Stefano Moriconi

Lead Scientist & Innovator with Technological & Strategic Vision | Email | Homepage | LinkedIn



Summary

Biomedical engineer, medical-imaging scientist, and translational researcher with 15+ years across industry, hospitals, and academia. Distinctive profile spanning clinical translational imaging and neurosurgical tooling, simulation-ready digital twins and high-performance compute (CUDA/edge), and frontier AI/ML – from generative imaging models to locally-hosted agentic stacks – unified by a track record of moving early applied concepts into production.

Impact & Scale

- **Flagship impact:** One of my flagship result is the re-design of the stroke-triage workflow at the Queen Square Institute of Neurology (UCLH), where my neurovascular imaging work – including early pulmonary-embolism diagnosis from thoracic CTA during the pandemic, done at King's College London with NHS Guy's and St Thomas' Hospitals – changed how patients are triaged.
- **Clinical scale:** trained and validated on large cohorts incl. SABRE longitudinal brain dataset, UK Biobank.
- **Compute:** NVIDIA DGX Spark, UCL & KCL HPC clusters, NVIDIA Cambridge-1 (Cambridge cluster), NVIDIA CLARA edge device.
- **Distributed training & inference:** PDDN trained from scratch across heterogeneous devices (desktop GPU + laptop GPU + NVIDIA CLARA edge) for real-time performance; proprietary cohort of 1500+ images from 250+ patients; ZEISS model fine-tuning on multi-centric surgical video studies across clinical segments (Neuro & Spine, Ear-Nose-Throat, Plastic Reconstruction, Dental).
- **Production:** King's College London – large-scale end-to-end medical-imaging pipelines on institutional + NVIDIA clusters; ZEISS Medical Technology – production image-processing pipelines on Microsoft Azure, codebases on Azure DevOps (CI/CD).
- **Retrieval-augmented / agentic:** Agentic orchestration with retrieval-augmented generation over knowledge vector databases and encoded/indexed local banks (SparkCopilot).
- **Leadership scale:** managed budgets of ~1M EUR, led a team of 4-5 members, supervised 2-3 at a time postgraduate and doctoral students; Jira – agile project and team management; Smartsheet – roadmapping and interfacing needs, features and products with R&D and business stakeholders.
- **Representative publication + code:** IEEE Transactions on Medical Imaging – Characterization of Polarimetric Properties in Various Brain Tumor Types Using Wide-Field Imaging Mueller Polarimetry – extended to near-real-time Mueller polarimetric image processing for neurosurgical intervention, with a working open codebase (PDDN).
- **Representative publication + code:** IEEE Transactions on Medical Imaging – Inference of Cerebrovascular Topology with Geodesic Minimum Spanning Trees, with a working open codebase (VTrails).

Core Expertise

Leadership and Translational Delivery: team lead, principal scientist and project manager, translational strategy, evidence-based & AI-enabled decision support, cross-functional stakeholder alignment.
Computational and Technical Methods: SW prototyping and development, Python, C/C++, machine learning & AI frameworks, Digital Twins for computational simulations and predictive inference, multi-modal real-world data science, quantitative and descriptive interpretation for decision-making.
Programme and Collaboration Strengths: matrix collaboration, academic-industry network, project and technology roadmapping, management and milestones delivery, innovation and impacful transformation.

Experience

Lead Innovation Expert, AI and Digital Twin May 2024 – Present
ZEISS Medical Technology *Germany*
Led AI and digital-twin innovation activities in advanced development, presenting future applied-research programmes to the ZEISS innovation board and helping steer decisions across technical, clinical, product, and business stakeholders.
Handled project and people management including budget and resource allocation, work-package definition, milestone planning, feasibility assessment, and coordination across cross-functional stakeholders and external partners.
Translated imaging- and AI-focused concepts in medical robotics and surgical visualisation into structured R&D opportunities with clearer technical maturity, risk framing, and roadmap relevance.

Focus: Prototyping, Concepts, Innovation, Ideation, Technology Screening, Medical Robotics, Surgical Imaging, Computer Vision, Risk Analysis, Feasibility Assessment

Senior Postdoctoral Research Associate Jun 2022 – May 2024

University Hospital Bern (Inselspital) *Switzerland*

Led translational imaging work in neurosurgery and neuro-oncology, designing quantitative visualisation and polarimetric-imaging workflows for clinically relevant use cases and decision support.
Built AI-enabled and edge-computing concepts for real-time intraoperative guidance in close collaboration with clinicians, engineers, and academic partners.
Designed, developed, and deployed neurosurgical applications and AI-enabled computational workflows, integrating NVIDIA edge-computing solutions for translational interventional prototypes.

Focus: Surgical Visualization, Image-Guided Intervention, Polarimetric Imaging, Fiber Tracts, Generative AI (Gen-AI), Diffusion Networks, Edge Computing, Real-Time

Postgraduate Research Assistant to Postdoctoral Research Associate Nov 2018 – Jun 2022

King's College London *United Kingdom*

Developed multimodal image-analysis pipelines across large datasets, spanning enhancement, registration, segmentation, topology extraction, and quantitative morphometry in clinically grounded translational research settings.
Extended modelling and imaging work into cardiopulmonary and thoracic CT/CT-angiography contexts, including pulmonary-embolism-related analyses and clinically grounded respiratory applications.
Developed modelling frameworks for simulation-ready anatomy, integrated quantitative analysis, and biomarker-oriented interpretation across vascular and translational research programmes.

Focus: 3D, Multimodal, Medical Image Processing, Large Dataset, Enhancement, Registration, Segmentation, Topology & Graph Extraction, Morphometry, Shape Analysis

Research Fellow and Research Assistant Sep 2012 – Sep 2015

National Research Council / San Raffaele collaborations *Italy*

Worked on motion-capture plethysmography and chest-wall displacement analysis in thoracic-surgery-related contexts, linking quantitative biomechanics to respiratory-function assessment.
Built a methodological foundation in biomedical imaging, radiotherapy-support workflows, CT/MR registration, contour propagation, and quantitative signal analysis.
Conducted methodological research in biomedical image registration for radiotherapy, digital signal processing for hearing analysis, and motion-capture-based plethysmography.

Focus: Medical Imaging, Organic Mesh Modelling, Deformation Propagation, Radiotherapy, Dose Planning, Psychoacoustic Modeling, Computational Models

Education

Ph.D. in Medical Physics and Biomedical Engineering | UCL, London, United Kingdom (Feb 2020)
M.Phil. in Medical Physics and Biomedical Engineering | UCL, London, United Kingdom (Mar 2017)
M.Sc. in Biomedical Engineering | PoliMi, Milano, Italy (Jul 2012)
B.Sc. in Biomedical Engineering | PoliMi, Milano, Italy (Sep 2009)

Scientific & Research Profile

Scientific Publications

43 publications, **H-index 12**, **378 citations**. Google Scholar | ResearchGate | ORCID

Credentials & International Recognitions

- Board Certified Sr. Engineer - Information Technology, PoliMi (since 2013)
- Member, Speaker & Reviewer: MICCAI, SPIE, CVPR, ACM, IEEE (2015–2024)
- Organiser, Chair & Editor, MICCAI CVII-STENT workshop series (2016–2019)

Teaching & Mentoring

- TA: UG/PG Biomedical Engineering modules (AI Concepts, Medical Image Processing, DSP, Vascular Digital Twins, Programming) – UCL, KCL, UniBe, Polimi, CNR (2013–2024)
- Supervision: BSc/MSc interns across ZEISS, UniBe, TUM, KTH, RWTH Aachen, LUH, UniCA
- UCL MedTech Society mentorship programme

SW Skills

Programming: Unix, Git, Python, C/C++, OpenMP, CUDA, Docker, HPC Clusters
Computer Vision: Camera/Pose/Topography Estimation, Live Tracking, AR/Image-Fusion, OpenCV, ITK
AI/ML: Generative Diffusion Networks, LLM/VLM, Agentic Systems, PyTorch, MONAI
Graphics: Blender, Autodesk, NURBS, Geometry, Parametrisation, Ray-Tracing, Rendering, VTK
Digital Twin: Isogeometric Analysis (CAD/CAE), Physical AI, Robotics, Anatomy & Object Virtual Twins, Omniverse, Physical System Simulation (Fluid, Thermal, Electro-Magnetic, Rigid/Elastic/Deformable-body)

Released Toolkits & Repositories

- VTrails Toolkit *[Computer Vision]* – End-to-end MATLAB toolkit that extracts geodesic vascular minimum-spanning trees from angiographic imaging by solving a connectivity-optimised anisotropic level-set

over a voxel-wise vesselness tensor field.
• pyHexNURBS-IGA *[Digital Twin]* – Solid NURBS-conforming scaffolding and Isogeometric Analysis (IGA) toolkit for hexahedral N-junction geometries (e.g
• PDDN *[AI/ML]* – Denoising diffusion network for polarimetric imaging data, extending the polarimetric-imaging toolkit line into modern generative deep learning with distributed/GPU-accelerated processing.
• **SparkCopilot** *[AI/ML], live demo at the end of the resume* – Self-hosted, local-first AI assistant/orchestration stack for on-device inference hardware, combining a reasoning-model gateway with specialised code, vision, and image-generation models behind an OpenAI-compatible API. (local on NVIDIA DGX Spark, required HW)
• TriDecimate *[Graphics]* – Deterministic, high-performance triangle-mesh decimation (greedy edge-collapse) with CPU (OpenMP) and optional CUDA GPU backends, a stable C ABI, and a Python (ctypes) wrapper – hardware-verified on real GPU hardware with real bugs found and fixed.
• TriRasterizer *[Graphics]* – Data-race-free, deterministic 2D triangle rasterizer (C11) with an optional CUDA backend, bit-identical output across thread counts and between CPU/GPU, exposed via a stable C ABI and a NumPy-friendly Python package.
• pyRayTRender *[Graphics]* – Fully Python-native (NumPy-vectorised), dependency-free ray-tracing rendering engine for triangular-mesh scenes – pinhole camera, Blinn-Phong shading, hard/soft shadowing, recursive mirror reflections.
• libmpMuelMat *[Computer Vision]* – Multi-platform computational library for polarimetric Mueller-matrix image processing, built for near-real-time, machine-learning-ready translational and experimental imaging set-ups.

Leading Projects

- **COVID-19 CTA HPC Processing** – thoracic imaging workflows for cardiopulmonary embolism
- **Thoracic-surgery-related Biomechanics** – quantitative analysis of breathing volumes and chest-wall displacement
- **HORAO near Real-Time Imaging** – AI-enabled polarimetric imaging for neuro-oncology and surgery
- **Neurovascular Digital Twin** – predictive analysis frameworks for translational cerebrovascular applications (stroke)
- **Multi-modal Image Processing** – End-to-end containerised pipelines for scalable quantitative medical image analysis

Working Routine: 20% Roadmap & Project Management; 5% Tutoring; 40% Research & Development; 10% Budget & Resources; 15% Screening & Innovation; 10% Networking & Collaboration

Research outputs: the major projects above are published and released as open toolkits – see Google Scholar for the papers and GitHub for the code.

Independent R&D & Curiosity

Personally owns and operates an NVIDIA DGX Spark for independent LLM foundation-model and agentic-AI development – home to the SparkCopilot agentic stack (live, scannable demo at the end of the resume) – and to hardware-verify GPU-accelerated computer-graphics and medical-imaging tooling end-to-end (see Released Toolkits & Repositories).

Awards

Grants & Funding

- **SNSF Spark Grant** – Principal Investigator, submitted, double-blind competitive evaluation, CHF 99,850, 2023, in a cohort with a 13.4% success rate
- **SNSF Fellowship** – Principal Investigator, submitted, competitively peer-reviewed, CHF 265,500, 2022, final score 7.70 / 9.0 (funding threshold 8.2), in a cohort with a 17.82% success rate
- **British Heart Foundation Clinical Research Training Fellowship** – Support in idea, writing, and materials, PI: Michael Greshan Rasiah, Awarded, GBP 281,294.60, 2023-2024
- **Royal Academy of Engineering Research Fellowship** – Support with algorithms and materials, PI: Dr. Carole Sudre, Awarded, GBP 499,158, 2019

IP & Patenting

- **Active**: Advanced NURBS Parametrisation for Isogeometric Analysis – strategic commercialisation rights in US & EU territories (neurovascular technologies) (EP4104141B1)
- **Active, US pending**: Graph-based Hemodynamics for Biomarkers of Neurovascular Resilience – strategic commercialisation rights in US & EU territories (neurovascular technologies) (EP4042446B1)

Strengths & Remarks

Creative Mind, Inventive Vision, Innovation & Impact, AI-Empowered, Team Leader, Interdisciplinary Approach, Speed & Fast-Prototyping, *Let's Do It!*, Excellence & Success. **Charitable activity:** organised and contributed to charity fundraising events, including the international-students marathon run in aid of BLISS – see JustGiving: Gift SurgForBliss and UCL Gift Surg event.

Live demo — SparkCopilot

The **SparkCopilot** agentic stack listed under Released Toolkits & Repositories is not public yet, but I would welcome the chance to show it working. The three steps below let you try the live chat demo from your own phone — no account required up front. The access key is time-boxed and expires on the date noted in the card; after that the codes simply stop granting access, and no data persists past that point.

SparkCopilot — Live AI-System Demo (try it yourself)

I built and run **SparkCopilot**, a self-hosted AI assistant/orchestrator on an **NVIDIA DGX Spark** personal AI supercomputer. Scan the three QR codes in order with your phone's Camera app — a couple of minutes, no account needed up front.

1. Install Tailscale

Camera app, then install the official app

2. Join (scan & paste)

Copy the decoded key (not a website)

3. Start the demo

opens the registration page once step 2 shows *Connected*

Setup. 1: install Tailscale from your app store or tailscale.com/download. **2:** in the app, *do not* tap *Log in* — go to **Settings** → **Accounts** → ··· → **"Use an auth key"** and paste the copied key. Success: your device shows *Connected* alongside *sparkcopilot*. **3:** scan QR 3, register, wait for approval, then chat. Laptop: `sudo tailscale up -authkey=<key>`. *If it hangs "connecting" (firewall), retry on mobile data or another network.*

While you test. The page (step 3) shows your place in line; once approved you get a one-time email/password for the chat — the only account involved. To finish, type *"I'm done testing"*: the session and temporary access are cleaned up automatically. The owner may review conversations to fix bugs, so avoid sensitive content.

Available through 30 November 2026; afterwards the QR codes stop working on their own. For a live walkthrough after that date, reach out directly and I will happily arrange one.

Publications

Complete record: 17 journal articles, 26 conference proceedings and abstracts, 2 monographs and 2 editorial volumes – h-index 12, i10-index 13, 378+ citations (Google Scholar); long author lists abbreviated to 'et al.', full record on Google Scholar.

Journal Articles

[1] Rasiah MG et al. & **Moriconi S**, In silico modelling of changes in spinal cord blood flow after endovascular aortic aneurysm repair, Computer Methods and Programs in Biomedicine, 2026 (while in industry).

[2] Tangwiriyasakul C et al. & **Moriconi S**, Deep generative computed perfusion-deficit mapping of ischaemic stroke, Communications Biology, 2026 (while in industry).

[3] Gros E et al. & **Moriconi S**, Brain tissue polarimetry under simulated intraoperative conditions: Effects of edema and temperature, Journal of Innovative Optical Health Sciences, 2026 (while in industry).

[4] Gros E et al. & **Moriconi S**, Alignment of histological and polarimetric large-scale imaging for brain tissue characterization, Journal of Biomedical Optics, 2025 (while in industry).

[5] Gros R et al. & **Moriconi S**, Characterization of polarimetric properties in various brain tumor types using wide-field imaging Mueller polarimetry, IEEE Transactions on Medical Imaging, 2024.

[6] **Moriconi S** et al., Near-real-time Mueller polarimetric image processing for neurosurgical intervention, International Journal of Computer Assisted Radiology and Surgery, 2024.

[7] Gros R et al. & **Moriconi S**, Effects of formalin fixation on polarimetric properties of brain tissue: fresh or fixed?, Neurophotonics, 2023.

[8] Felger LA et al. & **Moriconi S**, Robustness of the wide-field imaging Mueller polarimetry for brain tissue differentiation and white matter fiber tract identification in a surgery-like environment: an ex vivo study, Biomedical Optics Express, 2023.

[9] **Moriconi S** et al., Solid NURBS Conforming Scaffolding for Isogeometric Analysis, arXiv, 2022.

[10] Sudre CH et al. & **Moriconi S**, Accelerated vascular aging: ethnic differences in basilar artery length and diameter, and its association with cardiovascular risk factors and cerebral small vessel disease, Frontiers in Cardiovascular Medicine, 2022.

[11] **Moriconi S** et al., Inference of cerebrovascular topology with geodesic minimum spanning trees, IEEE Transactions on Medical Imaging, 2018.

[12] Broggi S et al. & **Moriconi S**, A comparative evaluation of 3 different free-form deformable image registration and contour propagation methods for head and neck MRI: the case of parotid changes during radiotherapy, Technology in Cancer Research & Treatment, 2017.

[13] Chiaramello E et al. & **Moriconi S**, Objective speech intelligibility prediction in sensorineural hearing loss using acoustic simulations and perceptual speech quality measures, The Journal of the Acoustical Society of America, 2014.

[14] Chiaramello E et al. & **Moriconi S**, Extraction of cochlear non-linearities with the bispectral analysis, Methods of Information in Medicine, 2014.

[15] Tognola G et al. & **Moriconi S**, A novel bispectral approach to study cochlear non-linearities in transient evoked otoacoustic emissions, The Journal of the Acoustical Society of America, 2013.

[16] Acosta J et al. & **Moriconi S**, Exercise improvement after pectus excavatum repair is not related to chest wall function, European Journal of Cardio-Thoracic Surgery, 2013.

[17] Sforza C et al. & **Moriconi S**, The effect of age and sex on facial mimicry: a three-dimensional study in healthy adults, International Journal of Oral and Maxillofacial Surgery, 2010.

Conference Proceedings and Abstracts

[1] Albano G et al. & **Moriconi S**, Enabling high-throughput polarimetric brain imaging via fast learned denoising on embedded GPUs, SPIE High-Throughput Biophotonics: Imaging, Spectroscopy, and Beyond XI, 2026.

[2] Sakiri A et al. & **Moriconi S**, Assessing the robustness of polarimetry to edema and temperature changes in brain tissue, SPIE Polarized Light and Optical Angular Momentum for Biomedical Diagnostics, 2026.

[3] Gros E et al. & **Moriconi S**, Co-registered histological-polarimetric dataset for tumor cell content estimation in brain tissue, SPIE Polarized Light and Optical Angular Momentum for Biomedical Diagnostics, 2026.

[4] Lucas T et al. & **Moriconi S**, Robust calibration of a dual-camera polarimetric system for near-real-time tissue imaging, SPIE Photonic Instrumentation Engineering XIII, 2026.

[5] Rasiah MG et al. & **Moriconi S**, SRS345 - Digital twin modelling of spinal cord blood flow to predict paraplegia after aortic aneurysm repair, British Journal of Surgery, 2026.

[6] Gros E et al. & **Moriconi S**, Whole-brain section image reconstruction for deciphering tumor margin using Mueller polarimetry imaging, SPIE Polarized Light and Optical Angular Momentum for Biomedical Diagnostics, 2025.

[7] Rodríguez-Núñez O et al. & **Moriconi S**, Estimation of light penetration depth in human brain tissue using Mueller polarimetric imaging: ex vivo study in formalin-fixed human cerebral white and gray matter, SPIE Tissue Optics and Photonics III, 2024.

[8] Gros R et al. & **Moriconi S**, Impact of histological processing on the polarimetric properties of healthy and neoplastic brain tissue, SPIE Tissue Optics and Photonics III, 2024.

[9] Novikova T et al. & **Moriconi S**, Complete Mueller polarimetry: do we need it for biological tissues diagnosis?, SPIE Polarization Science and Remote Sensing XI, 2023.

[10] Tangwiriyasakul C et al. & **Moriconi S**, Framework to generate perfusion map from CT and CTA images in patients with acute ischemic stroke: a longitudinal and cross-sectional study, MICCAI SWITCH Workshop, 2023.

[11] Novikova T et al. & **Moriconi S**, Partial Mueller polarimetry for the complete optical diagnosis of biological tissue, SPIE European Conferences on Biomedical Optics, 2023.

[12] **Moriconi S** et al., Denoising diffusion networks applied to Mueller polarimetric images of brain tissue, SPIE Polarized Light and Optical Angular Momentum for Biomedical Diagnostics, 2023.

[13] Rodríguez-Núñez O et al. & **Moriconi S**, Evaluation of light penetration depth for imaging Mueller polarimeter operating in a visible wavelength range in reflection geometry: ex-vivo studies of healthy brain white matter, SPIE Polarized Light and Optical Angular Momentum for Biomedical Diagnostics, 2023.

[14] McKinley R et al. & **Moriconi S**, Multi-domain cotraining for tissue segmentation in fixed and fresh brain tissue using Mueller polarimetry, SPIE Polarized Light and Optical Angular Momentum for Biomedical Diagnostics, 2023.

[15] Gros R et al. & **Moriconi S**, Evolution of polarimetric parameters of cadaver brain tissue with time and formaldehyde fixation in wide-field Mueller matrix images, SPIE Polarized Light and Optical Angular Momentum for Biomedical Diagnostics, 2023.

[16] Felger LA et al. & **Moriconi S**, Brain white matter fiber tracts identification using wide-field imaging Mueller polarimetry: Ex vivo studies in a surgery-like environment, SPIE Clinical and Translational Neurophotonics, 2023.

[17] **Moriconi S** et al., Towards quantifying neurovascular resilience, MICCAI CVII-STENT Workshop, 2019.

[18] **Moriconi S** et al., Elastic registration of geodesic vascular graphs, MICCAI, 2018.

[19] **Moriconi S** et al., VTrails: Inferring vessels with geodesic connectivity trees, Information Processing in Medical Imaging, 2017.

[20] **Moriconi S** et al., High quality surface reconstruction in radiotherapy: cross-sectional contours to 3D mesh using wavelets, IEEE EMBC, 2015.

[21] **Moriconi S** et al., Application and evaluation of wavelet-based surface reconstruction for contour propagation in radiotherapy, MICCAI ICART Workshop, 2015.

[22] Scalco E et al. & **Moriconi S**, Texture analysis to assess structural modifications induced by radiotherapy, IEEE EMBC, 2015.

[23] Belli ML et al. & **Moriconi S**, Analysis of serial CT images for studying the RT effects in head-neck cancer patients, IEEE EMBC, 2015.

[24] Chiaramello E et al. & **Moriconi S**, Objective measures of perceptual quality for predicting speech intelligibility in sensorineural hearing loss, IEEE EMBC, 2015.

[25] Tognola G et al. & **Moriconi S**, Objective estimation of hearing compensation by means of auditory spectral representations, IFMBE Proceedings, 2015.

[26] Tognola G et al. & **Moriconi S**, On the use of acoustic simulations and PESQ measures for the prediction of speech intelligibility in sensorineural hearing loss, IFMBE Proceedings, 2015.

Books & Monographs

[1] **Moriconi S**, Inferring geodesic cerebrovascular graphs: image processing, topological alignment and biomarkers extraction, University College London, 2020.

[2] Motta AF et al. & **Moriconi S**, Pectus excavatum surgical repair: new methods to evaluate the effects on local chest wall displacement, Politecnico di Milano, 2012.

Editorial Volumes

[1] Liao H et al. & **Moriconi S**, Machine Learning and Medical Engineering for Cardiovascular Health and Intravascular Imaging and Computer Assisted Stenting, MLMECH & CVII-STENT Workshops, MICCAI, 2019.

[2] Stoyanov D et al. & **Moriconi S**, Intravascular Imaging and Computer Assisted Stenting and Large-Scale Annotation of Biomedical Data and Expert Label Synthesis, CVII-STENT & LABELS Workshop, MICCAI, 2018.