Simone Saitta

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Research Experience

Politecnico di Milano
Milan, Italy

Ph.D. in Bioengineering (cum Laude) — Nov. 2019 - May 2023

- Development, training and application of deep neural networks for automatic 3D segmentation of medical images.
- Integration of deep neural networks within computational pipelines for mixed-reality applications in neurosurgery.
- Development of data-driven statistical shape models of hemodynamics from flow-encoded magnetic resonance images.
- Development of deep neural network-based methods for unsupervised 4D reconstruction of fluid flow from flow-encoded MRI.
- Development of a 4D variational data assimilation framework for blood flow dynamics in cerebral aneurysms.
- Gained programming experience with the FEniCS API for PDE-constrained optimization using an adjoint solver.

University of Cambridge
Cambridge, UK

Visiting Ph.D. student — Mar. 2022 - Aug. 2022

- Increased knowledge of inverse problems in medical imaging applications.
- Development of an unsupervised learning approach for denoising and super-resolution of flow-encoded MRI.

Politecnico di Milano
Milan, Italy

Consulting — Mar. 2022 - Aug. 2022

- Development of user-defined subroutines for particle-laden numerical simulations of fluid flow.
- Numerical modeling of multi-phase and multi-scale flows in complex geometries using a volume-of-fluid method.

National University of Singapore
Singapore

Research Engineer — Jan. 2019 - Aug. 2019

- Development of an automatic image registration computational framework based on iterative optimization methods.
- Implementation of automatic multi-view 4D image registration using python and simple-elastix.
- Technical achievements: programming experience with Python and C++ cross-platform libraries for object-oriented libraries for image processing.

Imperial College London
London, UK/Shanghai, China

Research Engineer — May 2018 - Dec. 2018

- Optimization of a finite element-based framework for non-invasive pressure calculation from magnetic resonance flow images.
- Implementation of a user-friendly GUI for medical image processing.
- CFD simulation of blood fluid dynamics in aortic dissections using the open-source finite element software SimVascular.
- Technical achievements: programming experience in the MATLAB environment.

Imperial College London
London, UK

MSc Thesis Project — Sep. 2017 - Apr. 2018

- MATLAB implementation of a finite element-based framework for solving the pressure Poisson equation from magnetic resonance flow images.
- Validation of numerical results with a 3D printed hydraulic mock-loop.
- Development and setup of fluid-structure interaction and computational fluid dynamics simulations: applications to pathological blood flow assessment.

Politecnico di Milano
Milan, Italy

MSc Course Project — Mar. 2016 - Sep. 2016

- Setup of CFD simulations of blood flow using Ansys Fluent.
- Hemodynamic assessment using two different models for blood viscosity: Newtonian and non-Newtonian (generalized power law).
- Implementation of user defined routines in Ansys Fluent to model blood viscosity and transient flow boundary conditions.

Technical Skills

Programming	*Experienced*: Python, MATLAB, C *Familiar*: C++
Libraries	PyTorch, VTK, ITK, FeniCS, elastix
Containerization	Docker, Singularity
Miscellaneous	Experience with HPC systems, including GPU-accelerated clusters
Simulation software	Ansys, Star-CCM+, OpenFOAM, SimVascular, CRIMSON
Data processing and visualization software	Paraview, Ensight, Meshmixer, 3DSlicer, SolidWorks
Languages	*Full proficiency*: Italian, English (*TOEFL iBT: 107*)

Grants, Awards & Qualifications

McKusick Fellowship Research Grant May 2023
$100,000 grant from the Marfan Foundation.
Project title: "Machine learning for identification of geometrical and biomechanical markers of aortic dissection in Marfan patients"

Switch2Product startup competition Dec. 2022
€30,000 prize for IPSE-XR: A deep learning and mixed reality-based solution to support neurosurgery

Esame di Stato Jan. 2021
Ingegneria Industriale

Publications

- **Saitta S.**, Sturla F., Caimi A., et al. (2022) "A deep learning-based and fully automated pipeline for thoracic aorta geometric analysis and planning for endovascular repair from computed tomography". *Journal of Digital Imaging*
- **Saitta S.**, Maga L., Armour C., et al. (2023) "Data-driven generation of 4D velocity profiles in the aneurysmal ascending aorta". *Computer Methods and Programs in Biomedicine*
- **Saitta S.**, Carioni M., Mukherjee S. Schönlieb C.B., Redaelli A. (2023) "Implicit neural representations for unsupervised denoising and super-resolution of 4D flow MRI". *arXiv pre-print*
- **Saitta S.**, Pirola. S, Piatti F., Lucherini F., et al. (2019). "Evaluation of 4D Flow MRI-based non-invasive pressure assessment in aortic coarctations". *Journal of Biomechanics*
- **Saitta S**., Sturla F., Gorla R., et al. (2023) "A CT-based deep learning system for automatic assessment of aortic root morphology for TAVI planning". *Computers in Biology and Medicine*
- Palumbo M.C., **Saitta S.**, Schiariti, M., et al. (2022) "Mixed Reality and Deep Learning for External Ventricular Drainage Placement: A Fast and Automatic Workflow for Emergency Treatments". *MICCAI 2022*
- **Saitta S.**, Guo, B., Pirola, S., et al. (2021) "Qualitative and quantitative assessments of blood flow on tears in type B aortic dissection with different morphologies." *Frontiers in Bioengineering and Biotechnology*
- Pirola S., Guo B., Menichini C., **Saitta S.**, et al. (2019). "4D Flow MRI-Based Computational Analysis of Blood Flow in Patient-Specific Aortic Dissection". *IEEE Transactions on Biomedical Engineering*
- Armour C., Guo B., Pirola S., **Saitta S.**, et al. (2020). "The influence of inlet velocity profile on predicted flow in type B aortic dissection". *Biomechanics and Modeling in Mechanobiology*
- Nannini G., Caimi A., Palumbo M.C., **Saitta S.**, et al. (2021). "Aortic Hemodynamics Assessment prior and after Valve Sparing Reconstruction: A Patient-Specific 4D flow-based FSI Model". *Computers in Biology and Medicine*
- Armour C., Guo B., **Saitta S.**, et al. (2022). "Evaluation and verification of patient-specific modelling of type B aortic dissection". *Computers in biology and medicine*
- Armour C.H., Guo B., **Saitta S.**, et al. (2022). "The Role of Multiple Re-Entry Tears in Type B Aortic Dissection Progression: A Longitudinal Study Using a Controlled Swine Model". *Journal of Endovascular Therapy*
- Riva A., Sturla F., Pica S., Camporeale A., Tondi L., **Saitta S.**, et al. (2022). "Comparison of Four-Dimensional Magnetic Resonance Imaging Analysis of Left Ventricular Fluid Dynamics and Energetics in Ischemic and Restrictive Cardiomyopathies". *Journal of Magnetic Resonance Imaging*
- Aigner P., Bart E.S., Panfili S., Körner T., Mach M., Andreas M., Königshofer M., **Saitta S.**, et al. "Quantification of paravalvular leaks associated with TAVI implants using 4D MRI in an aortic root phantom made possible by the use of 3D printing". *Frontiers in Cardiovascular Medicine*

Proceedings (selection)

- **Saitta S.**, Sturla F., Caimi A. et al. (2020). "A deep learning-based and fully automated pipeline for thoracic aorta geometric analysis and TEVAR planning from computed tomography". *Talk given at EACVI - Best of Imaging 2020*
- Munafò R., **Saitta S.**, Caimi A., et al. (2021). "3D Variational data assimilation of 4D flow MRI in computational hemodynamics of intracranial aneurysm." *ESB 2020*
- Munafò R., **Saitta S.**, Redaelli A. (2022). "Wall Shear Stress estimation in cerebral aneurysm: combining CFD and 4D flow MRI with 4D variational data assimilation". *WCB 2022*
- Munafò R., **Saitta S.**, Redaelli A. (2022). "Non-invasive pressure estimation in cerebral aneurysm: comparison among 4D flow MRI, CFD and 4DVar". *ECCOMAS Congress 2022*
- **Saitta S.**, Munafò R., Votta E. (2022). "Fast automatic segmentation of mitral valve structures from 3D transesophageal echocardiography for transcatheter procedures: training and validation of a 3D U-Net convolutional neural network". *ECCOMAS Congress 2022*

Education

Politecnico di Milano *Milan, Italy*
PhD in Bioengineering Nov. 2019 - May 2023

Politecnico di Milano *Milan, Italy*
MSc in Biomedical Engineering Sep. 2015 - Apr. 2018

Politecnico di Milano *Milan, Italy*
BSc in Biomedical Engineering Sep. 2012 - Jul. 2015

Teaching Experience

Politecnico di Milano *Milan, Italy*
Teaching assistant for the course of Biomechanics — Sep. 2020 - present

Politecnico di Milano *Milan, Italy*
Tutor for the course of Computer Science — 2018