

Dominik Dold, Dr. rer. nat.

🎓 neuromorphic computing, machine & deep learning, neuroscience, AI

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Work experience

- 2021 – 📌 **Internal Research Fellow in AI.** ESA ESTEC, ACT and Software Division, Noordwijk.
- 2020 – 2021 📌 **AI Residency Researcher.** Siemens AI Lab Residency, Siemens AG, Munich.
- 2017 – 2018 📌 **Visiting Researcher.** Senn group for computational neuroscience, University of Bern.
- 2016 – 2020 📌 **Doctoral Researcher.** Petrovici group for neuro-inspired AI, Heidelberg University.
- 2014 – 2015 📌 **Research Assistant.** Evers group for theoretical quantum dynamics, MPIK Heidelberg.

Education

- 2016 – 2020 📌 **Dr. rer. nat.**, Heidelberg University, Germany.
Thesis title: *Harnessing function from form: towards bio-inspired AI in neuronal substrates.*
- 2014 – 2016 📌 **M.Sc. in Physics**, Heidelberg University, Germany.
Thesis title: *Stochastic Computation in Spiking Neural Networks Without Noise.*
- 2010 – 2014 📌 **B.Sc. in Physics**, Heidelberg University, Germany.
Thesis title: *Energy Conservation in Fano Spectral Line Shape Control.*

General skills

- Languages 📌 very good writing, reading and communication skills in English
- Coding 📌 PYTHON, TensorFlow, PyTorch, Mathematica, Matlab, C(++), HTML
- Software 📌 familiar with Linux bash shell and Windows systems, version control (git), integrated testing (jenkins), job scheduler (slurm, moab), SPARQL, AWS
- Design 📌 L^AT_EX, Microsoft Office, Microsoft Powerpoint, Inkscape, TikZ, Gimp
- Teaching 📌 co-supervised two Master's theses and supervised lecture tutorials, physics experiments for students and soft skill courses for first-year students
- Social 📌 organized the Journal Club of my research group during my PhD

Communication skills

Selected talks

- 2021 📌 **International Joint Conference on Neural Networks (IJCNN)**, virtual.
Selected from submitted publications.
- 2019 📌 **Invited talk at Huawei research center**, Hangzhou, China.
Invited by Liao Jianxing & Dr. Yansong Chua.
📌 **Selected talk at the Cosyne conference 2019**, Lisbon, Portugal.
Selected from submitted abstracts.
- 2018 📌 **Invited talk at the ETH Institute of Neuroinformatics**, Zurich, Switzerland.
Invited by Dr. João Sacramento.
📌 **Intel Neuromorphic Research Community (INRC) workshop**, Reykjavik, Iceland.
Invited by Mike Davies as INRC project representative.

Communication skills (continued)

- **Neuroplasticity: From Bench to Machine Learning**, Guildford, England.
Selected from abstracts. Workshop at the Institute of Advanced Studies, University of Surrey.
- **From Neuroscience to Machine Learning**, Paris, France.
Invited to workshop at the European Institute for Theoretical Neuroscience.

Poster presentations

- 2019 ■ **Bernstein conference 2019** in Berlin, Germany.
- **CNS conference 2019** in Barcelona, Spain.
- **DS³ data science summer school** in Paris, France.
- **IRCN course in neuro-inspired computation** in Tokyo, Japan.
- 2018 ■ **Bernstein conference 2018** in Berlin, Germany.
- **EMBO dendrites workshop 2018** in Heraklion, Greece.
- 2017 ■ **Bernstein conference 2017** in Göttingen, Germany.
- **CNS conference 2017** in Antwerp, Belgium.

Additional training and experience

- June 2020 ■ **AI@Sustainability 72h Hackathon** organized by the Siemens AI Lab.
- August 2019 ■ **Team communication – key roles and intercultural contexts workshop**.[†]
- June 2019 ■ **DS³ data science summer school**.
Five-day school co-organized by the École polytechnique & the DATAIA Institute.
- March 2019 ■ **IRCN course in neuro-inspired computation**.
Four-day course offered by the University of Tokyo.
- **University leadership and management (Epigeum)**.[†]
- February 2019 ■ **Business management course "Grundlagenwissen BWL"**.[†]
- October 2018 ■ **Computational physics with GPUs**.[†]
- April 2017 ■ **Machine learning in science and industry**.[†]

[†] Courses offered by the Heidelberg graduate academy and graduate school for physics.

Awards

- 2019 ■ **First prize in the finals of the 2019 International Collegiate Competition for Brain-Inspired Computing (ICCBC 2019)** at Tsinghua University in Beijing, China.

Publications

Patent applications

- 2021 ■ **D. Dold & J. Soler Garrido**. Industrial device and method for building and/or processing a knowledge graph. 2020E22352 DE, 18 Jan 2021.
- **D. Dold & J. Soler Garrido**. Neuromorphic hardware for processing a knowledge graph represented by observed triple statements and method for training a learning component. 2020E22352 DE, 18 Jan 2021.
- **D. Dold & J. Soler Garrido**. Neuromorphic hardware and method for storing and/or processing a knowledge graph. 2020E22352 DE, 18 Jan 2021.

Publications (continued)

Peer-reviewed articles & preprints

- in prep. ■ W. Senn* & D. Dold* et al. Lagrangian dynamics of dendritic microcircuits enables real-time error backpropagation across cortical areas.
- 2021 ■ D. Dold & J. Soler Garrido. An energy-based model for neuro-symbolic reasoning on knowledge graphs. *20th IEEE International Conference on Machine Learning and Applications (IEEE ICMLA)*
- V. Caceres Chian*, M. Hildebrandt*, T. Runkler & D. Dold*. Learning through structure: towards deep neuromorphic knowledge graph embeddings. *International Conference on Neuromorphic Computing (ICNC 2021)*.
- J. Göltz & L. Kriener et al. Fast and energy-efficient neuromorphic deep learning with first-spike times. *Nature Machine Intelligence, Volume 3*.
- J. Soler Garrido*, D. Dold* & J. Frank. Machine learning on knowledge graphs for context-aware security monitoring. *IEEE International Conference on Cyber Security and Resilience (IEEE-CSR)*.
- D. Dold & J. Soler Garrido. SpikeE: spike-based embeddings for multi-relational graph data. *International Joint Conference on Neural Networks (IJCNN)*.
- 2020 ■ S. Billaudelle* ... D. Dold* et al. Versatile emulation of spiking neural networks on an accelerated neuromorphic substrate. *IEEE International Symposium on Circuits and Systems (ISCAS)*.
- 2019 ■ A. Kungl et al. Accelerated physical emulation of bayesian inference in spiking neural networks. *Frontiers in Neuroscience, 13, 1201*.
- D. Dold*, I. Bytschok* & M. Petrovici* et al. Stochasticity from function – why the bayesian brain may need no noise. *Neural Networks, 119, 200–213*.
- 2017 ■ I. Bytschok*, D. Dold* & M. Petrovici* et al. Spike-based probabilistic inference with correlated noise. *arXiv:1707.01746*.

* marks equal contributions

Supervised theses

- 2021 ■ V. Caceres. Towards the integration of graph neural networks into neuromorphic architectures. *Master's thesis, Technical University Munich*.
- 2018 ■ M. Zenk. Spatio-temporal predictions with spiking neural networks. *Master's thesis, Heidelberg University*.

Research proposals

- 2021 ■ D. Dold. Energy efficient and explainable learning systems for space missions. *ESA Research Fellowship*.
- 2019 ■ J. Jordan, L. Kriener, D. Dold, M. Petrovici & W. Senn. Real-time error-backpropagation for deep cortical microcircuits in spiking neuromorphic systems. *Intel INRC grant (cont.)*.
- 2018 ■ J. Jordan, D. Dold, M. Petrovici & W. Senn. Real-time error-backpropagation for deep cortical microcircuits in spiking neuromorphic systems. *Intel INRC grant*.