Dr. Alexander von Lühmann

CONTACT

Berlin

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EDUCATION

Dr.-Ing. summa cum laude
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

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

Management

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

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 complete list of my experience and projects visit ibs-lab.com and avolu.net

Technische Universität Berlin - Machine Learning Dept. | BIFOLD

Head of Research Group *11.2022 - present*

The "*Intelligent Biomedical Sensing (IBS) Lab*" develops machine learning methods and wearable instruments for comprehensive brain-body monitoring of the embodied brain in the everyday world.

- Group development and lead (3 Post Docs, 3+3 PhD researchers, 6 students)
- *Biomedical Electrical Engineering*: wearable, unobtrusive multimodal neurotechnology and biosensors for functional Near-Infrared Spectroscopy (fNIRS), diffuse optical tomography (DOT) and Oximetry, Electroencephalography (EEG), Electro -myo-, -oculo-, -cardiograpy (ExG).
- *Machine Learning:* methods for the extraction of multivariate biomarkers from complex bio signals. Physiological modeling and physiological transfer functions considering non-stationary and non-instantaneous relationships, context sensitivity, and automatic data annotation.

NIRx Medizintechnik GmbH/LLC

Lead Technology Advisor *06.2023 - present*
Scientific Director R&D & CSO *11.2020 – 06.2023*
Senior Scientist *08.2020 – 11.2020*

Scientific lead advisor on and science and technology strategy and roadmap.
Previously: Line and Project Management of Research & Development Division

- *Harvard Business School – Economics for Managers Course + Certificate*
- 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

MEMBERSHIPS

- **ISO/IEC** JWG "Oximeters" and **DIN**, expert for fNIRS standard 80601-2-71
- fNIRS Society (**sfNIRS**) – Board of Directors
- **OPTICA** (formerly OSA) – Optical Society of America
- Hum. Brain Mapping (**OHBM**)
- **VDI** Germany

AWARDS & SCHOLARSHIPS

- **ERC Starting Grant** 2025
- **Early Investigator Award** 2022 by the fNIRS Society
- **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**
- **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 ★ Input
★ Learner ★ Empathy
★ Communication

WORK EXPERIENCE (CONTINUED)

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 fNIRS and 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])
- www.openfnirs.org: lead development of flexible individualized 3D printed head caps (ninjaCap) and support ninjaNIRS hardware development.

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

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

Technische Universität Berlin - Machine Learning Dept.

Visiting Researcher *01.2019 – 10.2022*
PhD Researcher *08.2014 – 08.2018*

Dissertation 2018*: "Multimodal Instrumentation and Methods for Neurotechnology out of the Lab"*. Development of…

- multimodal miniaturized wearable EEG-fNIRS hardware (publication + patent [1]), Founder of the open source fNIRS project (opennirs.org), see [2].
- novel multimodal machine learning & blind source separation for fNIRS [3].
- Brain Computer Interface experimental paradigm design & execution: [9,10]

AvL Neurotech. – since 2022 Kallenbach & von Lühmann GbR

Freelance Consultant *since 2010*

- Machine Learning for Biomedical Signal Processing & Neurotechnology, Instrumentation design for Diffuse Optics (fNIRS, DOT) and EEG

REFERENCES

Prof. Dr. Klaus-Robert Müller
Machine Learning Department,
TU Berlin
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Prof. David Boas, PhD
Neurophotonics Center, Boston University & Harvard Medical School
dboas@bu.edu
dboas@mgh.harvard.edu

Dr. Alexander von Lühmann
Biomedical Engineering
& Neurotechnology

LATEST INVITED TALKS

See ibs-lab.com/media-talks for all talks

- **OHBM, 2025**, Brisbane, Australia
- 13th Int. **Winter Conference on BCI 2025**, Gangwon, Korea
- **Cambridge University** 2025, UK
- **U Birmingham, 2024,** School of Comp. Sci, UK
- **IEEE Brain Discovery & Neurotech. Workshop 2023**, Washington DC, USA
- **Polish Acad. Of Sciences, 2023** Int. Center of Biocybernetics, Warsaw, Poland
- **First Neuroscience of the Everyday World Conference 2023**, Boston, USA

ASS/GUEST. EDITING

- SPIE Neurophotonics
- Frontiers in Human Neuroscience

REVIEWING (EXCERPT)

- Nature Com. Biology | Dig. Med.
- Science Advances
- Neuroimage | Imag. Neuroscience
- 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

PUBLICATIONS (SELECTION)

>50 publications (25 peer-reviewed journal articles, 5 patents, >25 conference publications) with >2000 citations (Aug 2025), h-index = 17, i10 index = 23. Full list: IBS-lab website and google scholar.

Hardware Development

[1] OBrien, ..., von Lühmann, Boas, and Zimmermannm "*ninjaNIRS - an Open Hardware Solution for Wearable Whole-Head High-Density Functional Near-Infrared Spectroscopy*", **Biomed. Optics Express**, vol. 15, no. 10, 2024

[2] von Lühmann, Wabnitz, Sander and 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 **(cover article)**

[3] von Lühmann, Herff, Heger, and 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

[4] Dissanayake, Müller, and von Lühmann, „*Deep Learning from Diffuse Optical Oximetry Time-Series: An fNIRS-Focused Review of Recent Advancements and Future Directions"*, **IEEE Reviews in BME**, (in revision), 2025

[5] Codina, Blankertz, and von Lühmann, „*Multimodal fNIRS-EEG Sensor Fusion: Review of Data-Driven Methods and Perspective for Naturalistic Brain Imaging"*, **Imaging Neuroscience**, vol. 3 2025

[6] von Lühmann, Li, Müller, Boas, and 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

[7] von Lühmann, Martinez, Boas and Yücel, *"Using the General Linear Model to Improve Performance in fNIRS Single Trial Analysis and Classification: A Perspective"*, **Frontiers in Human Neuroscience**, 2020

[8] von Lühmann, Boukouvalas, Müller and 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

Consensus, Review, Opinion Paper

[9] Yücel*, Luke*, Mesquita* and von Lühmann*, et al., *"fNIRS reproducibility varies with data quality, analysis pipelines, and researcher experience"*, **Nature Communications Biology**, vol. 8, no. 1, pp 1159, 2025, | *joint first-authors

[10] von Lühmann, Zheng, Martinez, Kiran, Somers, Cronin-Golomb, Awad, Ellis, Boas and Yücel, *"Towards Neuroscience of the Everyday World (NEW) using functional Near Infrared Spectroscopy."* **Current opinion in biomedical engineering**, *pp. 100272., 2021*

[11] Yücel*, von Lühmann*, et al. *"Best practices for fNIRS publications."* **Neurophotonics,** vol. 8 no. 1, pp. 012101, 2021 | *joint first-authors

Multimodal Neuroimaging Datasets

[12] Shin, von Lühmann, Blankertz, Kim, Hwang and 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

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

THIRD PARTY FUNDING (EXCERPT)

Involved in >16 grant proposals with a funding success rate of 50% and over 10Mio€ effectively acquired for the applying institution.

ERC Starting Grant (2025 - 2029): INTEGRAL

Institution: TU Berlin ***Partners:*** none, PI grant
Indiv. Funding: 1.6M € ***Role:*** Principal Investigator

Summary: INTEGRAL develops a hybrid wearable platform that integrates high-density diffuse optical tomography (HD-DOT), EEG, and physiological sensors with advanced machine learning to enable continuous mapping of brain networks in everyday environments. This technology will provide unprecedented opportunities to study brain function beyond the lab, with broad impact on neuroscience, neurotechnology, and digital health.

EU KDT (2023 - 2025): NEWLIFE

Institution: NIRx ***Partners:*** 28, including Philips, Boston Scientific, Fraunhofer,...
Indiv. Funding: 670k€ ***Role:*** NIRx application lead

Summary: Newlife aims to improve outcomes for pregnant women and newborns by developing innovative sensing devices and utilizing AI/ML to analyze health and lifestyle data. Remote 24/7 support, connecting pregnant women and newborns to hospital professionals for preventive and predictive actions via mobile applications.

BMWi (2022 - 2025): NEUROQ

Institution: NIRx ***Partners:*** Fraunhofer, Charité, Universität Stuttgart, ...
Indiv. Funding: 143k€ ***Role:*** NIRx application lead

Summary: Development of a new generation of nitrogen-vacancy (NV) sensors ("optically pumped magnetometers") for non-invasive and contactless neural communication and diagnosis of neurological and psychiatric diseases.

PTB (2022 - 2025): TransMeT

Institution: NIRx ***Partners:*** PTB Berlin
Indiv. Funding: 350k€ ***Role:*** NIRx Application Lead and PI (until 2023)

Summary: Developing and testing of sensors and analysis methods to determine absolute oxygen saturation in the human brain based on picosecond (time domain) and continuous light fNIRS.

BMBF (2021 - 2024): UFO

Institution: NIRx ***Partners:*** Fraunhofer, Charité, Auticon, Universität Stuttgart, ...
Indiv. Funding: 270k€ ***Role:*** NIRx Application lead and PI (until 2023)

Summary: UFO is developing an immersive space for autistic people using VR and neuro sensors to improve their decoding of emotional experiences and regulatory strategies with the help of educational agents.

NIH U01 (2021 - 2025): NEW – Neuroscience in the Everyday World

Institution: Boston University ***Partner:*** 4 other Labs at Boston University
BU Funding: 6M USD ***Role:*** Lead grant concept development, since 2021 collaboration

Summary: NEW develops mobile High-Density fNIRS with EEG and eye-tracking for comprehensive brain-body monitoring in the everyday world

facebook (2019 - 2021): Industry sponsorship – 2 x Statements of Work

Institution: Boston University ***Partner:*** facebook (now meta)
BU Funding: ~2x 150k USD ***Role:*** grant concept development & writing

Summary: development of diffuse optical imaging equipment and methods for real-time single trial analysis / classificatoin