Johannes von Oswald

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I am a senior research scientist at Google Research working with Blaise Agüera y Arcas and João Sacramento at the Paradigms of Intelligence Team. Until 2023, I was a PhD student supervised by Angelika Steger and João Sacramento at the Institute of Theoretical Computer Science, ETH Zurich. My research focuses on how and what machines, in particular neural networks, learn from data. One important goal is to allow these learning algorithms to generalize broadly and solve novel complex tasks. Therefore, I am heavily inspired by (meta-) learning within a large, possibly open-ended, enviroment. Currently, I am working on mesa-optimization: the emergence of algorithms within neural networks, in paper link 1 and paper link 2 we showed that gradient descent is a mechanism learned by pure self-supervised learning which allows transformers to learn and generalize at test time to novel data provided in-context. I am currently working on incorporating these findings into large language models.

Education

ETH Zurich   Zurich | 2018 - 2023
PhD Student at the Institute of Theoretical Computer Science
Advisor: Prof. Angelika Steger & Dr. João Sacramento
Deep learning, in particular continual, meta and mesa-optimization.

Technical University Munich   Munich | 2014 - 2017
Master in Mathematics
Advisor: Prof. Daniel Cremers
Thesis: Bayesian Optimal Flow Prediction with Neural Networks
I studied mathematics with a minor in computer science and focused on computer
vision, inverse problems and dynamical systems.

ETH Zurich   Zurich | Summer 2016
Visiting student under the Swiss-European Mobility Programme.
I worked at the Institute for Visual Computing of Prof. Marc Pollefeys on neural
networks based object recognition incorporating depth information.

Hongkong University of Science and Technology   Hongkong | Autumn 2015
TU Munich exchange program. HKUST Dean's List for outstanding attainment.

Technical University Berlin   Berlin | 2011 - 2014
Bachelor in Mathematics
Advisor: Prof. Yuri Suris
Thesis: Special Solutions of the N-body Problem.
I studied mathematics with a minor in physics and a focus on differential geometry
and mathematical physics.

Fellowships & Awards

Swiss Data Science Center Fellowship ($\approx$ CHF 200.000 - 4 years of PhD salary)	2019 - 2023
Google Cloud Research Grant ($ 5000)	2021
ZNZ Travel Grant (CHF 1000)	2021
Pi School of Artificial Intelligence (EUR 2000)	2018

Tasks & Poster Presentations

ASAP Seminar - MesaNet: Sequence Modeling by Locally Optimal Test-Time Training | virtual	June 2025
Oral presentation at ICLR - Learning Randomized Algorithms with Transformers | Singapore	April 2025
Talk at the Helmholtz-ELLIS Workshop on Foundation Models in Science on modern RNNs | Berlin	March 2025
Tutorial at CoLLAs 2024 on the mechanics of in-context learning | Pisa	July 2024
Talk at the Alignment Workshop - Mechanistic Interpretability of in-context learning | New Orleans	Dec 2023
Talk at Mila, Montreal/ServiceNow - Uncovering mesa-opt. algorithms in Transformers | virtual	Oct 2023
Talk at ChatGPT Zurich Group - In-context learning in large language models | Zurich	Sep 2023
Oral presentation at NeurIPS - Transformers learn in-context by gradient descent | Hawaii	July 2023
Talk at SDSC - On Transformers and how they can learn in-context | Zurich	April 2023
Talk at Google Brain, San Francisco - On Transformers and how they can learn in-context | virtual	Feb 2023
Talk at Jagiellonian University, Krakau - Transformers learn in-context by gradient descent | virtual	Jan 2023
Talk at Sapienza University, Rome - Transformers learn in-context by gradient descent | virtual	Jan 2023
Talk at Google DeepMind - Transformers learn in-context by gradient descent | virtual	Dec 2022
Talk at Google DeepMind - On HyperNetworks and the prefrontal cortex | London	Aug 2022
Poster presentation at NeurIPS - Learning where to learn | Offsite at EPFL	Dec 2021
Poster presentation at ICML - Meta-learning via hypernetworks | virtual	July 2021
Talk at the Swiss Data Science Center - Hypernetworks for sparse and continuous data | virtual	Aug 2020
Poster presentation at ICLR - Continual learning with hypernetworks | virtual	June 2020
Spotlight poster presentation at NeurIPS - On adversarially-trained hypernetworks | Montreal	Dec 2018

Selected Publications & Preprints

[1] J. von Oswald, S. Kobayashi, Y. Akram, and A. Steger, "Learning randomized algorithms with transformers", in ICLR - Oral presentation (2025).

[2] J. von Oswald, N. Scherrer, S. Kobayashi, L. Versari, S. Yang, M. S. et al., B. A. y Arcas, and J. Sacramento, "Mesanet: sequence modeling by locally optimal test-time training", arXiv (2025).

[3] S. Kobayashi, Y. Akram, and J. V. Oswald, "Weight decay induces low-rank attention layers", in NeurIPS (2024).

[4] J. von Oswald, E. Niklasson, E. Randazzo, J. Sacramento, A. Mordvintsev, A. Zhmoginov, and M. Vladymyrov, "Transformers learn in-context by gradient descent", in ICML - Oral presentation (2023).

[5] J. von Oswald, M. Schlegel, A. Meulemans, S. Kobayashi, E. Niklasson, et al., R. Pascanu, and J. Sacramento, "Uncovering mesa-optimization algorithms in transformers", arXiv (2023).

[6] A. Meulemans, N. Zucchet, S. Kobayashi, J. von Oswald, and J. Sacramento, "The least-control principle for learning at equilibrium", in NeurIPS - Oral presentation (2022).

[7] N. Zucchet, S. Schug, J. von Oswald*, D. Zhao, and J. Sacramento, "A contrastive rule for meta-learning", in NeurIPS (2022).

[8] J. von Oswald, S. Kobayashi, and et al., "Neural networks with late-phase weights", in ICLR (2021).

[9] J. von Oswald, D. Zhao, S. Kobayashi, S. Schug, M. Caccia, N. Zucchet, and J. Sacramento, "Learning where to learn: Gradient sparsity in meta and continual learning", in NeurIPS (2021).

[10] J. von Oswald, C. Henning, B. F. Grewe, and J. Sacramento, "Continual learning with hypernetworks", in ICLR - Spotlight presentation (2020).

(* first author)

Teaching Experience (TA)

Algorithms and complexity	2022 & 2023
Algorithms and probability	2022 & 2023
Learning in deep artificial and biological neuronal networks	2019 & 2020 & 2021

Supervision

Julius Schulte (PhD Thesis) - Weight averaging through HyperNetworks
Oliver Sieberling & Yanick Schimpf (Deep learning project) - Swiss deep delta net
Vinay Hiremath (Master thesis) - Differentiable gated linear networks
Levan Varamashvili (Master thesis) - On how Transformers invert matrices
Laurent Verdan (Bachelor thesis) - Grokking beyond simple addition
Maximilian Schlegel (Bachelor thesis) - Transformers solve linear autoregressive tasks by gradient descent
Damian Cordes (Bachelor thesis) - On sparse continual meta-learning
Yuchen Chang (Bachelor thesis) - Understanding warm starting with the neural tangent kernel

Reviewing / Scientific Services

Area Chair - Neural Information Processing Systems (NeurIPS)	2025
Reviewer - Neural Information Processing Systems (NeurIPS), Top Reviewer in 2023	2021-2025
Reviewer - Conference on Lifelong Learning Agents (CoLLAs)	2023
Reviewer - International Conference on Machine Learning (ICML)	2021-2025
Reviewer - Transactions on Machine Learning Research (TMLR)	2022-2024
Reviewer - International Conference on Learning Representations (ICLR)	2021-2025
Reviewer - Workshop on Continual Learning in Computer Vision (CVPR)	2020 & 2021

Industry & Working Experience (Selection)

Google Research - Senior Research Scientist   Zurich | 2025 - today
Research on sequence modeling and large language models.

Google Research - Research Scientist   Zurich | 2023 - 2025
Research on sequence modeling, transformers, reinforcement learning and
mechanistic interpretability of deep learning models.

Google Research - PhD Intern at Google Research   Seattle | Summer 2023
Internship at Google in Seattle supervised by Max Vladymyrov.

Google Research - Research student at Google Research   Zurich | Autumn 2022
Research student at Google Zurich supervised by Alexander Mordvintsev.

Pi School - School of Artificial Intelligence   Rome | Summer 2018
Awardee of a Pi school scholarship for an eight weeks hands-on machine learning course
for industry applications.

Celonis - Business Process Mining   Munich | Summer 2015
Intern and working student developing tools for automated process creation for SAP
databases.

Nice Bar - Bar   Berlin & Brussels | 2011 - 2013
Co-Owner and Barkeeper.

Ronzino von Oswald SA - Textile Production   Berlin & Porto | 2010 - today
Co-founder and board advisor of textile production and sourcing company
based in Berlin and Porto, Portugal.