:

  "AI for Vision Zero in Road Safety"
  ivory-network.eu

- Partners:

  4 Universities
  8 Non-academic partners
  13 Associated Partners
  10 Countries

- Duration of the project:

  48 months (November 2023 – October 2027)

- Framework Program:

  This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101119590

Co-funded by the European Union

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PhD Goals

- To create an AI framework to process, harmonize, analyze and model an array of different available datasets and provide outputs in the form of risk mapping and network-level evaluations
- To develop new AI algorithms for road attribute collection
- To use the AI-augmented dataset creation effort for a suitable working methodology for the generation of hybrid road attribute data and enhanced proactive risk mapping

Road attribute collection

- iRAP Star Rating methodology
- Currently, data is collected mainly through manual coding, using street-level imagery
- Specific attribute collection is accredited to specific organizations, based on their proved reliability
- Automation requires good data sources and light-weight techniques for efficient implementation

Attribute extraction from aerial imagery

- Road Extraction from Aerial Imagery using segmentation models and a public dataset (Deep Globe Challenge)
- A large range of segmentation models were tested for best performance, along with different pre-processing and post-processing techniques
- Best performing models were also applied to different datasets, using OSM Aerial Maps
- Development of coding abilities and familiarization with Machine Learning metrics

Attribute extraction from street-level

- Partnership with FRED Engineering - Italy
- Speed limit sign recognition
- Using a combination of YOLO and OCR
- Over 90% overall accuracy compared with manually coded data
- Biggest different from iRAP format: differentiating between temporary and permanent signs

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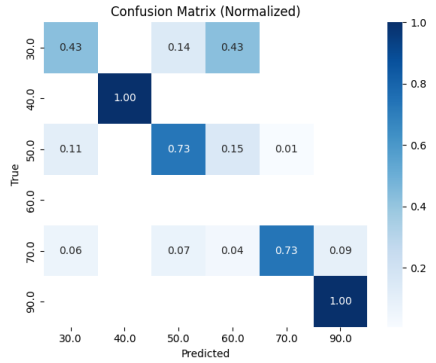

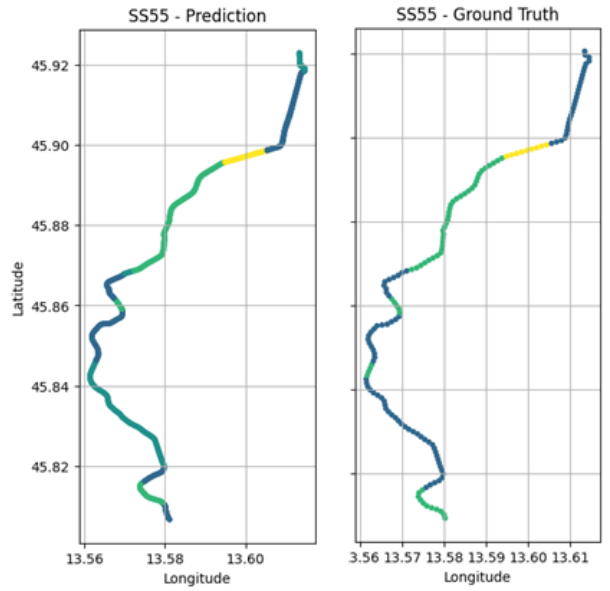

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iRAP

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Attribute extraction from multi sources

- Partnership with FRED Engineering - Italy
- Road intersection detection with iRAP coding criteria: type, quality and channelisation
- Steps: road marking detection, horizontal and vertical signs detection and classification, traffic light detection, OSM network analysis
- Fusing street-level imagery with KML and different types of models
- Addendum: curvature and grade were also explored in this dataset

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Discussion

- Road attribute automated collection is possible
- Efficacy of automated models depends on transferable frameworks, with open access and easy calibration
- High-level distinctions can be handled by automated models, while areas with low confidence can be flagged for manual review.
- Road safety and infrastructure monitoring can be faster and cheaper

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- Create safer urban road environments through proactive measures
- Produce risk maps and urban network-level evaluations through AI frameworks
- Identify high-risk areas and suggest infrastructure improvements, thereby contributing to the reduction of road crashes and fatalities

Scientific and Social Impact

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- Advance AI algorithms for collecting and analyzing road attribute data, including hybrid methods that combine automated and manual data collection
- Produce a functional AI framework capable of meaningful risk assessment and the quantification of factors influencing road safety
- More informed decision-making in urban road design

Future Challenges

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- Assessing **accuracy, reliability and transferability** of AI-generated data, integrating hybrid data collection methods
- Explore **practical applications** of AI in proactive road safety assessments from an infrastructure perspective
- Develop **reliable and transferable algorithms** to be applied in real assessments

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