Nico Catalano

PhD Candidate

Artificial Intelligence and Robotics Lab (AIRLab)
Department of Electronics, Information, and Bioengineering (DEIB)
Politecnico di Milano, Milan, Italy

nico.catalano@polimi.it | nicocatalano | Google Scholar

Education

Politecnico di Milano — *Milan, Italy*
PhD Computer Science and Engineering — *November 2021 - Present*
- Thesis: Few Shot Segmentation Combat Data Drought In Precision Agriculture
- Advisor: Prof. Matteo Matteucci

Eötvös Loránd University — *Budapest, Hungary*
MS Computer Science for Autonomous Systems — *August 2019 - June 2021*
- Thesis: Gaze-Based Social Region of Interest Detection of Humans
- Advisor: Prof. András Lőrincz

Kungliga Tekniska Högskolan — *Stockholm, Sweden*
MS Computer Science for Autonomous Systems — *August 2019 - June 2021*
- Minors in entrepreneurship

Politecnico di Milano — *Milan, Italy*
BS Computer Science and Engineering — *September 2016 - March 2020*

Research Intrests

My research lies at the intersection of Artificial Intelligence, Robotics, and Autonomous Systems, with a focus on Computer Vision. During my PhD at Politecnico di Milano, under the supervision of Prof. Matteo Matteucci, I investigated domain adaptation and learning from small data, focusing on scenarios where collecting and labeling large datasets is particularly challenging, such as agricultural robotics. In this context, I contributed to research on Few-Shot Segmentation and Domain Adaptation, developing methods to improve segmentation performance with minimal supervision.

To expand my expertise, I spent a research period at the Digital Signal Processing and Image Analysis lab at the University of Oslo, collaborating with Prof.Adín Ramírez Rivera on the analysis of Vision Transformer latent spaces for FSS and Semantic Segmentation using prototypical learning techniques. More recently, my research has evolved to explore the integration of Large Language Models with Computer Vision, leveraging textual information to enhance segmentation and video understanding tasks. This includes using multimodal approaches to refine segmentation predictions in Few-Shot Segmentation pipelines and incorporating language-driven reasoning for structured scene interpretation in video analysis.

Publications

Published

Nico Catalano, Monica Leone, and Matteo Matteucci.
Tackling Environmental Variability: Few Shot Segmentation for Domain-Adaptive Weed Segmentation in Agricultural Robotics.
In *International Conference on Automation Science and Engineering (CASE 2024)*, 2024.

Nico Catalano, Alessandro Maranelli, Agnese Chiatti, and Matteo Matteucci.
More than the Sum of Its Parts: Ensembling Backbone Networks for Few-Shot Segmentation.
In *International Joint Conference on Neural Networks (IJCNN)*, 2024.

Riccardo Bertoglio, Alessio Mazzucchelli, **Nico Catalano**, and Matteo Matteucci.
A comparative study of Fourier transform and CycleGAN as domain adaptation techniques for weed segmentation.
Smart Agricultural Technology, vol. 4, pp. 100188, 2023.

Agnese Chiatti, Riccardo Bertoglio, **Nico Catalano**,Matteo Gatti, and Matteo Matteucci.
Surgical fine-tuning for Grape Bunch Segmentation under Visual Domain Shifts.
In *2023 European Conference on Mobile Robots (ECMR)*, pp. 1–7. IEEE, 2023.

In Review

Nico Catalano, Sofia Matilde Luglio, Agnese Chiatti, Mino Sportelli, Christian Frasconi, Davide Facchinetti, Matteo Matteucci.
Balancing Accuracy and Cost in Precision Agriculture: a Few-Shot Learning Approach for Effictien Weed - Crop Segmentation.
in *Computer and Electronics in Agriculture*

Marius Aasan, Martine Hjelkrem-Tan, **Nico Catalano**, Changkyu Choi, Adín Ramírez Rivera.
Differentiable Hierarchical Tokenization for Vision Transformers
in *Conference on Computer Vision and Pattern Recognition*

Presentations

More than the Sum of Its Parts: Ensembling Backbone Networks for Few-Shot Segmentation.
In *International Joint Conference on Neural Networks (IJCNN)*, 2024.

Contributed Presentations

Tackling Environmental Variability: Few Shot Segmentation for Domain-Adaptive Weed Segmentation in Agricultural Robotics.
In *International Conference on Automation Science and Engineering (CASE 2024)*, 2024.

Teaching Experience

Fall 2024	**Fundamentals Of Computer Science**, Laboratory Assistant
Fall 2023	**Fundamentals Of Computer Science**, Laboratory Assistant
Spring 2022	**Game Development**, Laboratory Assistant
Fall 2022	**Fundamentals Of Computer Science**, Laboratory Assistant

Thesis Mentoring

2024 - Present	**Understanding Video Content with Multimodal Large Language Models and Graphs** Fabio Lusha
2024 - Present	**Visual Foundation Model for Few Shot Segmentation and Anomaly Detection** Paolo Pertino
2023	**Enhancing agricultural image embeddings for detecting weeds in few shot segmentation** Alessandro Maranelli https://hdl.handle.net/10589/214257
2022 - 2023	**The devil is in the details: a few-shot approach for small weeds segmentation** Monica Leone https://hdl.handle.net/10589/209137
2022 - 2023	**A Semi-Automatic Tool for Instance Segmentation** Maximilian Fehrentz

Outreach & Professional Development

Visiting Period

March 2024 - June 2024

Digital Signal Processing and Image Analysis (DSB) lab at the University of Oslo (UiO)

Collaboration with Prof. Adín Ramírez Rivera on the exploration of ViT latent spaces for Semantic Segmentation and Few Shot Segmentation.

Tool Development

2022 - 2023

Participation in the development of a semiautomatic segmentation tool for RGB images
https://github.com/maxfehrentz/SEMI-AUTOMATIC-SEGMENTATION-TOOL

Academic Reviews

- **Journals**: IEEE Access, IEEE Transactions on Circuits and Systems for Video Technology, IEEE/CAA Journal of Automatica Sinica, Springer Nature *The Visual Computer*, PLOS ONE.

- **Conferences**: IEEE International Conference on Automation Science and Engineering (CASE).