

SMARTHEP

REAL-TIME ANALYSIS FOR
SCIENCE AND INDUSTRY

ESR 11:
**Real-Time Analysis through computer
vision on dashcams and triggers
in High Energy Physics**

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Monteagudo



SMARTHEP is funded by the European Union's Horizon 2020 research and innovation programme, call H2020-MSCA-ITN-2020, under Grant Agreement n. 956086



Self-presentation

I am **SMARTHEP's ESR11**, Henrique, from Santiago de Compostela (Spain)

Academic Background

- MSc in Computer Vision (Universities of Coruña, Santiago, Vigo and Porto, 2022)
- BSc in Industrial Electronics and Automation Engineering (University of Vigo, 2020)

Prior experience

Briefly worked on two other European projects: InfraROB at UVigo (Spain) and AdMiRe at EPFL (Switzerland) in computer vision related topics, which is my main research interest.

Currently

PhD program in Computer Science and Engineering at the University of Bologna and working at Verizon Connect (Florence).

Supervised by Francesco Sambo, Leonardo Taccari and Samuele Salti.



UniversidadeVigo



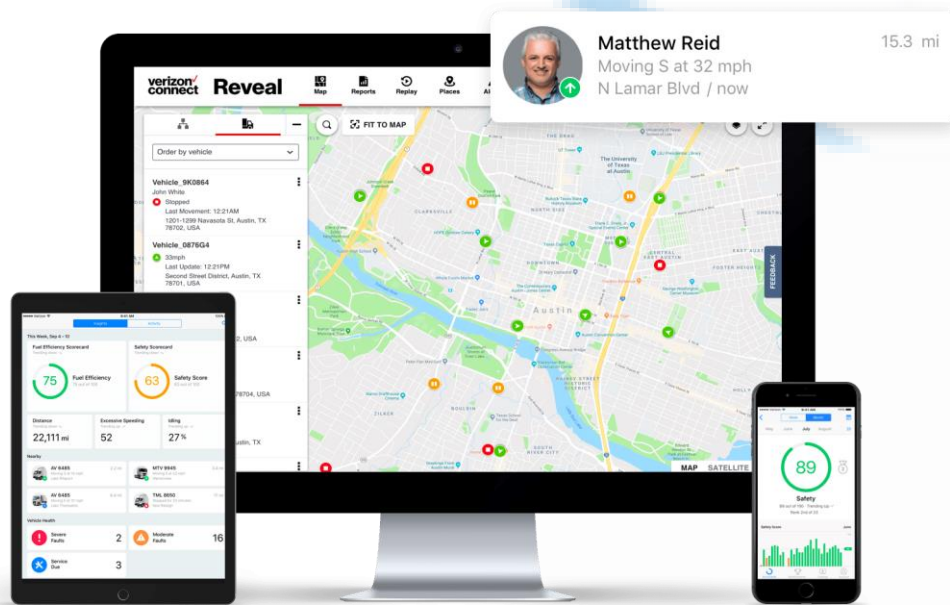
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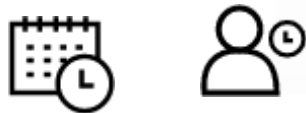
SMARTHEP

REAL-TIME ANALYSIS FOR
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Verizon Connect



Field service management



Compliance management



Integrated video



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verizon
connect

Road scene understanding with dashcams



Introduction

Main goal of this project: tackle **real time analysis** problems in the use cases of Verizon Connect, mainly on its video-related products.

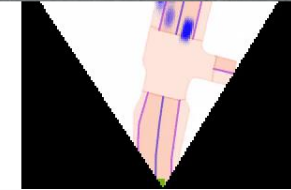
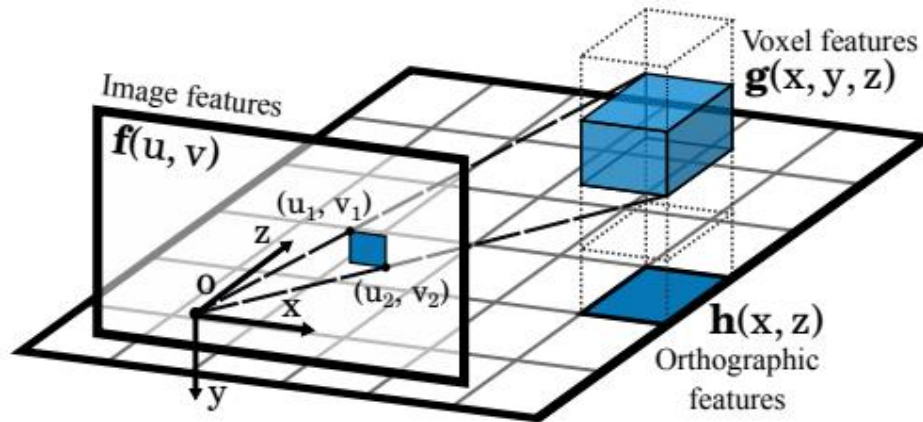
Tasks of interest:

- Accident anticipation
- Collision warnings
- Trajectory forecasting



Bird's Eye View Perception

- **Bird's Eye View:** a 2D orthographic projection of the world along the direction of gravity



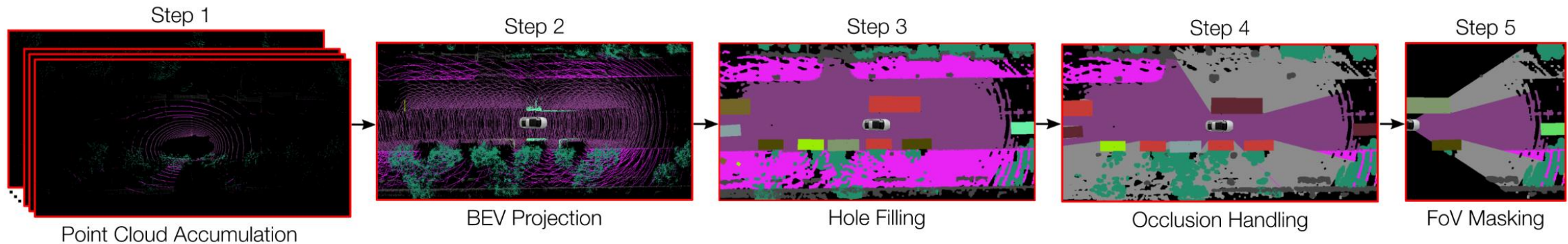
Widely used and desirable representation for road scenes.

- Road agents' movement mostly restricted to ground plane
- More compact than an explicit 3D representation like a voxel grid
- Easy to integrate additional cameras/sensors

Vehicle segmentation in BEV with *SimpleBEV*, Harley et al., ICRA 2023
 nuScenes dataset, underlying map is ground truth

Data problem

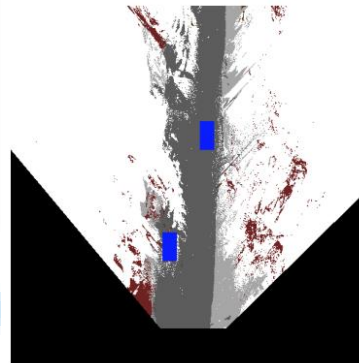
- Current work focuses on the supervised approach
- Generating labels for BEV tasks (e.g. semantic segmentation) requires annotated point cloud which are expensive to generate and require special sensors



Pipeline to generate BEV panoptic segmentation labels from annotated point clouds in the KITTI360 dataset
in *PanopticBEV*, Gosala and Valada, *Robotics and Automation Letters* 2022

1st approach - Pseudolabels

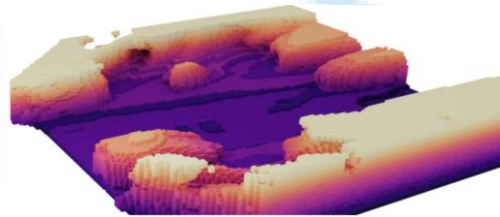
- Pseudolabel-based approach, inspired by *SkyEye, Gosala et al, CVPR 2023* the first functional BEV semantic segmentation work without GT labels. However, the quality of our pseudolabels was worse than SkyEye's and to improve we were converging towards their solution.



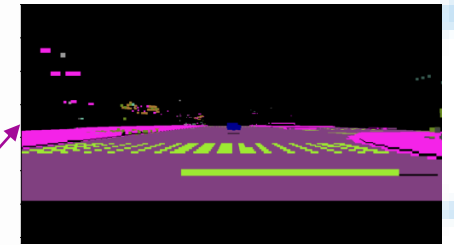
BEV semantic segmentation pseudolabel extracted with our proposal

2nd approach – Self-supervision

Density volume



Reconstructed perspective view



\mathcal{L}_{CE}

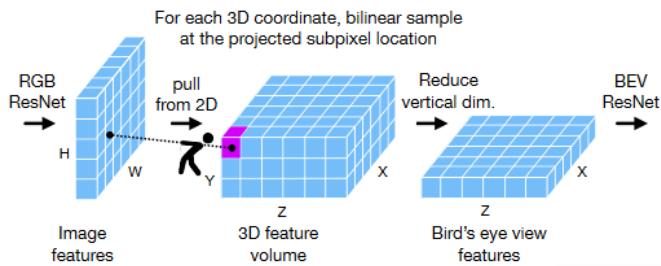
BEV semantic segmentation



Volumetric rendering



Ground truth semantic segmentation



Adam W. Harley et al. *Simple-BEV: What Really Matters for Multi-Sensor BEV Perception?* ICRA 2023.

Challenges and next steps

- Using only one image at a time → Scale problem, too many possible wrong 3D geometries generate the correct reconstruction target.

Currently

- Experimenting with enforcing spatiotemporal consistency using video
- Additional supervision from a RGB photometric loss

Other activities

Training

- Different PhD courses from the University of Bologna
- ACDL summer school on Data Science and Machine Learning

Tutoring

- Supervising a master student doing his internship and master's thesis at Verizon Connect

Conferences

- Attended the IEEE Intelligent Transportation Systems Conference at Bilbao to present a paper stemming from an innovation project in Verizon Connect:

“An object detection approach for lane change and overtake detection from motion profiles”

Secondment - UoM

- Starting soon until April 2023
- Anomaly detection on HEP data with prof. Caterina Doglioni

Thank you for your attention!



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