CHRISTIAN PEHLE

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Education

2015 – 2021 **PhD in Physics, Heidelberg University, Germany**
Adjoint Equations of Spiking Neural Networks (magna cum laude)
Supervisor: Karlheinz Meier[†], Johannes Schemmel

· Derived novel gradient based learning algorithm for spiking neural networks.

· Contributed to the digital design and verification of several neuromorphic chips.

2010 – 2014 MSc in Physics, Heidelberg University, Germany
Grade: 1.2 (approximately equivalent to a GPA of 3.9)
2010 – 2011 Vordiplom in Mathematics, Heidelberg University, Germany
Grade: 1.3 (approximately equivalent to a GPA of 3.8)
2007 – 2010 BSc in Physics, Heidelberg University, Germany
Grade: 1.5 (approximately equivalent to a GPA of 3.7)

Selected Publications and Preprints

Timo C Wunderlich and **Christian Pehle**. Eventprop: Backpropagation for exact gradients in spiking neural networks. *arXiv:2009.08378*, 2020 (*in review*)

Christian Pehle and Christof Wetterich. Neuromorphic quantum computing. *arXiv:2005.01533*, 2020 (*in review*)

K. Schreiber, T. C. Wunderlich, **C. Pehle**, M. A. Petrovici, J. Schemmel, and K. Meier. Closed-loop experiments on the brainscales-2 architecture. In *Proceedings of the Neuro-Inspired Computational Elements Workshop*, NICE '20. Association for Computing Machinery, 2020

Benjamin Cramer, Sebastian Billaudelle, Simeon Kanya, Aron Leibfried, Andreas Grübl, Vitali Karasenko, **Christian Pehle**, Korbinian Schreiber, Yannik Stradmann, Johannes Weis, et al. Training spiking multi-layer networks with surrogate gradients on an analog neuromorphic substrate. *arXiv:2006.07239*, 2020 (*in review*)

Thomas Bohnstingl, Franz Scherr, **Christian Pehle**, Karlheinz Meier, and Wolfgang Maass. Neuromorphic hardware learns to learn. *Frontiers in neuroscience*, 13:483, 2019

Syed Ahmed Aamir, Yannik Stradmann, Paul Müller, **Christian Pehle**, Andreas Hartel, Andreas Grübl, Johannes Schemmel, and Karlheinz Meier. An accelerated lif neuronal network array for a large-scale mixed-signal neuromorphic architecture. *IEEE Transactions on Circuits and Systems I: Regular Papers*, 65(12):4299–4312, 2018

Christian Pehle, Karlheinz Meier, Markus Oberthaler, and Christof Wetterich. Emulating quantum computation with artificial neural networks. *arXiv:1810.10335*, 2018 (*in review*)

Scholarships

2007–2014 German National Merit Foundation (highly selective, awarded to less than 0.5% of students)
2007–2014 Evangelisches Studienwerk Villigst (based on academic excellence and social involvement)

Research Funding

2019 – 2021 Participated in second multi-million hour compute time proposal at JUWELS on LTL (learning to learn): successfully ran multi-node deep-learning experiments, contributed to the final report.
2018 – 2019 Participated in a successful collaborative compute time proposal on LTL (learning to learn), which resulted in several million hours of compute time at JUWELS, with participants from 5 international research labs: participated in and presented at planning workshop, wrote proposal for subproject, ran feasibility study, executed research, implemented prototype multi-site workflow engine connecting HPC and neuromorphic hardware for the first time and contributed to the final report.
2017 – 2018 Assisted PhD supervisor with a successful collaborative bid (STRUCTURES excellence cluster) for several million Euro total in funding: did literature review, wrote draft for section in proposal, gave presentations at planning meetings, performed initial preparatory research.

Technical Skills

· Machine Learning: PyTorch, Tensorflow, JAX, algorithm design, scaling to HPC

· Programming: C/C++, Python, Haskell, git, basic unix tools and environment, LaTeX, etc.

· Hardware Design and Verification: Verilog/SystemVerilog, UVM, Verilator, SimVision, Vivado, DPI-C

· Tooling: Continuous Integration (Jenkins, Github workflows), Code Review (Gerrit), SLURM

Supervision & Teaching

2017 – 2020   Supervised graduate students in lab exercises.
2016   Taught Graduate Seminar: Brain Inspired Computing.
2011 – 2012   Graduate Teaching Assistant, Linear Algebra, Heidelberg University.
2009 – 2010   Teaching Assistant, Analysis, Heidelberg University.

Invited Talks / Workshops

2020   CNRS-Thales, NIST (online). Talk: Adjoint Equations and Spiking Neural Networks.
2019   OCNS workshop on generative connectomics and plasticity in Barcelona, Spain.
2019   HBP L2L (learning to learn) workshop in Fürberg, Austria.
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2017   SP9 Fürberg Workshop, in Fürberg, Austria.
2016   SP9 Fürberg Workshop on Stochastic Computing, in Fürberg, Austria.
2016   EITN in Paris, France.

Impact Activities

2021   Held virtual workshop on Deep Learning at the 5th HBP student conference with over 50 participants.
2020   HBP Tea and Slides VII, online seminar for general scientific audience with over 30 participants.
2017   2nd HBP Young Researchers Event in Geneva, Switzerland.

Open Source Involvement

2019 – present   **Norse** (*github.com/norse/norse*, > 200 stars on Github)

· Library for gradient based (deep) learning with Spiking Neural Networks in PyTorch

· Designed API, wrote the initial implementation

· Backends for several neuromorphic chips in development

Training & Development

2018   CapoCaccia workshop in Alghero, Italy.
2017   HBP CodeJam in Lausanne, Switzerland.
2016   HBP CodeJam in Manchester, UK.
2016   CapoCaccia workshop in Alghero, Italy.

Languages

German (native), English (fluent), French (basic), Latin (basic)

Other Interests

Programming Language Design and Type Theory, Long Distance Hiking (200 km+), Alpine Skiing

References available on request