Alberto Rota

alberto_rota@outlook.com | albe-rota | alberto-rota | Milan, Italy

Experience

Present **PhD Student Researcher** - Asensus Surgical Inc.
Feb 2023 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 **Teaching Assistant** - NEARLab Medical Robotics
Sep 2023 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 **Scientific Communicator** - Politecnico di Milano
Oct 2023 Course: *Understanding Artificial Intelligence*

- Introduced the basics of neural networks and data-driven algorithms interactively to high school students, reaching out to over 12 schools and 500 students over the course of 2 years
- Developed didactic and teaching skills

Education

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

Dec 2025 **Visiting Research Fellow** - Computer Aided Medical Procedures Lab, TUM, Munich, DE
July 2025 Focus: Implicit neural representation for spatial reconstruction in endoscopic surgery

Dec 2022 **MSc in Bioengineering** - Politecnico di Milano, Milan, IT
Sep 2020 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	*3D/CAD*	Blender, Autodesk Inventor
Coding	C, C#, C++	*Graphics*	Figma
LLMs	Claude, ChatGPT, Cursor, MCP	*Misc*	OpenFOAM, Wordpress, MS Office

AI Tooling and Prompt Engineering

Coding	Advanced prompt engineering for code generation, debugging, refactoring, technical documentation, task decomposition and iterative development	*Claude*, *Cursor*
Research	Literature review automation, paper summarization, research synthesis, crafting of queries for comprehensive academic search and analysis.	*ChatGPT*, *Consensus*
Writing	Advanced prompt engineering for academic writing, manuscript revision, tone adaptation, clarity enhancement and communication.	*Claude*, *ChatGPT*
Image Gen	Competent in generating and refining synthetic visual content with diffusion-based models.	*DALL-E*

Project Contributions

May 2025 – Dec 2024 **Self-Supervised Image 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 [1] [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 for pixel matching tasks

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 [2]

- 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 [3]

- 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 [4] and visual feedback for grasping force training

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

Participated in the development of a Deep Learning decision-support-system for Ovarian Cancer treatment planning [5]

- 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

Maintain. 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`

Maintain. 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. &

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 Centrifual Blood Pumps

Selected Research Papers

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

[2] **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 🔗.

[3] **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 🔗.

[4] **Alberto Rota**, Federica Xianyi Sun, and Elena De Momi. Performance-driven tasks with adaptive difficulty for enhanced surgical robotics training. In *2023 IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics (BioRob)*, 2023 🔗.

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

[6] 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

GDPR I authorize the processing of personal data according to EU Regulation 679/2016 or according to the reader's local regulations if not in the EU

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

NDA Research work in this CV tagged with [NDA] has been carried out under IP protection policies and a Non-Disclosure Agreement. Details available upon request and on a subject basis.