

Dr. Alexander von Lühmann



Biomedical Engineering
& Neurotechnology

CONTACT

- Berlin
- avonluh@gmail.com
- [linkedin.com/in/avonluh](https://www.linkedin.com/in/avonluh)
- www.avolu.net

EDUCATION

- Dr.-Ing.** with highest distinction
Neurotechnology & Machine Learning
Berlin Institute of Technology
2014 – 2018
- M. Sc. & B. Sc.** (both theses 1,0/A+)
Electrical Engineering & Inf. Tech.,
Karlsruhe Institute of Technology
2011 – 2014

COMPETENCIES

Management

- Line Management
- Project Management
- Research Grant Acquisition & Management
- Product & Process Development

Research & Development

- Data Science / Machine Learning
(*Matlab, Python*)
- Bio-signal Acquisition & Analysis
- Mixed-Circuit Electronics Design
(*Eagle, Pulsonix, Altium*)
- Microcontrollers & Embedded Programming (C, C++)
- CAD design & Rapid Prototyping
(*SolidWorks, SiemensNX, Blender3D*)
- Neuroscience & Physiology

WORK ETHICS

Outstanding results depend on passion, continuous learning, and commitment – and a great team. It is crucial for me to contribute to a trust- and truthful environment, in which good communication, open mindedness and integrity are highly valued. As a specialist for bio signal acquisition and -processing, combining hardware architecture engineering and data science, I work with an interdisciplinary focus to drive science and innovation.

WORK EXPERIENCE

For a more complete list of my work experience and projects please visit [my website](#).

NIRx Medizintechnik GmbH/LLC

Scientific Director R&D 11.2020 – present
Senior Scientist 08.2020 – 11.2020

Line and Project Management of NIRx' Research & Development Division

- Grew the R&D team from 6 to 15 (Software, ProductDesign, OptoElectronics)
- Ownership and expansion of NIRx' product portfolio and tech-strategy.
- Acquisition, management, and execution of research grants
- Lead design, research, & system architecture of fNIRS research instruments
- Product and process management, implementation of project management, requirements management, SOPs and development processes

Boston University & Harvard Medical School

Visiting Researcher 07.2020 – present
Postdoctoral Researcher 01.2019 – 06. 2020

Development of Hard- and Software infrastructure and data driven methods for wearable everyday Brain-Imaging using functional Near Infrared Spectroscopy (fNIRS) and Electroencephalography (EEG).

- Project and development lead of a hybrid real-time EEG-fNIRS brain decoding pipeline (Matlab). Human study and paradigm design.
- Development of a novel multimodal data driven unsupervised extension of the gold standard General Linear Model for fNIRS (see publications [4,5])
- Concept & vision development & grant writing (2 NIH grants, 1 industry sponsor, 66% success rate): Toward Neuroimaging in the Everyday World
- Contribution to 2nd generation wearable open source fNIRS infrastructure (www.openfnirs.org): lead development of flexible individualized 3D printed head caps (ninjaCap) and support hardware development.



Dr. Alexander von Lühmann

Biomedical Engineering
& Neurotechnology

MEMBERSHIPS

- **ISO/DIN** – JWG expert for fNIRS Norm 80601-2-71
- **OPTICA** (formerly OSA) – Optical Society of America
- fNIRS Society (**sfNIRS**)
- **VDI** Germany

AWARDS & SCHOLARSHIPS

- **BIMoS PhD Award** 2019: best dissertation in data science at TU Berlin
- German Society for Biomedical Engineering (**DGBMT**) **Klee-Award** 2018 (3rd)
- IEEE TBME 64(2) 2017 **Cover Article + Special Feature**
- fNIRS Society **Early Investigator Award Nominee** 2016
- **Scholarship + Research fellowship** at BIMoS Graduate School TU Berlin 2014-2018
- **Research scholarships** by Machine Learning Department TU Berlin, 2014-2018
- **Winner Innovation Academy Biotechnology** (BMBF) 2012

Gallup StrengthsFinder

- ★ Achiever
- ★ Learner
- ★ Input
- ★ Empathy
- ★ Communication

WORK EXPERIENCE (CONTINUED)

Crely Healthcare Pte. Ltd. (Singapore & US)

Chief Technology Officer 11.2018 – 08.2020

Development of an AI-based warning system for the prediction of Surgical Site Infections (SSI) with a non-invasive, wearable smart dressing that continuously monitors patient's biomarkers remotely for clinical intervention

- System and hardware architecture development and supervision
- Consultation in animal and clinical study

Berlin Institute of Technology, Machine Learning Dept.

Visiting Researcher 01.2019 - present

PhD Researcher 08.2014 – 08.2018

PhD Thesis: “*Multimodal Instrumentation and Methods for Neurotechnology out of the Lab*”, 2018. Development of multimodal wearable hardware, novel machine learning algorithms & experimental paradigms for mobile brain imaging.

- Design of hybrid wearable and modular instrumentation for multimodal wireless biosignal acquisition (M3BA) of EEG, fNIRS and Accelerometer (see publication [1], patent [1]). Distribution to and collaboration with 5+ international institutions.
- Founder of the open source fNIRS project (opennirs.org), see [2].
- Dev. of novel multimodal blind source separation framework for fNIRS [3].
- Brain Computer Interface experiment design & execution: [9,10]

Karlsruhe Institute of Technology, Biomedical Engineering Dept.

Research Project Manager 05.2013 – 01.2014

Exploratory project - Feasibility analysis and market study. Multimodal wearable biosensing device for vigilance assessment using ElectroDermal Activity, Electro-Oculography and Accelerometer

- Concept and grant design, application, project management and execution (BMBF project # 031A236)

REFERENCES

Prof. Dr. Klaus-Robert Müller
Machine Learning Department, Berlin
Institute of Technology

klaus-robert.mueller@tu-berlin.de

Prof. Dr. Benjamin Blankertz
Neurotechnology Department, Berlin
Institute of Technology

benjamin.blankertz@tu-berlin.de

Prof. David Boas, PhD
Neurophotonics Center, Boston
University & Harvard Medical School

dboas@bu.edu
dboas@mgh.harvard.edu

Prof. Dr. Olaf Dössel
Institute of Biomed. Engineering,
Karlsruhe Institute of Technology

olaf.doessel@kit.edu



Dr. Alexander von Lühmann

Biomedical Engineering
& Neurotechnology

INVITED TALKS (EXCERPT)

See avolu.net for all talks with recordings

- **fNIRS Conference**, Boston, '22 (upcoming)
- **Instituto Santos Dumont**, Brasil Virtual, '22
- **fNIRS Society Virtual**, '21
- **fNIRS Summer School, Tübingen University**, GER, '21
- **OSA Optics and the Brain Conference**, Florida, USA, '20
- **Neurophotonics Symposium, Boston University**, Boston, USA, '20
- **OHBM Neurofeedback Symposium**, Rome, Italy, '19
- **SPIE BiOs Photonics West**, San Francisco, USA 2019
- **fNIRS Workshops**, Neurophotonics Center, **Boston University**, Boston, USA, '19 & '18
- **Martinos Center, Harvard Medical School**, Boston, USA '17
- **Conquer CollabOrative, Drexel University**, Philadelphia, USA '17

REVIEWING (EXCERPT)

- Science Advances
- OSA Biomedical Optics Express
- SPIE Neurophotonics
- PLOS One
- IEEE TNSRE. (Neur. Sys.)
IEEE TBME (Biomed. Eng.)
- Frontiers in Human Neuroscience
- IOP Journal of Neural Eng.
- AIP Rev. of Sci. Instruments
- MDPI Sensors, MDPI Photonics

PUBLICATIONS (EXCERPT)

Author of >20 peer-reviewed publications with >550 citations, h-index = 8, i10 index = 8.
A complete list of publications is available on [my website](#) and [google scholar](#).

Hardware Development

- [1] A. von Lühmann, H. Wabnitz, T. Sander and K.-R. Müller, „M3BA: A Mobile, Modular, Multimodal Biosignal Acquisition architecture for miniaturized EEG-NIRS based hybrid BCI and monitoring”, **IEEE Trans. on Biomedical Engineering**, vol. 64, no. 6, pp. 1199-1210, 2017 (**special feature and front cover article IEEE TBME**)
- [2] A. von Lühmann, C. Herff, D. Heger, and T. Schultz, “Towards a wireless open source instrument: functional near-infrared spectroscopy in mobile neuroergonomics and BCI applications”, **Frontiers in Human Neuroscience**, vol. 9, no. 617, 2015

Data Science

- [3] A. von Lühmann, Z. Boukouvalas, K.-R. Müller, Tülay Adali “A new blind source separation framework for signal analysis and artifact rejection in functional Near-Infrared Spectroscopy”, **NeuroImage**, vol. 200, pp. 72-88, 2019
- [4] A. von Lühmann, X. Li, K.-R. Müller, D.A. Boas, M.A. Yücel, “Improved physiological noise regression in fNIRS: A multimodal extension of the General Linear Model using temporally embedded Canonical Correlation Analysis”, **NeuroImage**, vol 208, 2020
- [5] A. von Lühmann, A.O. Martinez, D.A. Boas, M.A. Yücel, “Using the General Linear Model to Improve Performance in fNIRS Single Trial Analysis and Classification: A Perspective”, **Frontiers in Human Neuroscience**, (in review), 2019

Consensus, Review, Opinion Paper

- [6] A. von Lühmann, et al. “Towards Neuroscience of the Everyday World (NEW) using functional Near Infrared Spectroscopy.” **Current opinion in biomedical engineering**, pp. 100272., 2021
- [7] M. Yücel, A. von Lühmann, et al. “Best practices for fNIRS publications.” **Neurophotonics**, vol. 8 no. 1, pp. 012101, 2021
- [8] Soekadar, Surjo R., et al. “Optical brain imaging and its application to neurofeedback.” **NeuroImage: Clinical** vol. 30, pp 102577, 2021

Multimodal Neuroimaging Datasets

- [9] J. Shin, A. von Lühmann, B. Blankertz, Do-Won Kim, H.-J. Wang and K.-R. Müller, „Open Access Dataset for EEG+NIRS Single-Trial Classification”, **IEEE Trans. on Neural Systems and Rehabilitation Engineering**, vol. 25, no. 10, pp. 1735-1745, 2017
- [10] J. Shin, A. von Lühmann, D.W. Kim, J. Mehnert, H.J. Hwang and K.-R. Müller, “Simultaneous acquisition of EEG and NIRS during cognitive tasks for an open access dataset”, **Nature Scientific Data**, vol. 5, art. No. 180003, doi: 10.1038/sdata.2018.3, 2018
- [11] A. von Lühmann, et al. “Open Access Multimodal fNIRS Resting State Dataset With and Without Synthetic Hemodynamic Responses.” **Frontiers in neuroscience** 14, 2020.

PhD Thesis

- [12] A. von Lühmann, “Multimodal instrumentation and methods for neurotechnology out of the lab”, PhD Thesis, **Technische Universität Berlin**, 2018

PATENTS (EXCERPT)

- [1] A. von Lühmann and K.-R. Müller, “Biosignal acquisition device and system, method for acquisition of biosignals”, **US Patent # US10799161B2**, granted in EU & US, CN, CA, 2016
- [2] A. von Lühmann, “NIRS device and method”, EU Patent **#EP20217768.9A1** (filed), 2021
- [3] A. von Lühmann, “Capacitive sensor system for measurement of electromagnetic bio-signals” **DE Patent # DE102012014219A1**, 2013