

Renato Mio

Research Associate – Brain and Behaviour Laboratory

University of Bayreuth (Germany)

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Doctoral researcher working at the intersection of neuromotor control, neural interfaces and machine learning. My work focuses on decoding the neural drive underlying hand movements from spinal motor neuron activity recorded non-invasively, to then develop machine learning models that can predict finger forces and generate commands for external devices. I also have 10 years of experience developing artificial robotic limbs and assistive devices. My past projects include studying human augmentation by controlling an additional robotic finger while playing piano, the design of low-cost bionic hand prostheses (now commercialised), and developing a real-time control system for a gait-assistance exoskeleton.

Qualifications

10/2022 – Present

PhD, Medical Informatics, University of Bayreuth – Germany

Thesis title: “Motor learning-based control of peripheral nerves for supernumerary degrees of freedom (sDoFs)”.

Developing non-invasive neural interfaces that enable people to control augmentative devices with applications in neurorehabilitation, human augmentation, and human-machine interaction.

Supervisor: Prof. Dr. A. Aldo Faisal

The project focuses on non-invasive neural signals as an interface modality to control human augmentation devices. My aim is to find signal components independent from muscle force that can be used as commands for human-machine interfaces.

09/2018 – 09/2019

MSc, Biomedical Engineering (Biomechanics), Imperial College London – United Kingdom

Final grade: Distinction (74.25%)

Thesis title: “Prediction of Human Ability for Supernumerary Control based on Motor Skills” (see our [Scientific Reports paper](#)).

Supervisor: Prof. Dr. A. Aldo Faisal / Co-supervisor: Dr. Ali Shafti

The project explored how motor skills influence the ability to learn the use of an additional robotic finger to play piano.

Featured in [Imperial College News](#), [Reuters](#), [New Scientist](#), [Daily Mail UK](#), [CBC](#), [VOA](#), [Yahoo News](#) and [Mirror](#).

03/2010 – 12/2014

BSc, Mechatronics Engineering, Pontifical Catholic University of Peru – Peru

Final grade: 17.74/20.00 (≈89% / First-Class Honours)

Thesis title: “Design of an upper-limb exoskeleton controlled by a brain-machine interface” ([available online](#) in Spanish).

Supervisor: MSc. Roberto Furukawa

Work Experience

06/2022 – Present

Research Associate, Chair of Digital Health with a Focus on Data Science, *University of Bayreuth*

- Developed subject- and task-independent machine learning models to decode finger forces from motoneuron discharge rates with $R^2=0.944$ regression accuracy and model transfer to leg muscles ([link to NER'25 paper](#), [link to poster](#)).
- Designed experimental protocols and collected two datasets of high-density EMG over the forearm muscles (1) during long finger contractions ($n=25$ participants, >16h of data), and (2) during both constant and variable (sinusoidal) finger forces ($n=52$ participants, >50h of data).
- Assisted in setting up the [Quantitative Live-In-Lab](#) (QLiLa), a fully sensorised apartment for human behaviour studies. Featured in [Zeit](#), [Süddeutsche Zeitung](#) and [Sat1.de](#).
- Mentored 2 master students, 1 graduate intern and 1 undergraduate student.

See my [researcher bio](#) at the [Faisal Lab's webpage](#).

03/2015 – 09/2018 & 11/2019 – 07/2022

Researcher, Biomechanics and Applied Robotics Research Group, *Pontifical Catholic University of Peru*

- Undertook lead and assistant researcher roles on multiple funded projects within the field of rehabilitation robotics.
- Designed a [3D-printed bionic hand prosthesis](#) and implemented the [control system for a lower-limb exoskeleton](#).
- Aided in securing grant funding for over \$500K.
- Mentored undergraduate national and international students interested in rehabilitation robotics research.

02/2017 – 07/2022

Co-founder & CTO, LAT Bionics (social start-up, formerly *Dando una mano*)

- Co-founded a social start-up to address a clear unmet need: upper-limb prostheses in low-resource settings cost upwards of \$10,000 USD, placing them out of reach for the vast majority of amputees in Latin America.
- Led the engineering team to design, iterate, and commercialise a **custom-fit 3D-printed bionic hand**, balancing clinical functionality, manufacturing constraints, and affordability. The device has reached **200+ users** and is in active commercial deployment.
- Managed the full translational arc from prototype to product: design documentation, regulatory considerations, user testing, and funding through grant writing (\$500K+ raised across related rehabilitation engineering projects).
- Published the technical design in a Best Student Paper Award-winning [conference paper](#). See our [TED Talk](#) and [social media page](#).

03/2020 – 07/2022

Hired Lecturer (part time), Mechanical Engineering Faculty, *Pontifical Catholic University of Peru*

- In charge of designing lecture materials and course evaluations.
- Carried out academic supervision of students from the BSc Mechatronics and BSc Biomedical Engineering courses.

03/2014 – 07/2018

Teacher Assistant, Mechanical Engineering Faculty, *Pontifical Catholic University of Peru*

- Designed, taught and graded hands-on laboratory sessions in several engineering courses.

Grants and Awards

Research grants

01/2021 – 07/2022. PI: Prof. Dante Elias.

Co-I on: **Development of a Transhumeral Arm Prosthesis with Haptic Feedback Controlled by Physiological Signals***.
By the National Fund for the Development of Science, Technology and Innovation of Peru – **50K USD**

02/2018 – 12/2018. PI: Prof. Quino Valverde.

Co-I on: **Optimization of Polymer Utilization on Additive Manufacturing Processes through Computational Modelling and Mechanical Characterization. Case Study: Hand Prostheses***.
By the National Fund for the Development of Science, Technology and Innovation of Peru – **100K USD**.

02/2016 – 12/2017. PI: Prof. Dante Elias.

Co-I on: **Implementation of a myoelectric upper-limb transradial prosthesis with force control and haptic feedback****.
By the National Fund for the Development of Science, Technology and Innovation of Peru – **100K USD**.

03/2016 – 10/2017. PI: Prof. Francisco Rumiche.

RA on: **Mechanical Characterization and FEA Simulation of Components for a 3D-printed Hand Prosthesis***.
By the Pontifical Catholic University of Peru – **46K USD**.

03/2015 – 12/2016. PI: Prof. Dante Elias.

RA on: **Development of a Lower-Limb Exoskeleton for Gait Patterns Reproduction and Movement Assistance**.
By the National Fund for the Development of Science, Technology and Innovation of Peru – **100K USD**.

Innovation Grant “Ideas Audaces” (“Bold Ideas”)

Lead designer on: **Giving a Hand – Custom 3D-printed low-cost hand prostheses**** (2016, Coordinator: Prof. Dante Elias).
By the National Fund for the Development of Science, Technology and Innovation of Peru – **\$26K**.
Media coverage: [TV Peru](#), [Andina News](#)

Socially Responsible Initiatives Grant

Leader of: **Integrating Virtual Reality and Disability****. The project aimed to include therapeutic interactive videogames developed by Mira Rehab as part of the physical rehabilitation program for children with cerebral palsy at a Peruvian Health Centre (2018).
By the Pontifical Catholic University of Peru – **\$2.6K**.

Co-I: Co-investigator RA: Research assistant *Assisted proposal writing **Led the proposal writing

Awards

- **Pitch Competition Winner, Ideenwettbewerb 2025/2026 (Bayreuth)** for [MetricMeals](#), an AI-powered food demand forecasting tool co-developed through the [Bayreuth AI Association](#). The product is now deployed at the University of Bayreuth canteen.
- **Best paper award finalist at ICORR 2025** for my paper on the [first-ever body-powered additional robotic finger](#).

- **Awarded silver medal in KIWIE 2023 Invention Exposition** for a patent on finger covers for hand prostheses. Featured in [Andina News](#) and [El Peruano](#) (in Spanish).
- **Awarded Best Student Paper** at the [18th IEEE International Conference on BioInformatics and BioEngineering](#). Read the paper [here](#).
- **Chevening Scholarship** (2018–19 cohort) granted by the UK Foreign and Commonwealth Office for a fully funded one-year master's programme in the UK, covering overseas tuition plus living costs (valued around £45,000).
- **Academic Excellence Scholarship** (2013–2014) granted by Pontifical Catholic University of Peru for 100% coverage of tuition fees.
- **Awarded 1st place in Peru in NASA Space Apps Challenge 2016**. Read the coverage by [PUCP university](#) (in Spanish).

Teaching and Supervision

Academic teaching experience

Electronic Design Automation	Kutaisi International University, Hired lecturer
Reinforcement Learning for Scientists and Engineers	University of Bayreuth, GTA
Seminar in Brain-Computer Interfaces	University of Bayreuth, GTA
Digital Health	University of Bayreuth, GTA
Introduction to Programming with Python for Digital Health & AI	University of Bayreuth, GTA
Rehabilitation Engineering	PUCP, Hired lecturer
Biomechatronics	PUCP, Hired lecturer
Control Theory	PUCP, Hired lecturer
Industrial Design for Biomedical Engineering	PUCP, GTA
Computer-Aided Manufacturing	PUCP, GTA
Simulation Tools	PUCP, GTA

Academic supervision experience

- J. Bodenschlägel, MSc, on studying forearm motoneurons controlling fingers using high density EMG, 2025 | [IEEE NER'25](#).
- M. Gonzales Pareja, MSc, on the development of an EMG-based control system for a transhumeral arm prosthesis, 2024.
- A. Maguina, BSc, on the design of a novel body-powered supernumerary robotic finger, 2023 | [Springer 2024](#) | [ICORR'25](#).
- G. Oshiro, BSc, on the design of supernumerary robotic arms to assist in cooking tasks, 2021.
- J.M. Pacheco, BSc, on the design of a modular upper-limb myoelectric prosthesis for children, 2021.
- V. Ticllacuri, BSc, on the design of a soft robotic device for muscle and blood flow stimulation in lower limbs, 2021 | [EMBC'21](#)[EMBC'24](#)[EMBC'24](#).
- J. Pérez, BSc, on the design of an elbow flexion mechanism for transhumeral prostheses with hybrid actuation, 2020.
- A. Morveli, BSc, on supernumerary robotic fingers to aid people with impaired hand mobility, 2020 | [IEEE BioSmart'23](#).
- G. Bustamante, BSc, on the design of supernumerary robotic limbs for industrial assembly tasks, 2020.

Mentoring of international students

As part of Rochester Institute of Technology Co-op Education Program (2018)

N. Hachmann – Rochester Institute of Technology, BSc, on the design and fabrication of a body-powered hand prosthesis simulator.

As part of MIT MISTI Internship Program (2017)

J. Faraguna – Massachusetts Institute of Technology, BSc, on parametric design strategies to automate prosthetic design processes.

B. Schelhaas – Massachusetts Institute of Technology, BSc, on the study of human hand anthropometry to find parametric relationships between segments' lengths.

Skills

Technical and computing skills

- Python (PyTorch, TensorFlow)
- Matlab (for signal processing, real-time control, robotics and data analysis)
- C# and C++
- CAD design (Autodesk Inventor, Fusion 360, Solidworks)
- FEA simulation (ANSYS)

Hardware

- Electromyography (high-density EMG with Novecento+ and Sessantaquattro+ amplifiers by OT Bioelettronica)
- Electroencephalography (ActiCHamp and CGX Quick 32r by Brain Products, Emotiv)
- fNIRS (NIRSport 2 by NIRx)
- Motion capture systems (XSens by Movella, Xsens Metagloves by Manus, Cyberglove)
- Eye tracking (Pupil Core)
- FDM and SLA 3D Printers (FormLabs, Ultimaker, AnyCubic)
- Arduino

Languages

Spanish (native) | English (C2) | German (B2) | Italian (A2)

Publications

- **R. Mio**, J. Bodenschlägel and A. A. Faisal, “Finger Force Prediction from Spinal Signals: Machine Learning Pipeline for the Neural Drive”, [IEEE NER’25](#).
- J. Bodenschlägel, **R. Mio** and A. A. Faisal, “Tracking Forearm Motor Units Across Constrained and Unconstrained Finger Force Control Tasks”, [IEEE NER’25](#).
- **R. Mio**, J. Narayan and A. A. Faisal, “Motor Unit Decomposition over Intrinsic Hand Muscles during Single and Multi-finger Flexion”, [Springer’25](#).
- A. Maguina, **R. Mio** and S. Caballa, “A Body-Powered Wrist-Driven Supernumerary Robotic Finger”, [ICORR’25](#).
- R. Borja-Inga, **R. Mio** and J. Narayan, “A Low-Cost Upper-Limb Prosthetic Tool for Handlebar-Driven Vehicles”, [IEEE BioRob’24](#).
- V. Ticllacuri and **R. Mio**, “Mathematical Modeling and Characterization of a Wearable Soft Robotic Device for Muscle Mechanotherapy”, [IEEE EMBC’24](#).
- V. Ticllacuri and **R. Mio**, “Computational Analysis of Mechanical Interactions between a Soft Robotic Device and a Skin-Muscle Phantom for Mechanotherapy”, [IEEE EMBC’24](#).
- **R. Mio** and A. Morveli, “Supernumerary Robotic Fingers for Assistance in Cylindrical and Pinch Grasps”, [BioSmart’23](#).
- **R. Mio**, S. Caballa, R. Vega-Centeno and M. Bustamante, “One-to-many Actuation Mechanism for a 3D-Printed Anthropomorphic Hand Prosthesis”, [IFMBE Springer’24](#).
- A. Maguina and **R. Mio**, “Augmented Grasps: Supernumerary Robotic Fingers and their Practical Uses”, [IFMBE Springer’24](#).
- V. Ticllacuri and **R. Mio**, “Design and Simulation of a Soft Robotic Device for Muscle Rehabilitation and Blood Flow Stimulation Therapy”, [EMBC’21](#).
- A. Shafti, S. Haar, **R. Mio**, P. Guillemot and A. A. Faisal, “Playing the piano with a robotic third thumb: assessing constraints of human augmentation”, [Scientific Reports 11, 21375 \(2021\)](#).
- **R. Mio**, M. Bustamante, G. Salazar and D. Elias, “A 3D-Printed Prosthetic Hand with Modular Reconfigurable Fingers”, [Springer’19](#).
- D. Elias, D. Cerna, C. Chicoma and **R. Mio**, “Characteristics of a Lower Limb Exoskeleton for Gait and Stair Climbing Therapies”, [Springer’19](#).
- **R. Mio**, M. Sánchez, Q. Valverde, J. Lara and F. Rumiche, “Mechanical Testing Methods for Body-Powered Upper-Limb Prostheses: A Case Study”, [ASTESJ’19](#).
- **R. Mio**, M. Sánchez and Q. Valverde, “Mechanical Testing Methods for Body-Powered Upper-Limb Prostheses: A Review”, [IEEE BIBE’18](#).
- M. Bustamante, R. Vega-Centeno, M. Sánchez and **R. Mio**, “A parametric 3D-printed body-powered hand prosthesis based on the four-bar linkage mechanism”, [IEEE BIBE’18](#).
- **R. Mio**, B. Villegas, L. Ccorimanya, K. M. Flores, G. Salazar and D. Elias, “Development and assessment of a powered 3D-printed prosthetic hand for transmetacarpal amputees”, [IEEE’17](#).

Media Coverage

- **Kurier**: Featuring the AI Association’s [project to use AI to forecast food demands](#) at the university, improve planning, and reduce food waste. Also covered by [UBT](#), [inFranken](#) and [Bayreuther Tagblatt](#).
- **Zeit.de**: Featuring our “live-in-lab”, an apartment fitted with all sorts of sensors for real-world human behaviour studies. [Link](#). Also covered on [Süddeutsche Zeitung](#) and [Sat1.de](#).
- **Imperial College News**: Featuring research in relation to my MSc project on robotic human augmentation by controlling an additional robotic finger while playing piano. [Link](#). Also featured [Reuters](#), [New Scientist](#), [Daily Mail UK](#), [CBC](#), [VOA](#), [Yahoo News](#), [Mirror](#), and other media.
- **Andina News**: Featuring our research on custom bionic hand prostheses. [Link](#) (in Spanish). Also featured in [PUCP university](#) news.
- **TV Peru**: Interviewed regarding my team’s work on affordable 3D-printed hand prostheses. [Link to video](#) (in Spanish).

More news in [personal website](#).

Extracurricular Activities

- **Co-founder and vicepresident** of the [Bayreuth AI Association e.V. \(2024\)](#), whose mission is to create a platform to foster the exchange of knowledge and upskill our members through practical applications of AI/ML. Our activities include skill-sharing sessions, guest talks from industry and academia experts, and hands-on programming projects.
- **Co-organisation** of the workshop **“AI in Radiology”**, in collaboration with Prof. Benjamín Castañeda (Local Chair) and the Peruvian Radiologists Society as a satellite event of the [MICCAI 2020 Conference](#).
- **Co-organisation** of the **“Makeathon 2016 – Disability and Inclusion”**. In this event, students and professionals volunteered to develop open-source solutions for specific disabilities during a 48-hour marathon. Co-organised by PUCP and the National Council for the Inclusion of People with Disabilities. [Video of the event](#).
- **Vice-president** of the Mechatronics Engineering Students Association (2013) at Pontifical Catholic University of Peru.

Conference Poster and Oral Presentations

- **R. Mio**, J. Bodenschlägel and A. A. Faisal, *“Motor unit tracking across force paradigms and subject-independent finger force prediction from spike trains”*, Neuroscience’25. Link to [slides](#).
- **R. Mio**, J. Bodenschlägel and A. A. Faisal, *“Finger Force Prediction from Spinal Signals: Machine Learning Pipeline for the Neural Drive”*, NER’25. Link to [slides](#).
- **R. Mio**, J. Bodenschlägel and A. A. Faisal, *“Generic attention-based model for force prediction from spinal motoneuron activity across upper- and lower-limb muscles”*, [Bavarian Conference on AI in Medicine](#). Link to [poster](#).
- Urs Keßner, **R. Mio**, J. Bodenschlägel and A. A. Faisal, *“Enhanced finger force estimation by integrating spatial information from motoneurons activations derived from high-density EMG”*, [Bavarian Conference on AI in Medicine](#). Link to [poster](#).
- R. Borja-Inga, **R. Mio** and J. Narayan, *“A Low-Cost Upper-Limb Prosthetic Tool for Handlebar-Driven Vehicles”*, [IEEE RAS EMBS 10th International Conference on Biomedical Robotics and Biomechatronics \(BioRob 2024\)](#). Link to [poster](#).
- **R. Mio**, J. Narayan and A. A. Faisal, *“Motor Learning and Changes at Motor Unit-Level Modulation Patterns in Variable-Force Single Digit Tasks”*, [Hybrid Neural Interfaces Summer School 2024](#). Link to [poster](#).
- **R. Mio**, J. Narayan and A. A. Faisal, *“Motor Units Recruitment and Modulation Patterns in Variable-Force Single Digit Tasks”*, [Neural Control of Movement 2024](#). Link to [poster](#).
- **R. Mio** and A. A. Faisal, *“Non-invasively decoding of the neural drive in the upper-limb during individual finger movements”*, [Neurophysiological Bases of Human Movement 2023](#). Link to [poster](#).
- **R. Mio**, J. Narayan and A. A. Faisal, *“Motor Unit Decomposition over Intrinsic Hand Muscles during Single and Multi-finger Flexion”*, [2023 Summer School on Neurorehabilitation](#) (link to [slides](#), short paper in Springer).
- **R. Mio** and A. A. Faisal, *“Neurophysiological constraints on human-robot interfacing for augmentation”*, [Neuroadaptive Technology 2022](#). Link to [poster](#).
- **R. Mio** and A. A. Faisal, *“Motor unit decomposition from surface high-density electromyography as an interfacing modality for human augmentation”*, [Bayreuth Lab for Digital Sciences Day](#). Link to [poster](#).
- **R. Mio** and M. Bustamante, *“Personalized fingers design with silicone rubber texture fingertip for increased grip in trans-metacarpal powered hand prostheses”*, [Cybathlon Symposium’16 \(Booklet pp42\)](#).