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
0000-0001-7429-891X
francescoioli@cnr.it
github.com/franioli
francesco-ioli
Google Scholar
H-Index: 12

LANGUAGES

Italian (Native)
English C1

PROGRAMMING

Python ★★★★★
Matlab ★★★★☆
C++ ★★★★☆
Bash/Shell ★★★★☆

PHOTOGRAMMETRY & LIDAR

Agisoft Metashape
Photomodeler
CloudCompare
COLMAP · MicMac
OpenMVG · OpenDroneMap

DEGREE

2021 – 2024 **PhD Environmental and Infrastructure Engineering**
Dept. of Civil and Environmental 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 R2**
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 Glambie-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
Visiting PhD student
University of Twente, ITC, Enschede (NL)
Developed a deep learning-based wide-baseline stereo matching workflow for 4D alpine glacier monitoring with low-cost time-lapse cameras. [Paper] [Code]

18 – 24/09/2022
Summer School of Alpine Research
University of Innsbruck, Obergurgl (AT)
Summer School *Close Range Sensing Techniques in Alpine Terrain* organized by Innsbruck University with ISPRS support. [Proceedings]

09/2019 – 02/2020
Visiting student for MSc Thesis
Dept. VAW, ETH Zürich, Zürich (CH)
MSc Thesis: *Evaluation of Airborne Image Velocimetry approaches with low-cost UAVs in riverine environments*. Supervisors: Prof. Livio Pinto, Dr. Martin Detert. [Paper]

2020
Internship
Dept. of Civil and Environmental Engineering, Politecnico di Milano
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 critial standard scenarios.

2019
Erasmus Exchange
Aalto University, Helsinki, Finland
Exchange semester with courses in laser scanning, remote sensing, image processing, hydrological modelling.

2017 – 2020
MSc Environmental and Land Planning Engineering
Politecnico di Milano, Milan, Italy
Major in Land Monitoring and Diagnostics. Grade: 110L/110.

2014 – 2017
BSc Environmental and Land Planning Engineering
Politecnico di Milano, 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** as work package leader.
MOHYCAM project aims 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.
- **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.
- 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.

- 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.
- 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.
- 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.
- **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.
- **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.
- Gaspari, F., **Ioli, F.**, F. Barbieri, E. Belcore, and L. Pinto (2022). "INTEGRATION OF UAV-LIDAR AND UAV-PHOTOGRAMMETRY 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.
- 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.

For complete publication list, see Scopus profile: scopus.com/authid/detail.uri?authorId=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) 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

PhD Student Mentoring

University of Zurich & CNR IRPI

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

MSc Thesis Co-supervisor

Politecnico di Milano , Milan, Italy

Co-supervised 6 Master's theses in Environmental and Land Planning Engineering (2020-2024):

- 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

Teaching Assistant

Politecnico di Milano , Milan, Italy

Provided academic support and laboratory tutoring for MSc and BSc courses:

- Photogrammetry and UAV surveying (MSc): Fall 2024
- *Trattamento delle Osservazioni* (Statistics) (BSc): Fall 2020, 2021, 2022, 2023
- *Sistemi Informativi Territoriali* (GIS) (BSc): Spring 2020, 2021
- *Tecniche di rilievo e modellazione 3D per l'architettura* (3D Modelling for Architecture) (BSc): Spring 2020, 2021, 2022.

2021 - 2025 **Tutor in Summer Schools** **Politecnico di Milano** , Belvedere Glacier, Macugnaga, Italy

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

2024 **Open Data Day 2024** **Open Knowledge Foundation**

Awarded for the Open Data Day 2024 mini-grant for the organization of the webinar *Mapping Climate Change in 4D: Belvedere Glacier's Open Geo Data for Education and Research* [Event Report]

2023 **EGU Higher Education Teaching Grant 2023** **EGU**

Winner of the EGU Higher Education Teaching Grant 2023 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.