

# Etienne Mueller

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## EDUCATION

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### Postdoctoral Researcher (Artificial Intelligence & 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

### Nengo Summer School (Neuromorphic AI Systems) 2023

*University of Waterloo, Canada*

- Summer school on large-scale brain modelling using Nengo to program neuromorphic hardware systems
- Modelling cognitive and behavioural data with a detailed neural model using a variety of single cell models

### Ph.D. in Computer Science (Artificial Intelligence) 2023

*Technical University of Munich, Germany*

- Thesis on the conversion of conventional to spiking neural networks for energy-efficient neuromorphic computation
- Research of novel biologically-inspired approaches for convolutional, recurrent and transformer architectures for natural language processing and pattern recognition with varying large datasets

### M.Sc. in Product Development and Production (Autonomous Driving) 2017

*Technical University of Hamburg, Germany*

- Thesis on the development of autonomous racing vehicles to sense and act under time constraints
- 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*

- Thesis on designing tools for workflow optimization of a waste utilization plant using CAD

### B.Sc. in Mechanical Engineering (Robotics) 2014

*Technical University of Hamburg, Germany*

- Thesis on 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 Technologies*

- 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 – 2014

*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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**Accepted: The 8th International Conference on Information Technology (InCIT)** Nov. 2024  
*Conference Talk*

**Bioinformatics Meetup** Aug. 2024  
*Talk at Melbourne Bioinformatics*

**International Conference on Neuromorphic Computing & Engineering (ICNCE)** Jun. 2024  
*Conference Poster Presentation*

**Doktorandenhuette** Mar. 2022  
*Talk at the Department of Robotics, Artificial Intelligence and Real-time Systems, TUM*

**Association for the Advancement of Artificial Intelligence (AAAI)** Feb. 2022  
*Conference Talk*

**International Conference on Systems and Informatics (ICSAI)** Nov. 2021  
*Conference Talk*

**Bernstein Computational Neuroscience Conference** Sep. 2021  
*Conference Poster Presentation*

**International Joint Conference on Neural Networks (IJCNN)** Jul. 2021  
*Conference Talk*

**Doktorandenhuette** Nov. 2020  
*Talk at the Department of Robotics, Artificial Intelligence and Real-time Systems, TUM*

**Infineon InnoWeek** Oct. 2020  
*Internal Research Conference Presentation*

**Bernstein Computational Neuroscience Conference Poster** Oct. 2020  
*Conference Poster Presentation*

**Ph.D. Second Year Presentation** Jul. 2020  
*Public Presentation*

**Infineon Deep Learning Symposium** Apr. 2019  
*Conference Poster Presentation*

**Doktorandenhuette** Dec. 2018  
*Talk at the Department of Robotics, Artificial Intelligence and Real-time Systems, TUM*

## 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

## SKILLS

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**Programming** Python, TensorFlow, JAX, Bash, Swift, Xcode, C++, SQL

**Languages** German (native), French (native), English (fluent), Spanish (basic), Chinese (basic)

**Interests** Music (Piano, Ukulele), Fitness, Health