

# Paolo Cudrano

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Artificial Intelligence and Robotics Lab (AIRLab)  
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Paolo Cudrano is a PhD candidate in Computer Science and Engineering at Politecnico di Milano. He is advised by Prof. Matteo Matteucci and is part of the Artificial Intelligence and Robotics Lab (AIRLab). His research focuses on continual deep learning, with particular interest in applications for embodied agents. In 2019, he obtained an MSc in Computer Science and Engineering from Politecnico di Milano. In the same year, he obtained a MSc in Computer Science from McMaster University, Canada. During this time, he focused on perception systems for autonomous vehicles, collaborating with the Centre for Mechatronics and Hybrid Technologies (CMHT) in Hamilton, ON, and with the Dept. of Mechanical Engineering at Politecnico di Milano. Following these activities, he currently maintains projects in autonomous driving and agricultural robotics. He obtained his BSc from Politecnico di Milano in 2016.

## EDUCATION

November 2020 – Present

### **Ph.D., Information Technology – Computer Science and Engineering**

Politecnico di Milano, Dept. of Electronics Information and Bioengineering, Milan, Italy

Supervisor: Prof. Matteo Matteucci

Topic: *Continual Learning & Embodied AI*

September 2016 – December 2019

### **M.Sc., Computer Science and Engineering (110/110 cum laude)**

Politecnico di Milano, Dept. of Electronics Information and Bioengineering, Milan, Italy

Supervisor: Prof. Matteo Matteucci

Thesis: *Autonomous vehicle heading and centerline displacement estimation via computer vision*

September 2017 – June 2019

### **M.Sc., Computer Science**

McMaster University, Dept. of Computing and Software, Hamilton, ON, Canada

Supervisor: Prof. Martin von Mohrenschildt

Thesis: *A study on lane detection methods for autonomous driving*

Collab. with Centre for Mechatronics and Hybrid Technologies, Hamilton ON, Canada

Double Degree agreement with Politecnico di Milano

September 2013 – September 2016

### **B.Sc., Engineering of Computing Systems (110/110 cum laude)**

Politecnico di Milano, Dept. of Electronics Information and Bioengineering, Milan, Italy

## PUBLICATIONS

Updated list on Google Scholar: <https://scholar.google.com/citations?user=YjUypF4AAAAJ>

### Journals

2024

M. Bellusci, **P. Cudrano**, S. Mentasti, R. Cortelazzo, and M. Matteucci, "Semantic interpretation of raw survey vehicle sensory data for lane-level HD map generation", *Robotics and Autonomous Systems*, Elsevier, Feb 2024

2022

**P. Cudrano\***, B. Gallazzi\*, M. Frosi, S. Mentasti and M. Matteucci, " Clothoid-Based Lane-Level High-Definition Maps: Unifying Sensing and Control Models", In *IEEE Vehicular Technology Magazine*, vol. 17, no. 4, Dec 2022

### Conferences

2024

**P. Cudrano\***, S. Mentasti\*, R. Cortelazzo\*, and M. Matteucci, " OptimusLine: Consistent Road Line Detection Through Time", In *2024 IEEE Intelligent Vehicles Symposium (IV)*, Jeju Island, Korea, Jun 2024

C. Sbrolli, **P. Cudrano**, and M. Matteucci, "Can Shape-Infused Joint Embeddings Improve Image-Conditioned 3D Diffusion?", In *2024 International Joint Conference on Neural Networks (IJCNN)*, Yokohama, Japan, Jun 2024

M. Uselli, M. Frosi, **P. Cudrano**, S. Mentasti, and M. Matteucci, "RadarLCD: Learnable Radar-Based Loop Closure Detection Pipeline", In *2024 International Joint Conference on Neural Networks (IJCNN)*, Yokohama, Japan, Jun 2024

2023

**P. Cudrano**, M. Bellusci, G. Macino, and M. Matteucci, "Continual Cross-Dataset Adaptation in Road Surface Classification", In *2023 IEEE 26th International Conference on Intelligent Transportation Systems (ITSC)*, Bilbao, Spain, Sep 2023

C. Sbrolli, **P. Cudrano**, and M. Matteucci, "CISPC: Embedding Images and Point Clouds in a Joint Concept Space by Contrastive Learning ", In *International Conference on Image Analysis and Processing ICIAP 2023*, Udine, Italy, Sep 2023

M. Bellusci, **P. Cudrano**, S. Mentasti, R. Cortelazzo, and M. Matteucci, "Semantic Bird's-Eye View Road Line Mapping", In *2023 IEEE 26th International Conference on Intelligent Transportation Systems (ITSC)*, Bilbao, Spain, Sep 2023

2022

B. Gallazzi\*, **P. Cudrano\***, M. Frosi, S. Mentasti and M. Matteucci, " Clothoidal Mapping of Road Line Markings for Autonomous Driving High-Definition Maps", In *2022 IEEE Intelligent Vehicles Symposium (IV)*, Aachen, Germany, Jun 2022

**P. Cudrano** et al., "Detection and mapping of crop weeds and litter for agricultural robots," In *2022 AEIT International Annual Conference (AEIT)*, Rome, Italy, Oct 2022

2020

**P. Cudrano**, S. Mentasti, M. Matteucci, M. Bersani, S. Arrigoni, and F. Cheli, "Advances in centerline estimation for autonomous lateral control", In *2020 IEEE Intelligent Vehicle Symposium (IV)*, Las Vegas, USA, Oct 2020

M. Bersani, S. Mentasti, **P. Cudrano**, M. Vignati, M. Matteucci and F. Cheli, "Robust vehicle pose estimation from vision and INS fusion", In *2020 IEEE 23rd International Conference on Intelligent Transportation Systems (ITSC)*, Rhodes, Greece, Sep 2020

## Workshops

2023

S. Mentasti, **P. Cudrano**, S. Arrigoni, M. Matteucci, and F. Cheli, "Beyond Image-Plane-Level: A Dataset for Validating End-to-End Line Detection Algorithms for Autonomous Vehicles", In *2023 IEEE 26th International Conference on Intelligent Transportation Systems (ITSC) Workshop on Building reliable datasets for Autonomous Vehicles*, Bilbao, Spain, Sep 2023

## RESEARCH EVENTS

### Conferences

- 37<sup>th</sup> Conference on Neural Information Processing Systems (NeurIPS 2023), New Orleans, USA, Dec 2023 (virtual attendance)
- 26<sup>th</sup> IEEE International Conference on Intelligent Transportation Systems (ITSC 2023), Bilbao, Spain, Sep 2023 (oral presentation)
- 2<sup>nd</sup> Conference on Lifelong Learning Agents (CoLLAs 2023), Montreal, Canada, Aug 2023 (virtual attendance)
- 36<sup>th</sup> Conference on Neural Information Processing Systems (NeurIPS 2022), New Orleans, USA, Dec 2022 (virtual attendance)
- 1<sup>st</sup> Conference on Lifelong Learning Agents (CoLLAs 2022), Montreal, Canada, Aug 2022 (virtual attendance)
- 10<sup>th</sup> International Conference on Learning Representations (ICLR 2022), Virtual, Apr 2022 (virtual attendance)

- 33<sup>rd</sup> IEEE Intelligent Vehicles Symposium (IV22), Aachen, Germany, Jun 2022 (poster presentation)
- 35<sup>th</sup> Conference on Neural Information Processing Systems (NeurIPS 2021), Virtual, Dec 2021 (virtual attendance)
- 34<sup>th</sup> Conference on Neural Information Processing Systems (NeurIPS 2020), Virtual, Dec 2020 (virtual attendance)

### Summer schools

- International Computer Vision Summer School ([ICVSS 2023](#)), Italy, July 2023
- European Summer School on Artificial Intelligence ([ESSAI 2023](#)), Slovenia, July 2023

## RESEARCH EXPERIENCE

November 2020 – Present

**Graduate student (Ph.D.),** Politecnico di Milano

Continual deep learning for embodied AI, aiming to develop AI agents that adapt and learn over time. Previous involvement in projects on autonomous vehicles.

April 2020 – September 2020

**Research intern,** Politecnico di Milano

Research on a real-time road marking detection system for autonomous vehicles, used on the AIRLab vehicle in collaboration with the Dept. of Mechanical Engineering.

September 2018 – December 2019

**Graduate student (M.Sc.),** Politecnico di Milano

Research on vision-based road line detection systems and their application to vehicular lateral control. Work conducted in collaboration with the Dept. of Mechanical Engineering of Politecnico di Milano for the development of an autonomous vehicle. This work led to two publications at international conferences.

September 2017 – August 2018

**Graduate student (M.Sc.),** McMaster University

Research on autonomous vehicles as part of a multidisciplinary team at the Centre for Mechatronics and Hybrid Technologies (CMHT). Focus on visual perception and road line detection within a larger project on vehicle pose estimation and behavior prediction.

## MSC THESES CO-SUPERVISED

- Continual learning for embodied AI: An empirical study of forgetting and transfer in visual odometry (Apr 2024)

- Neural Tangent Kernels for Maximum Mean Discrepancy: A Comprehensive Analysis (Apr 2024)
- Autonomous crop monitoring and mapping for plant nurseries (Sep 2023)
- Design, development, and validation of a skid-steering robot for agricultural terrains (Jul 2023)
- The lord of the sensors: a multi-sensor framework for SLAM (May 2023)
- Mapping of road markings for lane-based HD map generation (May 2023)
- Single-view shape reconstruction via image-conditioned 3D diffusion (Dec 2022)
- Real-time stabilization of inverse perspective mapping by exploiting lane markings invariants and vehicle angular velocity (Jul 2022)
- HD mapping and SLAM using road line markings for autonomous vehicles (Dec 2021)

## TEACHING EXPERIENCE

### Teaching assistant

2023/24	082746	FONDAMENTI DI INFORMATICA (Fundamentals of Computer Science)	Politecnico di Milano
2022/23	085851	INFORMATICA E ELEMENTI DI INFORMATICA MEDICA (Computer Science and Elements of Medical Informatics)	Politecnico di Milano
2021/22	089013	ROBOTICS	Politecnico di Milano
2020/21	089013	ROBOTICS	Politecnico di Milano

### Student Competitions

2022, 2023     Leading the Politecnico di Milano team at the [International Field Robot Event \(FRE\)](#) student competition

## PROFESSIONAL ASSOCIATIONS

- IEEE Member
- IEEE Intelligent Transportation Systems Society
- IEEE Computer Society
- AlxIA Member
- ContinualAI Unofficial Member

## GRANTS

- EurAI Travel Grant for ESSAI 2023 (2023): €400
- Departmental award for international summer school (2023): €500
- Departmental award for top-level publication (2022): €400
- Erasmus+ KA107 Double Degree Grant (2017): €7,970

## **ACADEMIC SERVICE**

### **Reviewer**

- IEEE Transactions on Intelligent Transportation Systems (T-ITS)
- IEEE International Conference on Robotics and Automation (ICRA)
- IEEE International Conference on Intelligent Transportation Systems (ITSC)
- IEEE Intelligent Vehicles Symposium (IV)
- IEEE International Conference on Metrology for eXtended Reality, Artificial Intelligence and Neural Engineering (MetroXRINE)

## **ADDITIONAL INFORMATION**

**Languages:** Italian (Native), English (C2), French (A2), German (A1)