FRANCESCO IOLI

Geomatics Researcher at CNR IRPI

PhD in Geoinformatics

Post-doctoral researcher at **CNR IRPI**, specializing 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 infrastructure for large-scale geospatial data processing. As a strong advocate for open science, I actively develop open-source tools (e.g. Deep-Image-Matching). 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 (IELTS 2019)

PROGRAMMING

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

PHOTOGRAMMETRY & LIDAR

Agisoft Metashape
Photomodeler
CloudCompare
COLMAP MicMac
OpenMVG ODM

TOOLS

PyTorch
PostgreSQL PostGIS

DEGREE

2021 – 2024 **PhD Environmental and Infrastructure Engineering**
Politecnico di Milano, Milan, Italy
Major in Geoinformatics. PhD Thesis: *Multi-temporal and Multi-scale photogrammetry for Alpine Glacier Monitoring*. Grade: Cum Laude.
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
Research on photogrammetry and 3D reconstruction pipelines for geo-hydrological hazard monitoring. Development of automated processing workflows for UAV and satellite imagery.

PREVIOUS WORK EXPERIENCE

07/2025 – 12/2025 **External consultant (20%)**
University of Zurich, Dept. of Geography, Zurich, Switzerland
I completed the development of automated pipelines for regional-to-global-scale DEM reconstruction using satellite multi-view stereo, with applications in glacier mass balance studies. for Glambie-2 Glacier Mass Balance Intercomparison Exercise submission....Leveraged HPC clusters (Slurm) for large-scale multi-view stereo processing.

10/2024 – 06/2025 **Post-doctoral Researcher**
University of Zurich, Dept. of Geography, Zurich, Switzerland
I developed automated pipelines for large-scale DEM reconstruction using satellite multi-view stereo, with applications in glacier mass balance studies.

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

EDUCATION AND TRAINING

Docker
Raspberry Arduino
Git GitHub
LaTeX

OTHER SOFTWARE

QGIS ESRI ArcGIS
RTKLib Leica Infinity
Photoshop Lightroom
GIMP Inkscape
AutoCAD

OPERATING SYSTEMS

INFRASTRUCTURE

HPC
Slurm workload manager
Virtualization
Proxmox & OpenStack (client)

HOBBIES

CERTIFICATIONS

Professional Engineer
Italian *Esame di Stato* (Civil/Env)
UAS Pilot License
EASA A2 Open & Critical Scenario
Driver's License (B)

04/2022-07/2022 **Visiting PhD student**
University of Twente, ITC (NL)
Development of a deep learning wide-baseline stereo matching workflow for 4D monitoring of an alpine glacier with low-cost time-lapse cameras. [Paper] [Code]

18 - 24/09/2022 **Summer School of Alpine Research**
University of Innsbruck, Obergurgl (AT)
I participated in the 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**
ETH Zürich, VAW (CH)
Evaluation of Airborne Image Velocimetry approaches with low-cost UAVs in riverine environments. Supervisors: Prof. Livio Pinto, Dr. Martin Detert [Thesis] [Paper]

2020 **Internship**
Politecnico di Milano, Dept. of Civil and Environmental Engineering
I learnt how to design and carry out topographic and UAV photogrammetric surveys for infrastructure and land monitoring. I learnt basics of AutoCAD for technical drawing from 3D point clouds. I obtained the A1/A3 and A2 UAV licenses with permission for flying in critical scenarios.

2019 **Erasmus Exchange**
Aalto University, Helsinki, Finland
Courses in remote sensing, GIS, and environmental engineering.

2017 - 2020 **MSc Environmental Engineering**
Politecnico di Milano, Milan, Italy
Major in Land Monitoring. Thesis on UAV photogrammetry for glacier monitoring. Grade: 110L/110.

2014 - 2017 **BSc Environmental Engineering**
Politecnico di Milano, Milan, Italy
Thesis on UAV snowpack surveys on Belvedere glacier. Grade: 102/110.

RESEARCH FUNDING AND GRANTS

.....MENTION TO CARIPLO PROJECT

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 & CNR IRPI).
- **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 Co-supervisor — University of Zurich & CNR IRPI

Co-supervision of PhD candidates .....

2019 – 2024

MSc Thesis Co-supervisor — Politecnico di Milano, 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

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 @ 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 General Assembly, Vienna (Oral) [Abstract]; Alpine Glaciology Meeting, Innsbruck (Poster).
- **2024:** EGU General Assembly, Vienna (Oral) [Abstract].
- **2023:** ISPRS Geospatial Week, Cairo (Oral); EGU General Assembly, Vienna (Oral); VGC, Dresden (Oral); SIFET Congress, Arezzo (Oral); GeoAI, Turin (Oral).
- **2022:** EGU General Assembly, Vienna (Oral); ISPRS Congress, Nice (Poster).

Memberships & Peer Review

- Reviewer for: *ISPRS Journal of Photogrammetry and Remote Sensing*, *Remote Sensing*, *The Cryosphere*.
- Member of: EGU (European Geosciences Union), SIFET (Italian Society of Photogrammetry and Topography).

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