



# FRANCESCO IOLI, PhD

## Geomatics Researcher at CNR IRPI

Post-doctoral researcher at the **Research Institute for Geo-Hydrological Protection IRPI** at CNR (Italy), specialising in **photogrammetry and geoinformatics for environmental monitoring**. My research bridges the gap between traditional photogrammetry and modern computer vision, focusing on deep learning-based image matching and automated 3D reconstruction pipelines.

I have experience in multi-scale 4D monitoring, ranging from **low-cost terrestrial sensors** for high-frequency glacier dynamics to **satellite multi-view stereo** for regional mass balance studies (developed at University of Zurich).

I have strong coding skills and experience with HPC for processing large-scale geospatial data. As a strong advocate for open science, I actively develop open-source tools. My background includes field expertise as a certified UAV pilot and topographer.

### PERSONAL DETAILS

- 📍 Turin, Italy
- 👤 03/09/1995
- ID 0000-0001-7429-891X
- ✉️ francescoioli@cnr.it
- 🔗 [github.com/franioli](https://github.com/franioli)
- 🔗 [francesco-ioli](https://francesco-ioli.github.io)
- 🎓 Google Scholar
- ✉️ H-Index: 12

### LANGUAGES

- 🗣 Italian (Native)
- 🌐 English C1 (IELTS 2019)

### PROGRAMMING

- 🐍 Python ★★★★
- \_MATLAB Matlab ★★★★
- CPP C++ ★★★★
- >\_ Bash/Shell ★★★★

### PHOTOGRAMMETRY & LIDAR

- 渲 Agisoft Metashape
- 渲 Photomodeler
- 渲 CloudCompare
- 渲 COLMAP · MicMac
- 渲 OpenMVG · OpenDroneMap

### ► DEGREE

#### 2021 – 2024 PhD Environmental and Infrastructure Engineering

**Politecnico di Milano**, Milan, Italy

Major in Geomatics. Grade: Cum Laude.

Thesis: *Multi-temporal and Multi-scale photogrammetry for Alpine Glacier Monitoring*. Supervisor: prof. L. Pinto, co-supervisor: prof. F. Nex.

I developed an image-based system with low-cost stereo cameras for short-term 4D glacier monitoring. I developed a software pipeline for daily 3D reconstruction with extreme-wide baseline between the stereo cameras using deep learning feature matching. I contributed to [Deep-Image-Matching](#), a multi-view image matching library with deep learning for SfM. I applied UAV photogrammetry for structural health assessment, including automated crack detection on concrete bridges, and cultural heritage documentation.

### ► CURRENT EMPLOYMENT

#### 06/2025 – present Post-doctoral Researcher

**CNR IRPI**, Turin, Italy

Developing automated low-cost image analysis workflows for glacier instability risk management at Planpincieux Glacier (Mont Blanc, Italy). Enhancing the current monitoring systems using terrestrial stereoscopic time-lapse cameras for kinematics detection, ice avalanche monitoring, and velocity computation via Digital Image Correlation and Structure-from-Motion techniques. Results directly support expert decision-making for glacier instability risk mitigation. Working on historical aerial photogrammetry for the reconstruction of periglacier debris volume estimation.

### ► PREVIOUS WORK EXPERIENCE

#### 07/2025 – 12/2025 External consultant (20%)

**University of Zurich, Dept. of Geography**, Zurich, Switzerland

Finalized automated pipelines for regional-to-global scale Digital Elevation Model (DEM) reconstruction from satellite multi-view stereo for the Glombie-2 Glacier Mass Balance Intercomparison Exercise using UZH Slurm-based HPC clusters.

#### 10/2024 – 06/2025 Post-doctoral Researcher

**University of Zurich, Dept. of Geography**, Zurich, Switzerland

Developed automated pipelines for large-scale DEM reconstruction using satellite multi-view stereo for regional glacier mass balance assessments.

#### 2022 Topographic technical consultant (part-time)

**Prof. Alberto Bianchi**

Topographic consultant for the Technical Consultant of Office and Part (CTU) R.G. 717/2019

#### 2022 Topographic technician (part-time)

**Gini Telecom**

UAV surveys for telecommunication antennas

## TOOLS

- PyTorch
- PostgreSQL · PostGIS
- Docker
- Raspberry · Arduino
- Git · GitHub
- LaTeX

## OTHER SOFTWARE

- QGIS · ESRI ArcGIS
- RTKLib · Leica Infinity
- Photoshop · Lightroom
- GIMP · Inkscape
- AutoCAD

## OPERATING SYSTEMS

- Linux
- Windows

## HPC INFRASTRUCTURE

- Slurm workload manager
- Virtualization  
Proxmox · OpenStack (client)
- Cloud Computing  
DigitalOcean · Lambda.ai

## HOBBIES



## EDUCATION AND TRAINING

04/2022 - 07/2022	<b>Visiting PhD student</b> <b>University of Twente, ITC</b> , Enschede (NL) Developed a deep learning-based wide-baseline stereo matching workflow for 4D alpine glacier monitoring with low-cost time-lapse cameras. <a href="#">[Paper]</a> <a href="#">[Code]</a>
18 - 24/ 09/2022	<b>Summer School of Alpine Research</b> <b>University of Innsbruck</b> , Obergurgl (AT) Summer School <i>Close Range Sensing Techniques in Alpine Terrain</i> organized by Innsbruck University with ISPRS support. <a href="#">[Proceedings]</a>
09/2019 - 02/2020	<b>Visiting student for MSc Thesis</b> <b>Dept. VAW, ETH Zürich</b> , Zürich (CH) MSc Thesis: <i>Evaluation of Airborne Image Velocimetry approaches with low-cost UAVs in riverine environments</i> . Supervisors: Prof. Livio Pinto, Dr. Martin Detert. <a href="#">[Paper]</a>
2020	<b>Internship</b> <b>Dept. of Civil and Environmental Engineering, Politecnico di Milano</b> Performed topographic and UAV surveys for infrastructure health monitoring and territorial monitoring. Learnt basics of CAD modeling for technical drawing from 3D point clouds. Obtained A1/A3 and A2 UAV licenses with permission for flying in critical standard scenarios.
2019	<b>Erasmus Exchange</b> <b>Aalto University</b> , Helsinki, Finland Exchange semester with courses in laser scanning, remote sensing, image processing, hydrological modelling.
2017 - 2020	<b>MSc Environmental and Land Planning Engineering</b> <b>Politecnico di Milano</b> , Milan, Italy Major in Land Monitoring and Diagnostics. Grade: 110L/110.
2014 - 2017	<b>BSc Environmental and Land Planning Engineering</b> <b>Politecnico di Milano</b> , Milan, Italy Grade: 102/110.

## RESEARCH FUNDING AND GRANTS

MOHYCAM — *Modified HYdrogeological hazards under complex ClimAte and environmental conditions: Monitoring activities and mitigation strategies [2025–2027]* (Fondazione Cariplo, Grant #2024-3388 *Territori Sicuri*, €677,735; PI: Prof. Livio Pinto, Politecnico di Milano).

**Contributed to proposal writing** for addressing hydrogeological vulnerabilities at the Belvedere Glacier (Monte Rosa), by combining advanced glacier dynamics monitoring with community-based risk awareness strategies.

## RESEARCH OUTPUTS

- Total number of publications:** 24 (Source: Scopus).
- Metrics:** H-index: 12, Total Citations: 272+ (as of Feb 2026).
- Open Science:** 100% of recent research outputs (2020–2025) are available via Open Access (DOI links provided below).

### Selected Publications (10 most significant):

- Gaspari, F., F. Barbieri, R. Fascia, Ioli, F., L. Pinto, and F. Migliaccio (2025). “Strategies for Glacier Retreat Communication with 3D Geovisualization and Open Data Sharing”. In: *ISPRS Int. J. Geo-Inf* 14.2, p. 75. [10.3390/ijgi14020075](https://doi.org/10.3390/ijgi14020075).
- Ioli, F., N. Dematteis, D. Giordan, F. Nex, and L. Pinto (2024). “Deep Learning Low-cost Photogrammetry for 4D Short-term Glacier Dynamics Monitoring”. In: *PFG – Journal of Photogrammetry, Remote Sensing and Geoinformation Science*. [10.1007/s41064-023-00272-w](https://doi.org/10.1007/s41064-023-00272-w).
- Morelli, L., G. Perda, Ioli, F., P. Trybała, A. Sterpin, S. Rigon, N. Sutherland, M. Medici, F. Remondino, and A. Vitti (2024). “Co-registering Laser Scanning Point Clouds and Photogrammetric Images with Deep Learning Multi-Modal Matching”. In: *Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci.*, XLVIII-2/W8-2024, pp. 335–342. [10.5194/isprs-archives-XLVIII-2-W8-2024-335-2024](https://doi.org/10.5194/isprs-archives-XLVIII-2-W8-2024-335-2024).

- Morelli, L., Ioli, F., F. Maiwald, G. Mazzacca, F. Menna, and F. Remondino (2024). "Deep-Image-Matching: a Toolbox for Multi-view Image Matching of Complex Scenarios". In: *Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci.*, XLVIII-2/W4-2024, pp. 309–316. [10.5194/isprs-archives-XLVIII-2-W4-2024-309-2024](https://doi.org/10.5194/isprs-archives-XLVIII-2-W4-2024-309-2024).
- Gaspari, F., F. Barbieri, R. Fascia, Ioli, F., and L. Pinto (2024). "An Open-Source Web Platform for 3D Documentation and Storytelling of Hidden Cultural Heritage". In: *Heritage* 7.2, pp. 517–536. [10.3390/heritage7020025](https://doi.org/10.3390/heritage7020025).
- Morelli, L., Ioli, F., R. Beber, F. Menna, et al. (2023). "COLMAP-SLAM: a Framework for Visual Odometry". In: *Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci.*, XLVIII-1/W1-2023, pp. 317–324. [10.5194/isprs-archives-XLVIII-1-W1-2023-317-202](https://doi.org/10.5194/isprs-archives-XLVIII-1-W1-2023-317-202).
- Ioli, F., A. Bianchi, A. Cina, C. De Michele, et al. (2022). "Mid-Term Monitoring of Glacier's Variations with UAVs: The Example of the Belvedere Glacier". In: *Remote Sensing* 14, p. 28. [10.3390/rs14010028](https://doi.org/10.3390/rs14010028).
- Ioli, F., A. Pinto, and L. Pinto (2022). "UAV-Photogrammetry for Metric Evaluation of Concrete Bridge Cracks". In: *Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci.*, XLIII-B2-2022, pp. 1025–1032. [10.5194/isprs-archives-XLIII-B2-2022-1025-2022](https://doi.org/10.5194/isprs-archives-XLIII-B2-2022-1025-2022).
- Gaspari, F., Ioli, F., F. Barbieri, E. Belcore, and L. Pinto (2022). "INTEGRATION OF UAV-LIDAR AND UAV-PHOTOGRAFMETRY FOR INFRASTRUCTURE MONITORING AND BRIDGE ASSESSMENT". In: *Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci.*, XLIII-B2-2022, pp. 995–1002. [10.5194/isprs-archives-XLIII-B2-2022-995-2022](https://doi.org/10.5194/isprs-archives-XLIII-B2-2022-995-2022).
- De Gaetani, C. I., Ioli, F., and L. Pinto (2021). "Aerial and UAV Images for Photogrammetric Analysis of Belvedere Glacier Evolution in the Period 1977–2019". In: *Remote Sensing* 13, p. 3787. [10.3390/rs13183787](https://doi.org/10.3390/rs13183787).

For complete publication list, see [Scopus profile: scopus.com/authid/detail.uri?authord=57219022961](#)

#### Software, Datasets & Infrastructure:

- Deep-Image-Matching** (Core Contributor): Toolbox for multi-view image matching with traditional and deep learning algorithms. [\[GitHub\]](#) [\[Paper\]](#)
- ICEPy4D** (Lead Developer): Open-source Python toolkit for 4D glacier monitoring using Deep Learning photogrammetry. [\[GitHub\]](#) [\[Paper\]](#)
- Belvedere Glacier Open Data & Web-GIS Platform**: Curated dataset (Zenodo DOI: [10.5281/zenodo.10817029](https://doi.org/10.5281/zenodo.10817029)) and interactive web platform for glacier documentation and storytelling. [\[Web-app\]](#)
- Satellite Multi-View Stereo Pipeline**: Automated HPC workflow (Slurm) for regional-scale DEM reconstruction from satellite imagery, with applications in glacier mass balance (University of Zurich).
- COLMAP-SLAM Framework** (Core contributor): Visual odometry system for real-time photogrammetric positioning. [\[GitHub\]](#) [\[Paper\]](#)

#### PhD Thesis:

- PhD Thesis** (2024): *Multi-temporal and Multi-scale photogrammetry for Alpine Glacier Monitoring*. Politecnico di Milano. Grade: Cum Laude. [\[Handle\]](#)

### ► RESEARCH SUPERVISION AND LEADERSHIP EXPERIENCE

2024 – present	<b>PhD Student Mentoring</b>	<b>University of Zurich &amp; CNR IRPI</b>
Mentoring and co-supervision of PhD candidates R. Pedrelli (UZH) and D. Cardone (CNR IRPI). Providing technical guidance on photogrammetric pipelines, satellite multi-view stereo, and glacier monitoring workflows.		
2019 – 2024	<b>MSc Thesis Co-supervisor</b>	<b>Politecnico di Milano</b> ,  Milan, Italy

Supervised 6 Master's theses in Environmental and Land Planning Engineering:

- L. Cerina (2024): Very-High Resolution Satellite Stereo Images for Alpine Glacier Monitoring. Supervisor: prof. L. Pinto.
- S. Bonora (2024): Progettazione e implementazione di un database georeferenziato per il monitoraggio del Ghiacciaio del Belvedere. Supervisor: prof. F. Migliaccio.
- I. Pincolini (2022): Digital Image Correlation for ice flow velocity estimation: a case study on the Belvedere Glacier with UAV orthophotos. Supervisor: prof. L. Pinto.
- F. Barbieri (2021): Monitoraggio di aree alpine inaccessibili con fotogrammetria UAV low-cost. Supervisor: prof. L. Pinto.
- A. Pinto (2021): Tecniche fotogrammetriche da drone per la ricostruzione metrica di fessure su ponti in calcestruzzo. Supervisor: prof. L. Pinto.
- F. Ferrario (2020): Triangolazione aerea assistita da DGPS in fotogrammetria da UAV: sperimentazione di una soluzione a basso costo per il DJI Matrice 210 V2. Supervisor: prof. L. Pinto.

### ► TEACHING MERITS

2020 – 2024	<b>Teaching Assistant</b>	<b>Politecnico di Milano</b> ,  Milan, Italy
Provided academic support and laboratory tutoring for MSc and BSc courses: Photogrammetry and UAV surveying (MSc): Fall 2024 <i>Trattamento delle Osservazioni</i> (Statistics) (BSc): Fall 2020, 2021, 2022, 2023 <i>Sistemi Informativi Territoriali</i> (GIS) (BSc): Spring 2020, 2021 <i>Tecniche di rilievo e modellazione 3D per l'architettura</i> (3D Modelling for Architecture) (BSc): Spring 2020, 2021, 2022.		
2021 – 2025	<b>Tutor in Summer Schools</b>	<b>Politecnico di Milano</b> ,  Belvedere Glacier, Macugnaga, Italy

*Design and Execution of Topographic Surveys for Land Monitoring* @ Belvedere Glacier aimed at introducing BSc and MSc students to topographic fieldwork in mountain environments.

2024	<b>Open Data Day 2024</b>	<b>Open Knowledge Foundation</b>
	Awarded for the <a href="#">Open Data Day 2024 mini-grant</a> for the organization of the webinar <a href="#">Mapping Climate Change in 4D: Belvedere Glacier's Open Geo Data for Education and Research</a> [Event Report]	
2023	<b>EGU Higher Education Teaching Grant 2023</b>	<b>EGU</b>
	Winner of the <a href="#">EGU Higher Education Teaching Grant 2023</a> for the open teaching material for the Summer School "Design and implementation of topographic surveys for territorial monitoring in mountain environments" [Teaching material]	

## ► AWARDS AND HONOURS

- Marie Curie Seal of Excellence – MSCA Postdoctoral Fellowship 2024 (score: 92.8) and 2025 (score: 95.4)
- Winner of the prize for young researchers *Premio Giovani 2023 – Sezione Ricerca* organized by the Italian Society of Photogrammetry and Topography SIFET during the congress *65° Convegno Nazionale SIFET*, with the contribution *Monitoraggio 4D ad alta frequenza di ghiacciai alpini tramite camere time-lapse a basso costo e Deep Learning Structure-from-Motion*.
- Finalist in the [EGU2024 Photo Competition](#)

## ► OTHER KEY ACADEMIC MERITS

### Presentations in Scientific Conferences

- 2025: EGU - Wien (oral) [[Abstract](#)], Alpine Glaciological Meeting - Innsbruck (poster) [[Abstract](#)].
- 2024: EGU - Wien (oral) [[Abstract](#)].
- 2023: EGU - Wien (oral) [[Abstract](#)], ISPRS Geospatial Week - Cairo (oral) [[Paper](#)], VGC Dresden (oral) [[Proceedings](#)], SIFET congress - Arezzo (IT) (oral) [[Link](#)], GeoAI - Torino (IT) (oral) [[Link](#)].
- 2022: EGU - Wien (oral) [[Abstract](#)], ISPRS Congress - Nice (poster) [[Paper](#)].

### Memberships & Peer Review

- Reviewer for: *ISPRS Journal of Photogrammetry and Remote Sensing*, *Remote Sensing (MDPI)*, *Drones (MDPI)*, *Earth Surface Dynamics*, *Geoscientific Instrumentation, Methods and Data Systems*
- Member of: EGU (European Geosciences Union), SIFET (Italian Society of Photogrammetry and Topography).

## ► ADDITIONAL INFORMATION

- UAS License: EASA A2 Open Category with Critical Scenario authorization
- Driver's license: B
- Professional qualification: Italian *Esame di Stato* for civil and environmental engineers
- Volunteer Experience:
  - Protect our Winters - POW (Climate advocacy, 2025–now);
  - Apwoyo (Homeless support, 2023–2024);
  - AGESCI Scout Chief (Education, 2017–2023);
  - Operazione Mato Grosso (Charity, 2016–2017);
  - Libera (Anti-mafia association, 2012–2016).

According to Regulation of the European Parliament 679/2016, I hereby express my consent to process and use my data in this CV and application for recruiting purposes.