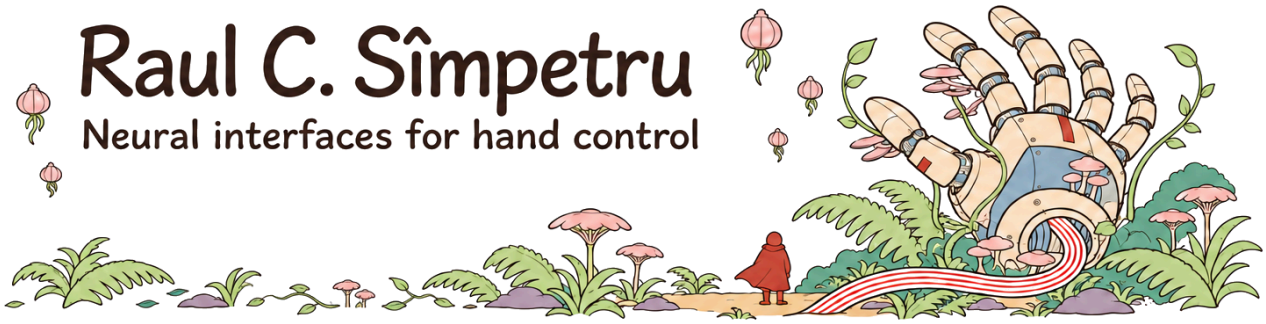
Raul C. Sîmpetru

Neural interfaces for hand control



raul.simpetru@fau.de simpetru.com ORCID 0000-0003-0455-0168 Google Scholar

I build neural interfaces that turn muscle activity into control of virtual hands, orthoses and prostheses. My work covers motor-intent decoding from high-density EMG, real-time assistive control, and biophysical simulation of motor units and EMG.

Work experience



2025–present — KIU, Kutaisi, Georgia
Invited professor, Computer Science
Helped build a new master's curriculum.

12.2023–present — n-squared Lab, FAU, Erlangen, Germany
Doctoral researcher

06.2022–09.2023 — n-squared Lab, FAU, Erlangen, Germany
Research and teaching assistant
High-density EMG and hand motor control.

10.2021–02.2022 — Fraunhofer IIS, Erlangen, Germany
Research assistant
Integrated a few-shot cancer-detection pipeline into a research system.

11.2020–08.2021 — MaD Lab, FAU, Erlangen, Germany
Teaching and student assistant
Weekly exercises for Algorithms and Data Structures for Medical Engineers. Gait-analysis and algorithm-benchmarking tools.

Education

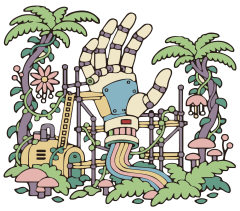


12.2023–12.2026 — FAU, Erlangen, Germany
Dr.-Ing., Artificial Intelligence in Biomedical Engineering
Supervisor Prof. Alessandro Del Vecchio. Dissertation submitted, defence expected December 2026. *Restoration of hand function through decoding of motor intent and movement manifolds from neural interfaces.*

06.2022–10.2023 — FAU, Erlangen, Germany
M.Sc. Medical Engineering
Predicting hand movements from spared motor units after cervical spinal cord injury through an artificial intelligence system.

10.2019–10.2022 — FAU, Erlangen, Germany
B.Sc. Medical Engineering
Robust prediction of hand kinematics from surface electromyography using convolutional neural networks and machine vision.

Research projects



04.2026–present
BMFTR START

BIONIK: bidirectional interface between neuroorthoses and users for interactive control
Neuroorthosis control: neural-intent decoding, shared autonomy and vibrotactile feedback. With FAU's Institute for Factory Automation and Production Systems (FAPS).

01.2024–present
ERC Starting Grant

GRASPAGAIN: a direct sensorimotor connection with the spared neural code of movement
Decoding spared spinal motor output after paralysis. My part: movement manifolds, real-time decoding, MyoGestic.

12.2023–05.2026
Medical Valley Award

GraspAgain: restoring hand function with an intelligent neuroorthosis
EMG decoding and real-time neuroorthosis control, tested in participant studies.

Collaborations

TUM / MIRMI, Munich
Prof. Cristina Piazza
Mapping sEMG-derived control manifolds to a prosthetic hand for individual finger control.

University of Campinas, Brazil
Profs. Ricardo G. Molinari, Renato N. Watanabe, Leonardo A. Elias
Co-development of MyoGen.

Teaching



2022–present
FAU, Erlangen, Germany

FAU Erlangen-Nürnberg
10 semesters since summer 2022, 5 ECTS each.

MindMove	An EMG-controlled virtual hand
Movement Neuroscience	Neural control of movement
Interfacing the Neuromuscular System	Recording and decoding EMG
Applied Programming	B.Sc. AI, summer 2025

2025–present
KIU, Kutaisi, Georgia

Kutaisi International University
4 semesters since spring 2025, 5 ECTS each. Course leader; on the committee founding a new master's programme.

Neurocomputing	Neural networks and their biology
Robotics	Kinematics, control, sensing
Deep Learning	Training deep networks
Digital Signal Processing	Sampling, filtering, spectra

2022–present
FAU, Erlangen, Germany

Thesis supervision
11 master's theses **2 bachelor's theses**
Topics: neural interfaces, EMG decoding, real-time systems, assistive control.

2020
FBZHL, FAU, Erlangen, Germany

Teaching certificate for teaching assistants

Awards

09.2026
Munich, Germany

Best Student Paper Award, IEEE CBS 2026 (co-author)
For *MyoKin3X*.



12.2024 — **IEEE TBME Featured Article**

04.2023 — Berlin, Germany — **DMEA Young Talent Award, 3rd prize**
German Health IT Association (bvitg e.V.).

Selected publications



Nature Communications 2026 · DOI
MyoGen: unified biophysical modeling of human neuromotor activity and resulting signals
Sîmpetru, R.C., Molinari, R.G., Rohlf, D.R., Batichotti, R.L., Watanabe, R.N., Elias, L.A., Del Vecchio, A.

Science Advances 2025 · DOI
MyoGestic: EMG interfacing framework for decoding multiple spared motor dimensions in individuals with neural lesions
Sîmpetru, R.C., Braun, D.I., Simon, A.U., März, M., Cnejevici, V., Souza de Oliveira, D., Weber, N., Walter, J., Franke, J., Höglinger, D., Prahm, C., Ponfick, M., Del Vecchio, A.

IEEE TNSRE 2024 · DOI
Identification of spared and proportionally controllable hand motor dimensions in motor complete spinal cord injuries using latent manifold analysis
Sîmpetru, R.C., Souza de Oliveira, D., Ponfick, M., Del Vecchio, A.

IEEE TBME 2024 · DOI
Learning a hand model from dynamic movements using high-density EMG and convolutional neural networks
Sîmpetru, R.C., Arkudas, A., Braun, D.I., Osswald, M., Souza de Oliveira, D., Eskofier, B.M., Kinfe, T.M., Del Vecchio, A.

IEEE TNSRE 2023 · DOI
Proportional and simultaneous real-time control of the full human hand from high-density electromyography
Sîmpetru, R.C., März, M., Del Vecchio, A.

Full list of 17 papers and 2 preprints on Google Scholar.

Software



creator, maintainer — **MyoGestic**
Open-source real-time EMG recording, decoding and closed-loop control. Version 2.0 (2026); clinical results in *Science Advances*.
GitHub · Docs · Zenodo

creator, maintainer — **MyoGen**
Open-source simulation from cortical drive to surface and intramuscular EMG. Version 0.13.0; published in *Nature Communications*.
GitHub · Docs · Paper

Service



2026–2028 — ISEK — **Early Career Researcher Committee member**
International Society of Electrophysiology and Kinesiology.

09.2026 — IEEE CBS, Munich, Germany — **Organizing committee and session chair, Medical Robotics**

Memberships

IEEE and IEEE EMBS
Member since 2022

The Physiological Society
Graduate student member since 2023

ISEK
Member since 2024

Fraunhofer Alumni Network
Member since 2021

Talks



06.2026 — Jyväskylä, Finland
Invited symposium talk, ISEK 2026
MyoGestic: real-time closed-loop control of preserved motor intent using wearable HD-EMG and deep learning.

07.2025 — St. John's, Canada
Rapid-fire talk and posters, 14th International Motoneuron Society Meeting
MyoGestic and MyoGen.

06.2024 — Nagoya, Japan
Oral presentation, ISEK 2024
Uncertainty-aware hand posture classification for better assistive devices in spinal cord injury patients.

12.2023 — London, UK
Selected oral presentation, The Physiological Society
Neurophysiological Bases of Human Movement, one of eight oral talks. *Can we use AI to find the unharmed motor dimensions and give them back to the patient?*

Science communication



07.2025
Public talk, AI Camp, Nuremberg Digital Festival
EMG-based hand control and neurorehabilitation.

05.2025
Public talk, Pint of Science, Nuremberg

10.2024
Public demonstration, Consumenta, Nuremberg
An intelligent neuroorthosis for restoring hand movement.

Skills



Neural interfaces — High-density surface and intramuscular EMG, motor-unit analysis, motor-intent decoding, movement manifolds, closed-loop myocontrol.

Machine learning — PyTorch, representation learning, computer vision, real-time inference, CUDA, Triton, TensorRT.

Systems — Python, C/Cython, MATLAB, JavaScript, gRPC, LSL, BLE, on-device inference.

Simulation — NEURON, motor-neuron and motor-unit models, musculotendon and EMG simulation.

Languages — Romanian (native), German (fluent), English (fluent).