Alberto Rota

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Experience

Present — Feb 2023 **PhD Student Researcher** - Asensus Surgical Inc.
Focus: Computer Vision Deep Learning methods for enhancing the spatial and contextual informative content of endoscopic image data, with focus on 3D reconstruction and occlusion restoration

- Developed, applied and surpassed state-of-the-art models and pipelines targeted at recovering 3D information from 2D endoscopic image data, with strong focus on self-supervised frameworks [NDA]
- Researched, developed and tested geometry-aware learned representations of 3D endoscopic spaces and 2D images [NDA]
- Worked in structured teams, both in contributing and leading positions
- Gained project management, time management and DevOps skills

Present — Sep 2023 **Teaching Assistant** - NEARLab Medical Robotics, Politecnico di Milano
Primary Course: Technologies for Motor Behavior Analysis and Virtual Modeling
Guest Lectures at: Medical Robotics and Technologies for Computer Aided Surgery

- Gained communication, didactic and public speaking skills

Present — Oct 2023 **Scientific Communicator** - Politecnico di Milano
Course: *Understanding Artificial Intelligence*

- Introduced the basics of neural networks and data-driven algorithms interactively to high school students, reaching out to over 16 schools and 500 students over the course of 2 years
- Developed didactic and teaching skills

Education

Ongoing — Feb 2023 **Ph.D in Bioengineering** - Politecnico di Milano & Asensus Surgical Inc., Milan, IT
Focus: Computer Vision applications for enhanced spatial context awareness in surgical robotics

Dec 2025 — July 2025 **Visiting Research Fellow** - Chair of Photogrammetry and Remote Sensing, TUM, Munich, DE
Focus: Geometry-guided reconstruction for challenging visual domains.

Dec 2022 — Sep 2020 **MSc in Bioengineering** - Politecnico di Milano, Milan, IT
Focus: AI and Computer Vision methods for 3D data in bioengineering; Virtualization of teleoperated surgical robotic environments

Tech Stack

ML/AI	Python, PyTorch, SciKit, WandB	*Research*	MATLAB, LaTeX, Consensus
CV	OpenCV, Open3D, Huggingface, Rerun	*Robotics*	ROS, Unity
DevOps	Docker, Git, Slurm, Tailscale	*3D/CAD*	Blender, Autodesk Inventor
Coding	C, C#, C++	*Graphics*	Figma
LLMs	Claude, ChatGPT, Cursor, MCP	*Misc*	OpenFOAM, Wordpress, MS Office

Research Project Contributions

Jun 2026 — Jul 2025 **UnReflectAnything [CVPR 2026 ORAL]** - Project Lead and Primary Contributor
Conceived, developed, and led the full research agenda of *UnReflectAnything*, an RGB-only framework that removes specular highlights from arbitrary images by predicting a highlight map and reconstructing a reflection-free diffuse image. [1]

- Designed and implemented a physically grounded synthetic ground-truth pipeline for virtually rendering and compositing specular highlights onto any RGB image
- Built and trained a token-space inpainting module capable of removing specularities and restoring diffuse illumination at the feature level
- Achieved competitive or state-of-the-art performance across multiple quantitative metrics compared to leading delighting and reflection removal methods
- Selected as CVPR Oral presentation and Award Candidate, ranking in the top 2% of submissions

Jul 2025 – Dec 2024 **Self-Supervised Feature Matching in Endoscopic Surgery** - Sole contributor

Developed an end-to-end self-supervised pipeline based on novel-view synthesis and contrastive optimization for semantic embedding adaptation of DINOv2 features towards a pixel matching task in the surgical endoscopy domain [2] [NDA]

- Ideated and developed an SSL pipeline for establishing pseudo-ground-matches in source-synthetic endoscopic image pairs to be used for contrastive learning
- Trained an adapter for DINOv2 to produce localized semantics to be used for correspondance tasks
- Surpassed state-of-the-art models pixel matching tasks on surgical endoscopy imagery

Ongoing – Mar 2026 **SpectraBREAST** - Computer Vision Pipeline leader

Leading the research agenda, pipeline development and deployment for the computer vision workpackage of the EU-funded SpectraBREAST project, including 3D reconstruction tasks and Hyperspectral registration task. [3]

- Successfully deployed a 3D reconstruction and registration framework for reconstructing hyperspectral 3D geometry from scans of *ex-vivo* breast lumpectomy specimens
- Supervised a team of 2 people, collaborating with multi-disciplinary teams

Jul 2022 – Mar 2020 **µVES - microVascular Evaluation System** - Leader and Primary contributor

Built a fully automated pipeline for the topological and morphological analysis of 3D micro-vascular networks images from confocal microscopy, with Deep-Learning-based confocal image segmentation and integration with a CFD simulation software [4]

- Built and trained a 3D U-Net for segmentation of 3D confocal microscopy images.
- Developed a complete pipeline for quantitative analysis inclusive of segmentation, skeletonization, and quantitative morphological measurements
- Primarily contributed and lead a team of 4 researchers, mastering problem-solving and leadership skills

Dec 2020 – Feb 2022 **STEVE - Surgical Training Enhanced Virtual Environment** - Sole contributor

Built a virtual reality training environment targeting teleoperated surgical robotics, enhanced with visuo-haptic assistance-as-needed guidance, personalized adaptive difficulty and visual feedback for haptic force training [5]

- Built a VR simulator for surgical robotics in C# with Unity, connected via ROS to a teleoperation console. Developed haptic assistance-as-needed guidance algorithms
- Planned and conducted and experimental study for statistical validation of the effect of the guidance strategies
- Supervised MSc students on the development and integration of surgical tasks with morpho-adaptive difficulty and visual feedback for grasping force training

Mar 2025 – Oct 2024 **OVIT - Ovarian Cancer Resectability Prediction** - Minor Contributor

Participated in the development of a Deep Learning decision-support-system for Ovarian Cancer treatment planning [6]

- Contributed to the development, statistical validation and academic publication of the pipeline
- Designed and assembled a heavy-duty multi-GPU workstation for the clinical Deep Learning workload, with remote SSH/VNC access, Dockerized environments, and strict adherence to GDPR and data privacy best practices

Open Source Contributions

Maintainer – Dec 2024 **Ground Control** - Open-source Python Package

A Terminal-based package for monitoring system hardware in real time with rich plots and graphics in the terminal. Aimed for multi-GPU machines and ML workflows. & `PyPI`

Maintainer – Apr 2025 **DaSSHboard** - VSCode Extension

A stylish customizable VS Code extension to manage multiple SSH remote connections with a smart one-click dashboard for faster access to remote development. &

Contributor – Jul 2025 **MedView** - VSCode Extension

A fast environment to preview and interact with medical images directly from a code editor, with support for `.nii` and `.dcm` files, aimed at streamlining AI development tasks in the medical image analysis field. &

Awards

Jun 2023 **Best Application Award** - Hamlyn Surgical Robotics challenge 2023
Haptic assistance for improving skill transfer in surgical robotics training

Apr 2022 **Best Development Award** - PoliMi Capstone Projects 2022
SPINTEST - Data-Driven Compliancy Assessment for Extra-Corporeal Centrifugal Blood Pumps

Selected Research Papers

[1] **Alberto Rota**, Mert Kiray, Mert Asim Karaoglu, Patrick Rukhamp, Elena De Momi, Nassir Navab, and Benjamin Busam. UnReflectAnything: RGB-only highlight removal by rendering synthetic specular supervision. *Computer Vision and Pattern Recognition - CVPR*, 2026.

[2] **Alberto Rota** and Elena De Momi. Self-supervised contrastive embedding adaptation for endoscopic image matching. *IEEE Transaction on Medical Imaging*, 2025 - *Under Review*.

[3] Anna Bicchi*, **Alberto Rota***, Leonardo Passoni*, Nicola Ancellotti, Andrea Peroni, Lorenzo Vinco, Dario Polli, and Elena De Momi. A lightweight fiducial-based pipeline for 3d hyperspectral mapping of ex-vivo lumpectomy specimens, 2026.

[4] **Alberto Rota**, Luca Possenti, Giovanni S Offeddu, Martina Senesi, Adelaide Stucchi, Irene Venturelli, Tiziana Rancati, Paolo Zunino, Roger D Kamm, and Maria Laura Costantino. A three-dimensional method for morphological analysis and flow velocity estimation in microvasculature on-a-chip. *Bioengineering & Translational Medicine*, 2023.

[5] **Alberto Rota**, Ke Fan, and Elena De Momi. Implementation and assessment of an augmented training curriculum for surgical robotics. In *2023 IEEE International Conference on Robotics and Automation (ICRA)*, 2023.

[6] Francesca Fati, Marina Rosanu, Luigi De Vitis, and **Alberto Rota** *et al.* Deep learning for decision support in ovarian cancer treatment planning. *Nature Women's Health*, 2025 - *Under Review*.

[7] Francesca Fati, **Alberto Rota**, Adriana V. Gregory, Anna Catozzo, Maria C. Giuliano, Mrinal Dhar, Luigi De Vitis, Annie T. Packard, Francesco Multinu, Elena De Momi, Carrie L. Langstraat, and Timothy L. Kline. Adapting foundation models for annotation-efficient adnexal mass segmentation in cine images. *CVPR Workshop on Subtle Visual Computing*, 2026.

[8] Junling Fu*, **Alberto Rota***, Shufei Li, Jianzhuang Zhao, Qingsheng Liu, Elisa Iovene, Giancarlo Ferrigno, and Elena De Momi. Recent advancements in augmented reality for robotic applications: A survey. In *MDPI Actuators*, 2023.

Disclosures

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Accessibility I authorize the publication and the complete accessibility of this CV according to the italian D. Lgs n. 33 of March 14 2013.

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