Guglielmo Cappellini

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Education

PhD **National PhD Program, PON R&I 2014-2020**, AI for Healthcare — Rome, IT
Jan 2022 – Dec 2024

"AI-based solution methods for PDEs with application to oncological hyperthermia". Tutored by prof. M. Vendittelli (Medical Robotics), co-funded by Medlogix Srl.

- Non-invasive temperature estimation in oncological hyperthermia (HT) treatment for decision support and optimization of dose delivery;
- Two-papers work presented at IEEE CDC 2023, Singapore;
- Tutoring and mentoring in "Fundamentals of Automation" and "Medical Robotics", with a focus on AI applications in healthcare;
- PhD thesis defended on May 30th, 2025 with Excellent classification.

MSc **Sapienza Università di Roma**, Nuclear Engineering — Rome, IT
Jan 2018 – May 2021

Thesis: "Study and characterization of radiolabeled nanovectors for application in precision molecular medicine", EQF 7, 108/110.

- Studies on Nuclear Physics, Thermodynamics, and Radiation Protection;
- Supervised by prof. R. Remetti (Radiation Protection for Nuclear Medicine).

BSc **Sapienza Università di Roma**, Energy and Nuclear Engineering — Rome, IT
Sept 2015 – Nov 2017

Thesis: "Radionuclides production and medical applications", EQF 6.

- Supervised by prof. L. Ferroni (Nuclear Energy Applications).

Experience

Department of Computer, Automation and Management Engineering (DIAG), Sapienza Università di Roma, PostDoc — Rome, IT
Jan 2025 – present

Development, innovation and certification of medical and non-medical devices for healthcare (Rome Technopole Spoke 6, FP4). Supervised by prof. M. Vendittelli.

- Extending the research on AI-based solution methods for PDEs with application to oncological HT;
- AI-based methods for real-time simulation of deformable tissues with application to interactive virtual reality for medical training. Preliminary results under submission;
- Interest on graph convolutional neural networks (GNNs) for the explainability of complex systems, with application to radiomics.

Department of Radiation Oncology, Amsterdam UMC Hospital, Visiting PhD Student — Amsterdam, NL
Dec 2023 – May 2024

Study of HT techniques and its clinical application, to investigate and validate new solutions to improve the real time controls and to estimate temperature at depth in superficial HT, and to participate in other ongoing projects in the same research area.

- Experimental emulation of HT treatment: a system to simulate perfusion, a muscle-equivalent phantom, a superficial EM applicator, and the thermometry system;
- Supervised by Research Physicist H. Crezee and Associate Professor H. P. Kok.

Department of Nuclear Medicine, Policlinico Umberto I, Rome, MSc Thesis Intern — Rome, IT
Dec 2020 – May 2021

"99mTc-labeled Keratin-coated gold nanoparticles for selective anticancer photothermal therapy" (Frantellizzi, De Vincentis et. al.)

- Research on Radiopharmacology, Nanomedicine, and Nanophotonics;
- Developed mathematical model for MATLAB simulation of microfluidic devices for radiolabeled nanoparticles.

Projects

AMD-STITCH: Sapienza Information-Based Technology InnovaTion Center for Health (Reference)

Ontology-based data preparation on electronic medical records of Italian diabetes patients within a 13 years timeframe

- Data modeling and data cleaning, providing effective techniques for setting up a unified and shared database;
- Database management and SQL implementation for unified data systems;
- Working within secure data environments with large-scale healthcare datasets;
- Gaining experience with relational databases and clinical data structures.

Skills

Programming & Scientific Computing: Expert in Python for multivariate statistics (TensorFlow, PyTorch, NumPy, SciPy, pandas) and AI (FNN, GCNNs, CNN); working knowledge of C++; version control with Git/GitHub; familiar with reinforcement learning, containerization (Docker), and high-performance computing environments; good understanding of Web, app development, and DevOps

Mathematics: Specialized in computational methods for partial differential equations (MATLAB); strong foundation in numerical analysis, calculus, linear algebra, and optimization techniques for machine learning applications

Clinical Data & Terminologies: Experience working with large-scale healthcare datasets; strong foundation in data standardization and clinical data structures

Languages: English (fluent, IELTS Academic: 7.5), Spanish, Italian (native). Can understand written French (not spoken, but eager to learn)

Teaching & Mentorship: Passionate educator with formal pedagogical training (Percorso formativo 24 CFU in anthropological-psychological-pedagogical disciplines and teaching methodologies); committed to clear communication of complex technical concepts across disciplines

Professional Qualifications: Licensed Professional Industrial Engineer (Esame di Stato Sez. A)

Interests: Interested in deep learning applications to radiotherapy and in radiomics; experienced in coordinating people with different backgrounds on the same goal; interdisciplinary research background bridging engineering and medical physics

Publications

Adaptive Estimation of the Pennes' Bio-Heat Equation - I: Observer Design Dec 2023

Cristofaro, A., Cappellini, G., Staffetti, E., Trappolini, G., Vendittelli, M.

10.1109/CDC49753.2023.10383905 (2023 62nd IEEE Conference on Decision and Control (CDC), Singapore)

Adaptive Estimation of the Pennes' Bio-Heat Equation - II: A NN-Based Implementation for Real-Time Applications Dec 2023

Cappellini, G., Trappolini, G., Staffetti, E., Cristofaro, A., Vendittelli, M.

10.1109/CDC49753.2023.10384113 (2023 62nd IEEE Conference on Decision and Control (CDC), Singapore)

Adaptive Estimation of Pennes' Bio-Heat Equation: Observer Design and PINNs-based Implementation

Cappellini, G., Cristofaro, A., De Santis, E., Staffetti, E., Trappolini, G., Vendittelli, M.

submitted to IEEE Transactions on Control Systems Technology

Extracurricular Activities

- Professional drummer and musical director with extensive performance background across multiple genres;
- Early experiences in orchestra; co-founded bands including "Subba and the Roots" and "La Situa"; secured national touring grant (NuovoIMAIE 2018, €15k); formal jazz studies with renowned drummers (M. Guiliana, R. Gatto, M. Campanale, D. Panza, G. de Rienzo, F. Mendolia);
- Current member of "Dimensione Brama", a multidisciplinary ensemble combining theatrical and musical performance (12th place finalists in XFactor18, 2024);
- More than 500 concerts and 3 albums released; experience in studio recording and production. My hands on these!