

# Etienne Mueller

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## EDUCATION

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### Postdoctoral Researcher AI & Computational Neuroscience since 2023

*University of Melbourne, Australia*

- Developing a neural network growth algorithm to create biologically-inspired memory cells for more efficient recurrent neural networks, using ML for simulations of brain imaging data across different developmental stages using JAX
- Running deep convolutional neural networks on a Slurm-based HPC with up to 4xH100 GPUs per node for automated segmentation of synchrotron brain imaging data, reducing the need for manual annotation by a factor of 10

### Ph.D. in Computer Science 2023

*Technical University of Munich, Germany*

- Thesis on biologically-inspired neural networks for energy-efficient computation
- Research of novel biologically-inspired approaches for natural language processing and pattern recognition with varying datasets

### M.Sc. in Product Development and Production 2017

*Technical University of Hamburg, Germany*

- Development of autonomous racing vehicles
- Awarded Best Autonomous Design at Formula Student Germany
- Awarded the Incentive Prize of the Technical University of Hamburg endowed with 1,500€

### Semester Abroad 2016

*Institut Catholique d'Arts et Métiers Nantes, France*

- Designing tools for workflow optimization of a waste utilization plant using CAD

### B.Sc. in Mechanical Engineering 2014

*Technical University of Hamburg, Germany*

- Measuring and increasing the accuracy and repeatability of industrial robots using MATLAB

## PROFESSIONAL EXPERIENCE

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### AI Engineer 2022 – 2023

*Flowers Software GmbH*

- Established the AI research department at a seed-financed startup, deploying deep learning infrastructure from scratch
- Developed a TensorFlow-based information extraction workflow on AWS to identify recurring positions on invoices that complies with EU data privacy law, saving the company over €5,000/month by eliminating third-party API costs

### Technical Advisor 2021 – 2022

*Technical University of Munich*

- Led the technical coordination of a pilot case for an EU-funded (Horizon 2020) project (SHOP4CF)
- Creation of modular tools for autonomous factories for Industry 4.0

### AI Researcher 2018 – 2022

*Infineon Technologies AG*

- Research in neuromorphic computing and spiking neural networks, leading to 11 first- and second-author publications
- Developed a TensorFlow-based toolbox for converting conventional to spiking neural networks, which was subsequently used in a research project to reduce the simulation time of hardware components in neuromorphic systems by half

### Component Manager 2017 – 2018

*BMW AG*

- Technical supervision of cooling water pumps for electric and combustion vehicles for BMW, Mini and Rolls Royce
- Requirement engineering and long-term testing of different models in cooperation with Bosch and Continental

### Formula Student Member @ e-ognition Hamburg e.V. 2012 – 2017

*Developer Driverless Actuator Technology (2016 – 2017)*

- 1st Place Formula Student Driverless: Autonomous Design
- 3rd Place Formula Student Driverless: Overall

*Division Manager Business Plan (2014 – 2016)*

- Special Award for educational video "How to Business Plan" at Formula Student Hungary

*President & Team Captain (2013 – 2014)*

- Special Award for Ecological Design by Magna Steyr

*Division Manager Aerodynamics (2012 – 2013)*

## **Co-founder & CEO**

2015 – 2016

*Slive*

- Developed smart wearable devices and location-based algorithms for hands-free data use in industrial environment
- Secured the Nissen Foundation Start-Up Grant (€3,000) to support early-stage product development and business growth

## **Research Assistant**

2013 – 2013

*Institute of Aircraft Production, Technical University of Hamburg*

- Manufacturing of components via a six-axis industrial robot and CAM software
- Secured the Nissen Foundation Start-Up Grant (€3,000) to support early-stage product development and business growth

## TEACHING EXPERIENCE

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### **Lecturer in Cognitive Systems**

2019 – 2021

- Covering topics such as cognition, biological inspired computational models and neurorobotics
- Creating and grading of exams for over 400 students

### **Thesis Supervision in Deep Learning and Spiking Neural Networks**

2018 – 2021

- Master Thesis (2021): Performance of Time to First Spike Encoded Spiking Neural Networks
- Research Internship (2021): Conversion of Analog to Spiking Transformer Networks
- Master Thesis (2021): Conversion of Analog LSTM-based Recurrent Neural Networks
- Master Thesis (2021): Conversion of Analog GRU-based Recurrent Neural Networks
- Research Internship (2020): Carla as Open Source Platform for Analyzing and Evaluating Autonomous Driving
- Master Thesis (2020): Converting Analog to Spiking Convolutional Neural Networks for Object Detection
- Master Thesis (2019): Semantic Segmentation of Integrated Circuit Layout Images

## PUBLICATIONS

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**E. Mueller**, W. Qin, "Reverse Engineering Neural Connectivity: Mapping Neural Activity Data to Artificial Neural Networks for Synaptic Strength Analysis," in *8th International Conference on Information Technology (InCIT)*, Chonburi, Thailand and Kanazawa, Japan, 2024, (accepted).

**E. Mueller**, S. Klimaschka, D. Auge, A. Knoll, "Neural Oscillations for Energy-Efficient Hardware Implementation of Sparsely Activated Deep Spiking Neural Networks," in *Association for the Advancement of Artificial Intelligence (AAAI) Practical DL*, Online (Vancouver, Canada), 2022, pp. 1-7.

**E. Mueller**, D. Auge, A. Knoll, "Exploiting Inhomogeneities of Subthreshold Transistors as Populations of Spiking Neurons," in *International Conference on Natural Computation, Fuzzy Systems and Knowledge Discovery (ICNC-FSKD)*, Online (Fuzhou, China), 2022, pp. 1-8.

**E. Mueller**, V. Studenyak, D. Auge, A. Knoll, "Spiking Transformer Networks: A Rate Coded Approach for Processing Sequential Data," in *7th Int. Conference on Systems and Informatics (ICSAI)*, Online (Jiaxing, China), 2021, pp. 1-5.

**E. Mueller**, J. Hansjakob, D. Auge, A. Knoll, "Minimizing Inference Time: Optimization Methods for Converted Deep Spiking Neural Networks," in *International Joint Conference on Neural Networks (IJCNN)*, Online (Shenzen, China), 2021, pp. 1-8.

D. Auge, J. Hille, **E. Mueller**, A. Knoll, "A Survey of Encoding Techniques for Signal Processing in Spiking Neural Networks," *Neural Processing Letters*, vol. 53, issue 6, pp. 4693-4710, Dec 2021.

**E. Mueller**, D. Auge, A. Knoll, "Normalization Hyperparameter Search for Converted Spiking Neural Networks," in *Bernstein Computational Neuroscience Conference*, Online (Berlin, Germany), 2021, P 8.

D. Auge, J. Hille, **E. Mueller**, A. Knoll, "Hand Gesture Recognition in Range-Doppler Images Using Binary Activated Spiking Neural Networks," in *IEEE International Conference on Automatic Face and Gesture Recognition*, Online (Jodhpur, India), 2021, pp. 1-7.

D. Auge, J. Hille, F. Kreutz, **E. Mueller**, A. Knoll, "End-to-end Spiking Neural Network for Speech Recognition Using Resonating Input Neurons," in *30th International Conference on Artificial Neural Networks (ICANN)*, Online (Bratislava, Slovakia), 2021, pp. 245-256.

E. Mueller, J. Hansjakob, D. Auge, "Faster Conversion of Analog to Spiking Neural Networks by Error Centering," in *Bernstein Computational Neuroscience Conference*, Online (Berlin, Germany), 2020, P 146.

D. Auge, P. Wenner, E. Mueller, "Hand Gesture Recognition using Hierarchical Temporal Memory on Radar Sequence Data," in *Bernstein Computational Neuroscience Conference*, Online (Berlin, Germany), 2020, P 3.

Daniel Auge, E. Mueller, "Resonate-and-Fire Neurons as Frequency Selective Input Encoders for Spiking Neural Networks," Chair of Informatics, TUM, Munich, Technical Report TUM-I2083. 2020


PRESENTATIONS

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<b>Accepted: The 8th International Conference on Information Technology (InCIT)</b> <i>Conference Talk</i>	Nov. 2024
<b>Bioinformatics Meetup</b> <i>Talk at Melbourne Bioinformatics</i>	Aug. 2024
<b>International Conference on Neuromorphic Computing &amp; Engineering (ICNCE)</b> <i>Conference Poster Presentation</i>	Jun. 2024
<b>Doktorandenhuette</b> <i>Talk at the Department of Robotics, Artificial Intelligence and Real-time Systems, TUM</i>	Mar. 2022
<b>Association for the Advancement of Artificial Intelligence (AAAI)</b> <i>Conference Talk</i>	Feb. 2022
<b>International Conference on Systems and Informatics (ICSAI)</b> <i>Conference Talk</i>	Nov. 2021
<b>Bernstein Computational Neuroscience Conference</b> <i>Conference Poster Presentation</i>	Sep. 2021
<b>International Joint Conference on Neural Networks (IJCNN)</b> <i>Conference Talk</i>	Jul. 2021
<b>Doktorandenhuette</b> <i>Talk at the Department of Robotics, Artificial Intelligence and Real-time Systems, TUM</i>	Nov. 2020
<b>Infineon InnoWeek</b> <i>Internal Research Conference Presentation</i>	Oct. 2020
<b>Bernstein Computational Neuroscience Conference Poster</b> <i>Conference Poster Presentation</i>	Oct. 2020
<b>Ph.D. Second Year Presentation</b> <i>Public Presentation</i>	Jul. 2020
<b>Infineon Deep Learning Symposium</b> <i>Conference Poster Presentation</i>	Apr. 2019
<b>Doktorandenhuette</b> <i>Talk at the Department of Robotics, Artificial Intelligence and Real-time Systems, TUM</i>	Dec. 2018

OPEN SOURCE PROJECTS


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**High-Performance Zebrafish (HPZ) **

- A Python and bash toolkit designed to automate recurring brain imaging data tasks on a Slurm-based HPC setup
- End-to-end pipeline that consolidates multiple manual steps for loading, preprocessing, and detecting neurons and spikes in microscopy data into a single automated process, reducing manual intervention and error by a factor of five
- Automated setup for new users to easily work with zebrafish brain imaging data, improving onboarding efficiency

**Convert2SNN **

- A TensorFlow-based library that converts conventionally trained neural networks with continuous activation functions to spiking neural networks, with minimal to no performance loss, to estimate energy consumption in neuromorphic systems
- Supports key spike encoding techniques, including rate, population, and temporal coding, with the ability to estimate spike counts for efficiency evaluation, reducing the need for extensive hardware simulations during development

**Razer Blade for Data Science **

- Collection of instructions, settings, and bash scripts for setting up Nvidia-based gaming notebooks to work with Linux and CUDA

SKILLS

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<b>Programming</b>	Python, TensorFlow, JAX, MATLAB, Bash, Java, C++, SQL
<b>Languages</b>	German (native), French (native), English (fluent), Spanish (basic), Chinese (basic)
<b>Interests</b>	Music (Piano, Ukulele), Fitness, Health