Kilian Lieret

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My research develops AI systems that autonomously perform complex problem-solving tasks in software engineering and beyond. My multidisciplinary background includes postdoctoral research on Graph Neural Networks, petabyte-scale data analysis in experimental high energy physics, and dual degrees in mathematics and physics.

Professional Experience

Research Software Engineer II **since Feb 2024**

Princeton University, Princeton Language & Intelligence Initiative Princeton, U.S.A.

Adviser: Karthik Narasimhan

- Agentic AI for Software Engineering: lead developer of `SWE-agent` since Mar 2024; repeatedly achieved SotA on `SWE-bench`; refactored and built around `SWE-ReX` for 10x execution time speedup and cloud capabilities
- Contributed to achieving SotA on various cybersecurity benchmarks (`SWE-agent EnIGMA`), and open-weight SotA on `SWE-bench` by large-scale generation of agent trajectories for synthetic issues (`SWE-smith`)

Associate Research Scholar / Postdoctoral Research Associate **July 2022 – Jan 2024**

Princeton University, Inst. for Research & Innovation in Software for High Energy Physics Princeton, U.S.A.

Adviser: Peter Elmer

- Machine learning for high-throughput algorithms in High Energy Physics
- Learned-clustering with graph neural networks and transformers (more information)

Education

Ph.D. in Experimental High Energy Physics **Oct 2018 – May 2022**

Ludwig Maximilian University Munich, Germany

Adviser: Thomas Kuhr

Thesis: *Calibration of Machine Learning-based Hadronic Tagging in Preparation for a $|V_{cb}|$ Measurement and Clustering of Kinematic Distributions*

Graduated *Summa Cum Laude*

- Calibration & debiasing of machine learning algorithms for the reconstruction of particle decays
- Cluster analyses of kinematic distributions of particle decays
- Part of the Belle II Software Team; responsible for software performance testing

Elite-M.Sc. course on Theoretical and Mathematical Physics **Oct 2014 – Sep 2018**

Ludwig Maximilian University and Technical University of Munich Munich, Germany

Thesis: *Construction of Angular Observables Sensitive to New Physics in $\bar{B} \longrightarrow D^* \tau^- \bar{\nu}_\tau$ Decays and Measurements of Differential Cross Sections of $\bar{B} \longrightarrow D^* \ell^- \bar{\nu}_\ell$ Decays with Hadronic Tagging at Belle*

B.Sc. in Physics **Oct 2011 – Sep 2015**

Ludwig Maximilian University Munich, Germany

Thesis: *Truth-Level Based Estimation of the Sensitivity to Phenomenological Minimal Supersymmetric Standard Models in Events With One Hard Lepton*

B.Sc. in Mathematics **Oct 2011 – Aug 2014**
Ludwig Maximilian University Munich, Germany
Thesis: *Elliptic Functions*
Graduated *top of my class*

Leadership

High Energy Physics Software Foundation **2020 – 2023**
Co-led the Software Training and Careers Working Group; organized cross-experiment software training events with more than 1,500 participants

Belle II Collaboration **2020 – 2023**
Co-led the Software Documentation and Training Group

Research stays and internships

University of Tokyo Visiting research scientist **Dec 2017 – Feb 2018**
Tokyo Institute of Technology Research-oriented summer school **Jul 2017 – Sep 2017**
Nagoya University Nagoya University Program for Academic Exchange **Sep 2015 – Sep 2016**
LHCb, CERN Research-oriented summer school **Jul 2015 – Sep 2015**

Scholarships

University of Tokyo **Dec 2017 – Feb 2018**
German National Academic Foundation **Apr 2013 – Jun 2018**
Max Weber-Program of the state of Bavaria **Dec 2013 – Oct 2017**
Tokyo Institute of Technology **Jul 2017 – Sep 2017**
German Academic Exchange Service (DAAD) **Sep 2015 – Aug 2016**

Selected Publications (NLP)

SWE-smith: Scaling Data for Software Engineering Agents **Preprint 2025**
J. Yang, K. Lieret, C. E. Jimenez, A. Wettig, K. Khandpur, Y. Zhang, B. Hui, O. Press, L. Schmidt, D. Yang

EnIGMA: Enhanced Interactive Generative Model Agent for CTF Challenges **ICML 2025**
T. Abramovich, M. Udeshi, M. Shao, K. Lieret, H. Xi, K. Milner, S. Jancheska, J. Yang, C. E. Jimenez, F. Khorrami, P. Krishnamurthy, B. Dolan-Gavitt, M. Shafique, K. Narasimhan, R. Karri, O. Press

SWE-bench Multimodal: Do AI Systems Generalize to Visual Software Domains? **ICLR 2025**
J. Yang, C. E. Jimenez, A. L. Zhang, K. Lieret, J. Yang, X. Wu, O. Press, N. Muennighoff, G. Synnaeve, K. R. Narasimhan, O. Press

SWE-agent: Agent-Computer Interfaces Enable Automated Software Engineering **NeurIPS 2024**
J. Yang, C. E. Jimenez, A. Wettig, K. Lieret, S. Yao, K. Narasimhan, O. Press

SciCode: A Research Coding Benchmark Curated by Scientists **NeurIPS 2024**
M. Tian, . . . , K. Lieret, . . . , H. Peng

Selected Publications (AI for physics)

High Pileup Particle Tracking with Learned Clustering **ACAT 2024**
K. Lieret, G. DeZoort

High Pileup Particle Tracking with Object Condensation **CTD 2023**
K. Lieret, G. DeZoort, D. Chatterjee, J. Park, S. Miao, P. Li

An Object Condensation Pipeline for Charged Particle Tracking at the High Luminosity LHC **CHEP 2023**
K. Lieret, G. DeZoort

Selected Publications (Physics)

Not listing* $\sim$ 150 *additional publications as part of the Belle and Belle II collaborations (2019 – 2023)

Measurement of differential distributions of $\overline{B} \to D^{(*)}\tau^-\overline{\nu}_\tau$ *and implications for* $|V_{cb}|$ **Phys. Rev. D, 2023**
M. T. Prim, F. Bernlochner, F. Metzner, K. Lieret, (... 144 more), V. Zhukova (The Belle collaboration)

Clustering of kinematic $\overline{B} \to D^{(*)}\tau^-\overline{\nu}_\tau$ *distributions with ClusterKinG* **JHEP, 2020**
J. Aebischer, T. Kuhr, K. Lieret

Selective background Monte Carlo simulation at Belle II **EPJ Web of Conf., 2020**
J. Kahn, E. Dorigatti, K. Lieret, A. Lindner, T. Kuhr

Recent talks, posters, interviews

From Code Completion to Autonomous Software Engineering Agents Databricks Data+AI Summit, SF, **Jun 2025**
SWE-bench Multimodal: Do AI Systems Generalize to Visual Software Domains? ICLR, Singapore, **Apr 2025**
Technical fireside chat: Key lessons from pushing AI beyond autocomplete GenAI collective, NY, **Apr 2025**
Beyond Code Completion: Building Next-Gen AI Engineering Agents Daytona AI Builder's day, SF, **Apr 2025**
Interview/podcast (together with C.E. Jimenez) Databrew by Databricks, **Apr 2025**
From Code Completion to Autonomous Software Engineering Agents MLOps Agent hour, *virtual*, **Mar 2025**
NeurIPS Hacker Cup AI Lecture Series: SWE-agent *virtual*, **Aug 2024**
High Pileup Particle Tracking with Object Condensation CTD, Toulouse, **Oct 2023**
Tracking with Graph Neural Networks PyHEP, *virtual*, **Oct 2023**
An Object Condensation Pipeline for Charged Particle Tracking CHEP, Norfolk, **May 2023**
Building a Global HEP Software Training Community CHEP, Norfolk, **May 2023**

Open source projects

I am passionate about open-source development and have authored more than 20 open-source projects over the past 10 years. Currently, most of my time is spent on `SWE-agent`, `SWE-ReX`, `SWE-smith`, and related projects. Previously, I worked on `gnn_tracking`, a library for particle trajectory reconstruction using graph neural networks. An overview of my other open-source projects is available at lieret.net/opensource.