

# Lorenzo Pellegrini

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## Research themes

My research activity is focused on Artificial Intelligence and Computer Vision. In particular, my main research field is Continual Learning and concerns the experimentation and formulation of new methodologies to mitigate the phenomenon known as Catastrophic Forgetting. Another area to which I direct my research efforts is embedded and robotic systems, in the perspective of creating autonomous systems capable of showing Lifelong Learning characteristics in the presence of strong constraints on energy consumption and computational capabilities. My latest research efforts covered privacy-sensitive approaches to continual learning with Biometric data.

## Academic experience

### Current Placement

- 2022–now **Assegnista di Ricerca**, *University of Bologna, Cesena, Italy*
  - Supervisor: Prof. Davide Maltoni
  - Tema: Biometria e Machine Learning
  - Since: 01/02/2022
- 2023–now **Contract Professor, Programming**, *University of Bologna, Cesena, Italy*
  - programming course, laboratory module, Degree in Information systems technologies
  - 1 year.
- 2018–now **Teaching assistant, Machine Learning**, *University of Bologna, Cesena, Italy*
  - Machine Learning course, Master's Degree in Computer Science and Engineering.
  - 5 years.

### Previous

- 2021 **Research Intern**, *Facebook AI Research*
  - Supervisor: Dr. Abhijit Ogale
  - Perception and Action Group
  - 4 months

## Education

- 2018–2022 **Ph.D. in Computer Science and Engineering**, *Università di Bologna, Cesena, Italy*
  - Thesis: Continual learning for computer vision applications
  - Supervisor: Prof. Davide Maltoni
- 2015–2018 **M.S. in Computer Science and Engineering**, *Università di Bologna, Cesena, Italy, 110L/110 - Magna cum Laude*
  - Thesis: Integrazione Architetturale di Personal Assistant Agent basati su modello BDI con Servizi Cognitivi: Un Caso di Studio in Ambito Ospedaliero
  - Supervisor: Prof. Alessandro Ricci

2012–2015 **B.S. in Computer Science and Engineering**, *Università di Bologna*, Cesena, Italy, *110L/110 - Magna cum Laude*

- Thesis: Implementazione di una infrastruttura basata su Kafka e Storm per il Mobile Cloud computing
- Supervisor: Prof. Mirko Viroli

2007–2012 **Diploma**, *Liceo Scientifico Alessandro Serpieri*, Rimini, Italy, *86/100*

- PNI - Matematica, Fisica, Scienze naturali

## Teaching

### Contract Professor

2023–now **Contract Professor, Programming**, *University of Bologna*, Cesena, Italy

- programming course, laboratory module, Degree in Information systems technologies
- 1 year.

### Tutoring

2018–now **Teaching assistant, Machine Learning**, *University of Bologna*, Cesena, Italy

- Machine Learning course, Master's Degree in Computer Science and Engineering.
- 5 years.

2018/19 **Teaching assistant, Algoritmi e Strutture Dati**, *University of Bologna*, Cesena, Italy

- Algoritmi e Strutture Dati course, Bachelor's Degree in Computer Science and Engineering.
- 1 year.

## Awards

2021 **Best Library award**, *Workshop on Continual Learning in Computer Vision (CVPR 2021)*

2019 **2nd place, Lifelong robotic vision: object recognition challenge**, *IROS 2019*

## Chairing

Challenge Chair 4th Workshop on Continual Learning in Computer Vision *CVPR 2023*

Challenge Chair 3rd Workshop on Continual Learning in Computer Vision *CVPR 2022*

## Organization of competitions

2023 **4th CLVision Challenge**, *4th Workshop on Continual Learning in Computer Vision at CVPR 2023*

Competition on Continual Lifelong Learning in the novel Class-incremental with Repetition (CIR) setup.

Competition website: <https://sites.google.com/view/clvision2023/challenge>

2022 **3rd CLVision Challenge**, *3rd Workshop on Continual Learning in Computer Vision at CVPR 2022*

Competition on Continual Lifelong Learning for Object Detection in egocentric videos, based on an ad-hoc dataset (EgoObjects) provided by Meta.

Competition website: <https://sites.google.com/view/clvision2022/challenge>.

Report: <https://arxiv.org/abs/2212.06833>

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## Talks, presentations, tutorials

2023 **Oral presentation**, *IEEE International Joint Conference on Biometrics (IJCB)*

Detecting Morphing Attacks via Continual Distributed Training

Conference website: <https://ijcb2023.ieee-biometrics.org/>

2023 **Tutorial**, *IEEE International Joint Conference on Biometrics (IJCB)*

Face Recognition and Verification: recent trends and threats. An analysis of the state-of-the-art solutions and the development of methods to contrast the recently emerged Morphing Attack

Conference website: <https://ijcb2023.ieee-biometrics.org/>

2021 **Poster presentation**, *European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning (ESANN)*

Continual learning at the edge: Real-time training on smartphone devices

Conference website: <https://www.esann.org/proceedings/2021/>

2020 **Oral presentation**, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*

Latent replay for real-time continual learning

Conference website: <https://www.iros2020.org/>

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## Reviewing for International Journals

2023 **IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems**, <https://iee-ceda.org/publication/ieee-transactions-computer-aided-design-integrated-circuits-systems-tcad>, Online ISSN: 1937-4151

2022 **Neural Networks**, <https://www.sciencedirect.com/journal/neural-networks>, Online ISSN: 1879-2782

2022 **Machine Learning**, <https://www.springer.com/journal/10994>, Online ISSN: 1573-0565

2020 **IEEE Transactions on Neural Networks and Learning Systems**, <https://cis.ieee.org/publications/t-neural-networks-and-learning-systems>, Online ISSN: 2162-2388

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## Program Committee member

2023 **2nd EAI Conference on AI for People (CAIP)**, <https://aiforpeople.org/conference/>

2022 **2nd Workshop Towards a Complete Analysis of People: From Face and Body to Clothes at ICPR 2022 (T-CAP)**, <https://sites.google.com/view/t-cap2022/committee>

- 2022 **1st International Workshop and Challenge on People Analysis: From Face, Body and Fashion to 3D Virtual Avatars at ECCV (WCPA)**, <https://sites.google.com/view/wcpa2022/committee>
- 2021 **1st EAI Conference on AI for People: Towards Sustainable AI**, <https://aiforpeople.org/conference/2021/organisation.php>
- 2021 **1st Workshop Towards a Complete Analysis of People: From Face and Body to Clothes at ICIAP 2021 (T-CAP)**, <https://sites.google.com/view/t-cap2021/committee>
- 2020 **4th Lifelong Learning Workshop at ICML 2020 (LifelongML)**, <https://lifelongml.github.io/fourth-workshop/organizers/>

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## Reviewing for Conferences and Workshops

- 2023 **41st IEEE Conference on Robotics and Automation (ICRA)**
- 2023 **2nd EAI Conference on AI for People (CAIP)**
- 2023 **4th Workshop on Continual Learning in Computer Vision at CVPR 2023 (CLVISION)**
- 2022 **3rd Workshop on Continual Learning in Computer Vision at CVPR 2022 (CLVISION)**
- 2022 **2nd Workshop Towards a Complete Analysis of People: From Face and Body to Clothes at ICPR 2022 (T-CAP)**
- 2022 **1st International Workshop and Challenge on People Analysis: From Face, Body and Fashion to 3D Virtual Avatars at ECCV (WCPA)**
- 2021 **1st EAI Conference on AI for People (CAIP)**
- 2021 **2nd Workshop on Continual Learning in Computer Vision at CVPR 2021 (CLVISION)**
- 2021 **1st Workshop Towards a Complete Analysis of People: From Face and Body to Clothes at ICIAP 2021 (T-CAP)**
- 2020 **1st Workshop on Continual Learning in Computer Vision at CVPR 2020 (CLVISION)**
- 2020 **2020 IEEE International Conference on Evolving and Adaptive Intelligent Systems (EAIS)**
- 2020 **24th European Conference on Artificial Intelligence (ECAI)**
- 2020 **29th International Joint Conferences on Artificial Intelligence (IJCAI)**
- 2020 **4th Lifelong Learning Workshop at ICML 2020 (LifelongML)**

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## Software

April 2020 - **Lead Maintainer**, *Avalanche: an End-to-End Library for Continual Learning*, now ContinualAI, <https://avalanche.continualai.org/>

Avalanche is an end-to-end Continual Learning library based on Pytorch, born within ContinualAI with the unique goal of providing a shared and collaborative open-source (MIT licensed) codebase for fast prototyping, training and reproducible evaluation of continual learning algorithms.

The project currently has 1400 stars and 240 forks on GitHub: <https://github.com/ContinualAI/avalanche>.

I was the main designer and implementer of the first versions of Avalanche and I'm currently the Lead Maintainer of the Benchmarks module.

April 2020 - **Designer and Implementer**, *Avalanche: an End-to-End Library for Continual Learning*, SmartCity-BioLab, University of Bologna, <https://github.com/lrzpellegrini/CL-CORe-App/>

The CORe (Continual Object Recognition) App is an Artificial Vision application for Android devices that can classify objects from the CORe50 dataset and also learn how to classify objects of new categories by using the AR1\* Continual Learning Algorithm with Latent Replay (more info in the Papers sections). All the inference and training tasks are performed on-device, offline and without accelerators.

Short video demo: <https://youtu.be/Bs3tSjwbHa4>.

## Metrics

At 02/10/2023 ([Google Scholar profile](#)):

- Citations: 402
- H-Index: 8
- i10-index: 6

## Publications

### Thesis

L. Pellegrini, "Continual learning for computer vision applications," Ph.D. dissertation, Università di Bologna, 2022.

### Book Chapters

V. Lomonaco, L. Pellegrini, G. Graffieti, and D. Maltoni, "Architect, regularize and replay (arr): A flexible hybrid approach for continual learning," in *Towards Human Brain Inspired Lifelong Learning*, World Scientific Publishing, 2023.

### Journal

G. Graffieti, D. Maltoni, L. Pellegrini, and V. Lomonaco, "Generative negative replay for continual learning," *Neural Networks*, vol. 162, pp. 369–383, 2023, ISSN: 0893-6080. DOI: 10.1016/j.neunet.2023.03.006, [ScimagoJR: Q1 (Artificial Intelligence)].

L. Pellegrini, D. Maltoni, G. Graffieti, *et al.*, "A weakly supervised approach for recycling code recognition," *Expert Systems with Applications*, vol. 215, p. 119 282, 2023, ISSN: 0957-4174. DOI: 10.1016/j.eswa.2022.119282, [ScimagoJR: Q1 (Artificial Intelligence)].

A. Cossu, G. Graffieti, L. Pellegrini, *et al.*, "Is class-incremental enough for continual learning?" *Frontiers in Artificial Intelligence*, vol. 5, 2022, ISSN: 2624-8212. DOI: 10.3389/frai.2022.829842, [ScimagoJR: Q2 (Artificial Intelligence)].

V. Lomonaco, L. Pellegrini, P. Rodriguez, *et al.*, “Cvpr 2020 continual learning in computer vision competition: Approaches, results, current challenges and future directions,” *Artificial Intelligence*, vol. 303, p. 103 635, 2022, ISSN: 0004-3702. DOI: 10.1016/j.artint.2021.103635, [ScimagoJR: Q1 (Artificial Intelligence)].

H. Bae, E. Brophy, R. H. Chan, *et al.*, “Iros 2019 lifelong robotic vision: Object recognition challenge [competitions],” *IEEE Robotics and Automation Magazine*, vol. 27, no. 2, pp. 11–16, 2020. DOI: 10.1109/MRA.2020.2987186, [ScimagoJR: Q1 (Computer Science Applications)].

### Conference and Workshops

H. Hemati, A. Cossu, A. Carta, *et al.*, “Class-incremental learning with repetition,” in *2023 Conference on Lifelong Learning Agents*, 2023, Accepted, DOI pending.

L. Pellegrini, G. Borghi, A. Franco, and D. Maltoni, “Detecting morphing attacks via continual incremental training,” in *2023 IEEE International Joint Conference on Biometrics (IJCB)*, 2023, Accepted, oral presentation, DOI pending.

V. Lomonaco, L. Pellegrini, A. Cossu, *et al.*, “Avalanche: An end-to-end library for continual learning,” in *2021 IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops (CVPRW)*, 2021, pp. 3595–3605. DOI: 10.1109/CVPRW53098.2021.00399.

L. Pellegrini, L. Vincenzo, G. Graffieti, D. Maltoni, *et al.*, “Continual learning at the edge: Real-time training on smartphone devices,” in *2021 European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning (ESANN)*, 2021, pp. 23–28. DOI: 10.14428/esann/2021.ES2021-136.

V. Lomonaco, D. Maltoni, and L. Pellegrini, “Rehearsal-free continual learning over small non-i.i.d. batches,” in *2020 IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops (CVPRW)*, 2020, pp. 989–998. DOI: 10.1109/CVPRW50498.2020.00131.

L. Pellegrini, G. Graffieti, V. Lomonaco, and D. Maltoni, “Latent replay for real-time continual learning,” in *2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2020, pp. 10 203–10 209. DOI: 10.1109/IROS45743.2020.9341460.

L. Ravaglia, M. Rusci, A. Capotondi, *et al.*, “Memory-latency-accuracy trade-offs for continual learning on a risc-v extreme-edge node,” in *2020 IEEE Workshop on Signal Processing Systems (SiPS)*, 2020, pp. 1–6. DOI: 10.1109/SiPS50750.2020.9195220.