Christopher Hahn

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Current Positions

- Stanford University — Stanford, USA
  Visiting Assistant Professor (Research) — *Aug 2022 - now*
  Member of the Stanford Center for AI Safety (https://aisafety.stanford.edu/)
- CISPA Helmholtz Center for Information Security — Saarbrücken, Germany
  Independent Research Group Leader (STAI - Safety × AI group) — *Jun 2022 - now*
  Member of the CISPA-Stanford Center for Cybersecurity (https://cispa-stanford.org)

Education

- Saarland University — Saarbrücken, Germany
  Dr. rer. nat. (Ph.D.) with summa cum laude — *2017 - 2021*
  Thesis title: "Logical and Deep Learning Methods for Temporal Reasoning"
  Advisor: Prof. Bernd Finkbeiner, Ph.D.
  Reviewers: Christian Szegedy, Ph.D. (Google Research); Prof. Dr. Andreas Podelski (University of Freiburg)
- Saarland University — Saarbrücken, Germany
  M.Sc. in Computer Science with Honors — *2016 - 2017*
- Saarland University — Saarbrücken, Germany
  B.Sc. in Computer Science (major) and Computer Linguistics (minor) — *2013 - 2016*

Current Research Lines

- Transformers and their application to symbolic reasoning, hardware specifications, and code.
- Verification and runtime assurance of systems.
- Automated reasoning tools for safety, security, and information-flow control.

Publications

Preprints and Unpublished Manuscripts

- Cosler M., **H. C.**, Mendoza D., Schmitt F., Trippel C., nl2spec: Interactively Translating Unstructured Natural Language to Temporal Logics with Large Language Models, *under review.*
- Cosler M., **H. C.**, Omar A., Schmitt F., NeuroSynt: A Neuro-symbolic Portfolio Solver for Reactive Synthesis, *under review.*
- Crews P., **H. C.**, McCune J., Trippel C., A Formal Foundation for Recoverability, *under review.*
- **H. C.**, Schmitt F., Tillman J. J., Metzger N., Siber J., Finkbeiner B., Formal Specifications from Natural Language, *(arXiv preprint).*
- Metzger N., **H. C.**, Siber J., Schmitt F., Finkbeiner B., Attention Flows for General Transformers, *(arXiv preprint).*
- Kreber J. U., **H. C.**, Generating Temporal Reasoning Problems with Transformer GANs, *(arXiv preprint).*

Conference Papers

- Cosler M., Schmitt F., **H.C.**, Finkbeiner B., Iterative Circuit Repair Against Formal Specifications. *Eleventh International Conference on Learning Representations (ICLR'23).*
- Coenen N., Finkbeiner B., Frenkel H., **H. C.**, Metzger N., Siber J., Temporal Causality in Reactive Systems, *In Proceedings of the 20th International Symposium on Automated Technology for Verification and Analysis (ATVA'22).*
- Coenen N., Dachselt R., Finkbeiner B., Frenkel H., **H. C.**, Horak T., Metzger N., Siber J., Explaining Hyperproperty Violations, *In Proceedings of the 34th International Conference on Computer-Aided Verification (CAV'22).*
- Horak T., Coenen N., Metzger N., **H. C.**, Flemisch T., Méndez J., Dimov D., Finkbeiner B., Dachselt R., Visual Analysis of Hyperproperties for Understanding Model Checking Results, *IEEE VIS: Visualization & Visual Analytics (IEEE VIS '22).*
- Schmitt F., **H. C.**, Kreber J., Rabe M.N., Finkbeiner B., Deep Learning for Temporal Logics, *6th Conference on Artificial Intelligence and Theorem Proving (AITP '21).*
- Schmitt F., **H. C.**, Rabe M. N., Finkbeiner B., Neural Circuit Synthesis from Specification Patterns, *35th Conference on Neural Information Processing Systems (NeurIPS '21).*
- Coenen N., Finkbeiner B., **H. C.**, Hofmann J., Schillo Y., Runtime Enforcement of Hyperproperties, *The 19th International Symposium on Automated Technology for Verification and Analysis (ATVA '21).*
- **H.C.**, Schmitt F., Kreber J., Rabe M.N., Finkbeiner B., Teaching temporal logics to neural networks, *Ninth International Conference on Learning Representations (ICLR'21)*
- Coenen N., Finkbeiner B., **H.C.**, Hofmann J., The hierarchy of hyperlogics: a knowledge reasoning perspective, *17th International Conference on Principles of Knowledge Representation and Reasoning (KR'20)*
- Finkbeiner B., **H.C.**, Hofmann J., Tentrup L., Realizing omega-regular Hyperproperties, *In Proceedings of 32nd International Conference on Computer-Aided Verification (CAV'20)*
- **H. C.**, Algorithms for monitoring hyperproperties, *in Proceedings of International Conference on Runtime Verification (RV'19)*, **Tutorial at 3rd World Congress on Formal Methods (FM Week '19)**.
- Coenen N, Finkbeiner B., **H. C.**, Hofmann J., The hierarchy of hyperlogics, *In Proceedings of 34th Annual ACM/IEEE Symposium on Logic in Computer Science (LICS'19).*
- **H. C.**, Stenger M., Tentrup L., Constraint-based monitoring of hyperproperties, *In Proceedings of 25th International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS'19).*
- Finkbeiner B., **H. C.**, Hans T., MGHyper: Checking satisfiability of HyperLTL formulas beyond the $\exists^*\forall^*$ fragment, *In Proceedings of 16th International Symposium on Automated Technology for Verification and Analysis (ATVA'18).*
- Finkbeiner B., **H. C.**, Lukert P., Stenger M., Tentrup L., Synthesizing reactive systems from hyperproperties, *In Proceedings of 30th International Conferences on Computer-Aided Verification (CAV'18).*
- Finkbeiner B., **H. C.**, Torfah H., Model checking quantitative hyperproperties, *In Proceedings of 30th International Conferences on Computer-Aided Verification (CAV'18).*
- Finkbeiner B., **H. C.**, Stenger M., Tentrup L., RVHyper: A runtime verification tool for temporal hyperproperties, *In Proceedings of 24th International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS'18).*
- Finkbeiner B., **H. C.**, Stenger M., Tentrup L., Monitoring hyperproperties, *In Proceedings of 17th International Conference on Runtime Verification (RV'17).*
- Finkbeiner B., **H. C.**, Stenger M., EAHyper: Satisfiability, implication and equivalence checking of hyperproperties, *In Proceedings of 29th International Conference on Computer-Aided Verification (CAV'17).*

- Finkbeiner B., **H. C.**, Deciding hyperproperties, *In Proceedings of 27th International Conference on Concurrency Theory (CONCUR'16).*

Journal Papers

- Finkbeiner B., **H. C.**, Stenger M., Tentrup L., Efficient monitoring of hyperproperties using prefix trees. *In International Journal on Software Tools for Technology Transfer (STTT'20)*, **TACAS Special Issue**.
- Finkbeiner B., **H. C.**, Philip L., Stenger M., Tentrup L., Synthesis from hyperproperties, *In International Journal Acta Informatica (ACTA'19)*, **SYNT Special Issue**.
- Finkbeiner B., **H. C.**, Stenger M., Tentrup L., Monitoring hyperproperties, *In International Journal on Formal Methods in System Design (FMSD'19)*, **RV Special Issue**.

Workshops

- Schmitt F., **H.C.**, Schmitt F., LTL Synthesis with Transformer Neural Networks, *International Workshop on Synthesis SYNT'22, co-located with CAV.*
- Finkbeiner B., **H.C.**, Hofmann J., Deciding Realizability of HyperQPTL Specifications, *International Workshop on Synthesis SYNT'19, co-located with CAV.*
- Finkbeiner B., **H.C.**, Lukert P., Tentrup L., On the Expressiveness of HyperLTL Synthesis, *International Workshop on Synthesis SYNT'18, co-located with CAV.*

Honors and Awards

Invitation to Special Issues	RV'17, CAV'18, and TACAS'19
2018 Busy Beaver Award	For outstanding teaching performance in 'Programming 1', awarded by the computer science student council.
2017 BeStE Award	For student initiatives and extraordinary commitment, awarded by the presidential board of Saarland University.
Departmental Ph.D. Scholarship	Awarded by the Graduate School of Computer Science.
German National Scholarship	Awarded by the Federal Ministry of Education.

Service

- Organizer of the 1st International Workshop on Deep Learning-Aided Verification (DAV), co-organized with Markus N. Rabe (Google), `https://dav-workshop.github.io/`
- PC member: IJCAI'21, IJCAI-ECAI'22, ICML'22, IJCAI'23, NeSy-Gems'23, ACL'23, ICLR-tiny'23
- Reviewer: LICS'19, ATVA'19, STTT'20, CSL'20, CONCUR'20, LICS'21, CAV'21, CONCUR'21, ATVA'21, CAV'23

Talks

- "Silicon Valley & Generative AI", keynote at CISPA community event, Saarbrücken, Germany, March '23.
- "nl2spec: Interactively Translating Unstructured Natural Language to Temporal Logics with LLMs" at Google Research, Mountain View, USA, March '23.
- "From Natural Language to Formal Specifications" at Software Verification Lunch, Stanford, USA, Dec '22.
- "Deep Learning for Temporal Logics" at Stanford Center for AI Safety, Stanford, USA, Oct '22.
- "Runtime Enforcement of Hyperproperties" at the 19th International Symposium on Automated Technology for Verification and Analysis (ATVA) in Gold Coast and virtual, Australia, Oct '21.
- "Teaching Temporal Logics to Neural Networks" at the Ninth International Conference on Learning Representations (ICLR), virtual, May '21.

- "Transformers Generalize to the Semantics of Logics" at University of California, Berkeley, USA, Aug '20.
- "Teaching Temporal Logics to Neural Networks" at Google Research, Mountain View, USA, June '20.
- "Realizing ω-regular Hyperproperties" at the 32nd International Conference on Computer-Aided Verification (CAV), Los Angeles and virtual, July '20.
- "Algorithms for Monitoring Hyperproperties" Tutorial at RV at the 3rd World Congress on Formal Methods in Porto, Portugal, Oct '19.
- "Temporal Hyperproperties" Invited Tutorial at TU Munich, Germany, July '19.
- "Deciding Realizability of HyperQPTL Specifications" at the 8th Workshop on Synthesis in New York (SYNT@CAV), USA, July '19.
- "Monitoring Hyperproperties" at the 17th International Conference on Runtime Verification in Seattle (RV), USA, Sep '17.
- "EAHyper: Satisfiability, Implication, and Equivalence Checking of Hyperproperties" at the 29th International Conference on Computer-Aided Verification (CAV) in Heidelberg, Germany, July '17.
- "Deciding Hyperproperties" at Highlights of Logics, Games and Automata in Brussels, Belgium, Sep '16.
- "Deciding Hyperproperties" at the 27th International Conference on Concurrency Theory (CONCUR) in Quebec, Canada, Aug '16.

Teaching

Summer 22	Advisor for seminar on 'Neural-Symbolic Computing'.
Summer 20	Advisor for seminar on 'Neural-Symbolic Computing'.
Summer 19	Advisor for seminar on 'Software Reliability'.
Winter 18/19	Advisor for seminar on 'Hyperproperties'.
Summer 18	Advisor for seminar on 'Formal Verification of Security Protocols'.
Winter 17/18	Teaching Assistant for 'Programming 1' **(won Busy Beaver award)**.
Summer 17	Lecturer for mathematics preparation course for CS freshmen **(won BeStE award)**.
Winter 16/17	Teaching Assistant for 'Verification'.
Summer 16	Lecturer and Coach for mathematics preparation course for CS freshmen.
Summer 16	Student TA for 'Concurrent Programming'.
Winter 15/16	Organizer didactics seminar for re-exam student TAs.
Winter 15/16	Supervision Student TA for 'Programming 1'.
Summer 15	Coach for mathematics preparation course for CS freshmen.
Winter 14/15	Organizer of didactics seminar for re-exam student TAs.
Winter 14/15	Student TA for 'Programming 1'.
Summer 14	Student TA for mathematics preparation course for CS freshmen.
Winter 13/14	Re-exam student TA for 'Programming 1'.

Teaching Videos

- Programming 1 at Saarland University: YouTube-Channel (in German): `https://www.youtube.com/channel/UCVAodHZqVrgCeUrvDQgMijw`.
- mathematics preparation course for CS freshmen at Saarland University: YouTube-Channel (in German): `https://www.youtube.com/channel/UCLS4RYPaUVSg_TLtr2-oUOg`.

Advising

Ayham Omar	ongoing (CISPA)	Neural Reactive Synthesis
Chuyue (Livia) Sun	ongoing (Stanford)	Natural language to Speciffications, with Caroline Trippel
Daniel Mendoza	ongoing (Stanford)	Deep Learning for Temporal Logics, with Caroline Trippel
Paul Crews	ongoing (Google)	A Formal Foundation for Recoverability, with Caroline Trippel
Matthias Cosler	2022 (CISPA)	Circuit Repair with Transformers (M.Sc.)
Ayham Omar	2022 (CISPA)	Predicting Timed Traces with Transformer Neural Networks (B.Sc)
Jens Kreber	2022 (Saarland)	Generating and Solving LTL with Adversarial Transformers (M.Sc.)
Tobias Hans	2021 (Saarland)	Algorithms for Deciding HyperCTL* (M.Sc.)
Frederik Schmitt	2020 (Saarland)	LTLSynthesis from specification patterns with neural networks (M.Sc.)
Frederik Schmitt	2020 (Saarland)	Research Immersion Lab (Gruaduate School)
Matthias Cosler	2019 (Saarland)	Towards Synthesizing Smart Contracts (B.Sc.)
Jens Heinen	2018 (Saarland)	Model Checking Timed Hyperproperties (M.Sc.)
Philip Lukert	2018 (Saarland)	HyperLTL Synthesis (B.Sc.)
Tobias Hans	2018 (Saarland)	MGHyper (B.Sc.)

Programming Languages and Skills

Python, Tensorflow, Jax, numpy, scikit-learn, C, Unix, Ocaml, Haskell, SML, scientific writing and presenting, grant writing

In the News (German TV)

"Saarlandian as researcher in Silicon Valley" (in German) - Saarländischer Rundfunk:
`https://www.ardmediathek.de/video/wir-im-saarland-das-magazin/saarlaender-als-start-up-forscher-im-silicon-valley/sr/Y3JpZDovL3NyLW9ubGluZS5kZS9NQS1XSU1TXzEyNjIwNy9zZWN0aW9uLzU`

Languages

German	Native proficiency
English	Full professional proficiency
French	Elementary proficiency

Christopher Hahn, Stanford, USA, April, 3, 2023