Institut de Robòtica i Informàtica Industrial

CSIC

UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

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Deep learning-based scene understanding for urban autonomous navigation

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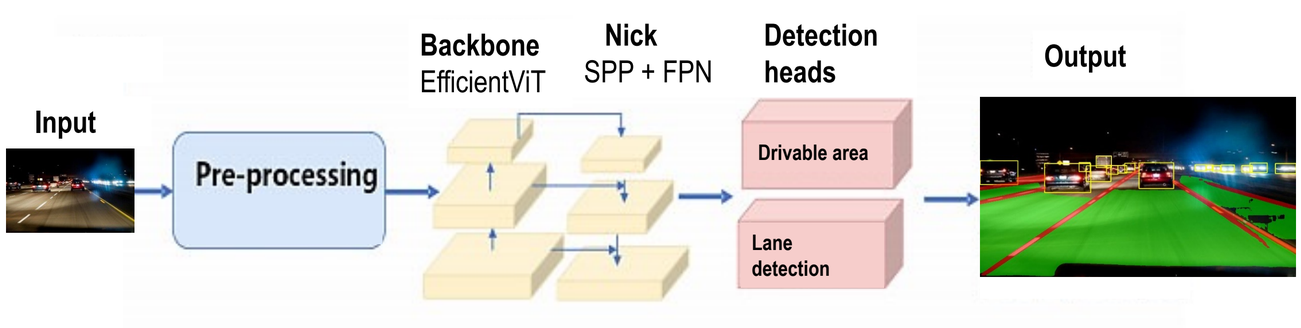
MOTIVATION

- The motivation for this research stems from the critical need to develop a comprehensive understanding of the semantic environment surrounding autonomous vehicles (AVs), and to use this understanding effectively to drive the vehicle's control system.



* **SPP** (Spatial Pyramid Pooling)
* **FPN** (Feature Pyramid Network)

OBJECTIVES

The main objective is to build an **End-to-End** architecture to improve the scene understanding of a navigation platform and vehicle control by processing images using deep learning.

The E2E architecture will incorporate both Panoptic Segmentation (PS) and Physically-Informed Neural Networks (PINNs) approaches.

- PS to improve scene perception and detection of traversable areas.
- PINNs for decision making and control of vehicle dynamics and traffic flow principles.

RESULTS

- BDD100K dataset used to train the model.

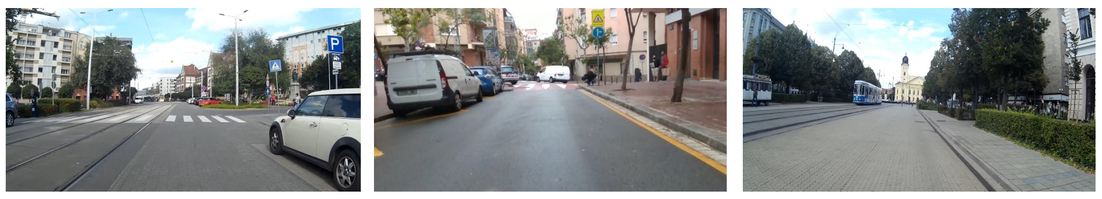
The results demonstrate a satisfactory performance in both lane line and drivable area segmentation.

- For drivable area segmentation, it was able to achieve 93.5 MIoU.
- In lane detection, it exhibited high accuracy, with a 87.31% accuracy rate and a 31.6% IoU metric.
- Furthermore, it achieved an impressive 91 fps with 38.9M parameters.

The visual and metric results demonstrated the model's remarkable capabilities.

Data collection

- Our preliminary assessment was conducted on a mobile robot called Ona.
- The data were obtained from ONA in Esplugues, Debrecen, and Braunschweig.



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Research Plan defense: Fabruary 2024

Funding

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Publications

[1] A. Santamaria-Navarro, S. H. Juan, F. H. Cotarelo, A. L. Gestoso, I. Del Pino, N. A. R. Linares, C. Fernandez, A. Baldó i Canut, C. Lemardelé, A. Garrell, J. Vallvé, H. Taher, A. Puig-Pey, L. Pages, A. Sanfeliu. ***Towards the deployment of an autonomous last-mile delivery robot in urban areas***. IEEE Robotics and Automation Magazine. (to appear 2024).