Dr. rer. nat. Sebastian Lapuschkin

* December 16, 1986 in Würzburg

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scholar.google.com/citations?user=wpLQuroAAAAJ

Short Bio

Sebastian Lapuschkin is the Head of the Explainable Artificial Intelligence research group at Fraunhofer Heinrich Hertz Institute (HHI) in Berlin.

He received his Ph.D. degree with distinction from the Technische Universität Berlin in 2018 for his pioneering contributions to the field of Explainable Artificial Intelligence (XAI) and interpretable machine learning. From 2007 to 2013 he studied computer science (B. Sc. and M. Sc.) at the Technische Universität Berlin, with a focus on software engineering and machine learning.

Sebastian is the recipient of multiple awards, including the Hugo-Geiger-Prize for outstanding doctoral achievement and the 2020 Pattern Recognition Best Paper Award.

His research has shaped the field of XAI from the very beginning, with contributions to the first wave of XAI such as the popular and widely-used Layer-wise Relevance Propagation method, as well as timely works influencing the second wave of XAI with additions to the sub-fields of Mechanistic Interpretability, Data Attribution and XAI-based model- and data improvement.

Sebastian is an avid advocate for Open Science, demonstrated by numerous Free Open Source Software toolboxes published with the intent to warrant and facilitate reproducibility in AI research.

Since 2024 he is co-organizing The World Conference on eXplainable Artificial Intelligence and serves as a Topic Editor on "Opportunities and Challenges in Explainable Artificial Intelligence" for the MDPI Open Access Journals.

Further research interests include efficient machine learning and data analysis, as well as data and algorithm visualization.

Professional Experience

Technological University Dublin — DUBLIN, IRELAND

External Scholar — 2025 -
at the Centre of eXplainable Artificial Intelligence. The Centre is the first of its kind in the Republic of Ireland and it aims to increase further and synergise cross-centres, college and external research collaboration.

Multidisciplinary Digital Publishing Institute (MDPI)

Topic Editor — 2024 - 2026
for "Opportunities and Challenges in Explainable Artificial Intelligence".
Submission pre-screening, review management and decision handling.

XAI4Science

Organizer — 2024 -
of the 1st workshop "XAI4Science: From Understanding Model Behavior to Discovering New Scientific Knowledge (2025)", co-located with ICLR 2025 at Singapore EXPO, Singapore.
TBA: 2nd of the workshop at AAAI 2026, Singapore.

World Conference on eXplainable Artificial Intelligence

Steering Committee Member — 2024 -
for the 3rd XAI World Conference (2025) in Istanbul, Turkey,
as well as future undisclosed instances of the conference.
Panelist, Conference and Special Track co-organization.

Programme Committee Chair — 2023 - 2024
for the 2nd XAI World Conference (2024) in Valetta, Malta.
Conference and Special Track co-organization.

Fraunhofer Heinrich-Hertz-Institute — BERLIN, GERMANY

Contact Person — 2025 -
for the Erasmus Mundus Joint Master in Intelligent Field Robotic Systems (IFRoS) associate partnership of Fraunhofer HHI.

Ethics Committee Member	*2023 -*

Founding member of the first ethics committee at Fraunhofer HHI.

Head of Explainable Artificial Intelligence	*2021 -*

Research Group Leadership and direction of XAI research & applications.

Tenured Researcher	*2019 - 2020*

PostDoc research position in the Machine Learning Group at Fraunhofer HHI.

Research Associate	*2014 - 2018*

Founding member of the Machine Learning Group at Fraunhofer HHI.

Technische Universität Berlin   Berlin, Germany

Research Associate	*2013 - 2014*

Supervision by Prof. Dr. Klaus-Robert Müller.

Student Research- & Teaching Assistant	*2011 - 2013*

Research & Teaching assistant to Prof. Dr. Klaus-Robert Müller.

Student Teaching Assistant	*2009 - 2011*

Teaching assistant to Prof. Dr. Marc Alexa, Prof. Dr. Odej Kao and Prof. Dr. Oliver Brock.

Education

Technische Universität Berlin   Berlin, Germany

PhD in Machine Learning (*summa cum laude*)	*2018*

Date of oral defense: December 19th, 2018.
Dean's signature on Doctorate Certificate dated January 23rd, 2019.

Thesis: "Opening the machine learning black box with Layer-wise Relevance Propagation"
Supervision headed by Prof. Dr. Klaus-Robert Müller.

Master of Science in Computer Science	*2013*

Focus on machine learning, computer vision and large scale data analysis.

Bachelor of Science in Computer Science	*2010*

Focus on algorithms and software development

Deutschhaus-Gymnasium   Würzburg, Germany

Abitur (pre-university secondary education)	*2007*

Teaching

Teaching of and teaching support for 19 university courses since 2009, including

"Responsible Artificial Intelligence 1", Technische Universität Berlin	*2023 -*
"(An Introduction to) Explainable AI", Universitat de Girona / IFRoS	*2021 -*

Talks & Lectures

Over 30 invited talks and individual lectures held since 2017, including

Explainability in the Era of LLMs: New Challenges and Pathways to Actionable Insights	*2025*

2025 Workshop on Self-Supervised Learning for Signal Decoding, Aalborg, Denmark

XAI as a Tool Beyond Model Understanding – From Heatmaps to Concepts and XAI Automation	*2024*

CBS CoCoNUT | Max Planck Institute for Human Cognitive and Brain Sciences

Explaining AI with Concept Relevance Propagation	*2023*

4th Japanese-American-German Frontiers of Science (JAGFOS) Symposium

Towards Human-understandable Explanations with XAI 2.0	*2022*

AI4Good webinar series of the International Telecommunication Union (ITU)

Towards Actionable XAI	*2022*

International Artificial Intelligence Doctoral Academy

Supervision & Guidance

Collaboration with and (co-)supervision of 3 (Senior) Technical Staff, 2 PostDocs, 32 PhD Students, 40+ Master's Students, 3 Bachelor's Students and 9 Guest Researchers since 2017

Third-Party Funded Research Projects

9 third-party funded research projects acquired and managed since 2018, including

xJuRAG *2025 - 2028*
Explainable AI für juristische RAG-Anwendungen
Funded with 1.2MM€ by BMBF

ACHILLES *2024 - 2028*
Human-Centred Machine Learning: Lighter, Clearer, Safer
Funded with 8.2MM€ by the European Union

TEMA *2022 - 2026*
Trusted Extremely Precise Mapping and Prediction for Emergency Management
Funded with 11.3MM€ by the European Union

iToBoS *2021 - 2025*
Intelligent Total Body Scanner
Funded with 11.7MM€ by the European Union

Honors & Awards

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Machine Learning and the Physical Sciences Reproducibility Badge	*2024*
Stanford Top 2% Scientist Worldwide[*]	*2022 - 2024*
Best Short Paper Award @ ETRA	*2023*
Pattern Recognition Best Paper Award and Pattern Recognition Medal	*2020*
Hugo-Geiger-Prize (1st place)	*2019*
Freunde des HHI Nachwuchspreis	*2019*
ERCIM Cor van Baayen Award (finalist)	*2019*
Best Paper Award @ ICMLW	*2016*

Patents

Attention Head Functionalities in Machine Learning Models	*2025*
Relevance Score Assignment dealing with an Attention Module and Applications thereof	*2024*
A Concept Representation of a Machine Learning Model	*2024*
Analyzing an Inference of a Machine Learning Predictor	*2023*
Method and System for Simulating an Optical Image of a Photonic and/or Electronic Device	*2022*
Pruning and/or Quantizing Machine Learning Predictors	*2020*
Relevance Score Assignment for Artificial Neural Networks	*2016*

Publications

Summary of Scientific Impact

	All	Since 2020
# Publications	96	76
# Citations	20446	18256
h-index	37	36
i10-index	62	61
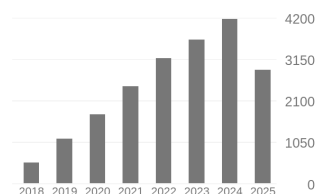
per Google Scholar, retreived on September 24nd, 2025.

Selected Publications

Theoretical & Methodological Contributions to XAI

1. Achtibat, Hatefi, Dreyer, Jain, Wiegand, **Lapuschkin**, Samek (2024).
   "AttnLRP: Attention-Aware Layer-wise Relevance Propagation for Transformers".
   In: *Proceedings of the 41st International Conference on Machine Learning (ICML)* 135–168.
   In this paper we adapt the popular LRP method to contemporary Transformer architectures, yielding state-of-the-art explanation quality at exceptional computational efficiency. This acievement enables the analysis of the reasoning processes of Vision Transformers and LLMs in real time, eg. in chat bot applications.

2. Achtibat, Dreyer, Eisenbraun, Bosse, Wiegand, Samek and **Lapuschkin** (2023).
   "From attribution maps to human-understandable explanations through Concept Relevance Propagation".
   In: *Nature Machine Intelligence* 5(9):1006–1019.
   A paper introducing the second generation of Explainable Artificial Intelligence with human-readable and abstract concept-based explanations.

3. Pahde, Dreyer, Samek and **Lapuschkin** (2023).
   "Reveal to Revise: An Explainable AI Life Cycle for Iterative Bias Correction of Deep Models".
   In: *Proceedings of the International Conference on Medical Image Computing and Computer-Assisted Intervention* 596–606.
   This paper is dedicated to the incorporation of XAI as a standard component into the life cycle of Artificial Intelligence systems, with the intent to improve performance, reliability, and safety of AI.

4. Hedström, Weber, Krakowczyk, Bareeva, Motzkus, Samek, **Lapuschkin** and Höhne (2023).
   "Quantus: An Explainable AI Toolkit for Responsible Evaluation of Neural Network Explanations and Beyond".
   In: *Journal of Machine Learning Research* 24(34):1–11.
   In this paper we present the Quantus toolkit, the first-ever comprehensive XAI evaluation toolkit, constituting a well-organized collection of metrics and tutorials for evaluating explainable models, driven by community contributions.

5. Montavon, **Lapuschkin**, Binder, Samek and Müller (2017).
   "Explaining NonLinear Classification Decisions with Deep Taylor Decomposition".
   In: *Pattern Recognition* 65:211–222.
   A paper discussing the mathematical foundation of LRP and its properties. Pattern Recognition Best Paper Award and Pattern Recognition Medal winner of 2020.

6. **Bach**, Binder, Montavon, Klauschen, Müller and Samek (2015).
   "On Pixel-wise Explanations for Non-Linear Classifier Decisions by Layer-wise Relevance Propagation".
   In: *PLoS ONE* 10(7):e0130140.
   A very influential and early work on local XAI, introducing the widely used Layer-wise Relevance Propagation method. This work has so far received over 5400 citations as counted by Google Scholar.

Applications of XAI

7. Kahardipraja P, Achtibat R, Wiegand T, Samek W and **Lapuschkin S** (2025).
   "The Atlas of In-Context Learning: How Attention Heads Shape In-Context Retrieval Augmentation".
   In: *CoRR abs/2505.15807*.
   In this work we use our group's state-of-the-art XAI techniques in order to differentiate between different types of attention heads and their roles in LLMs. We use the gained insights in order to obtain reproducible control over the generation process via the isolation of function vectors. We further gain the capability predict whether a candidate token ranked highly for prediction is grounded in context or in parametric knowledge, allowing users to select a preferred generation path. With our technique also obtain hallucination-free and near-causal citation capabilities for each predicted token at zero additional computational cost, solving a fundamental problem with safe and reliable deployment of LLMs.
   Accepted for publication at NeurIPS 2025.

8. Anders, Weber, Neumann, Samek, Müller and **Lapuschkin** (2022).
   "Finding and Removing Clever Hans: Using Explanation Methods to Debug and Improve Deep Models".
   In: *Information Fusion* 77:261–295.
   The authors' first work in a series dedicated to the exploitation of knowledge derived from XAI for the improvement of performance and robustness of AI systems.

9. Yeom, Seegerer, **Lapuschkin**, Binder, Wiedemann, Müller and Samek (2021).
   "Pruning by Explaining: A Novel Criterion for Deep Neural Network Pruning".
   In: *Pattern Recognition* 115:107899.
   In this paper we leverage information about the importance of latent neural network structures obtained through XAI, in order to drastically reduce over-parameterization by identifying and removing non-critical components, resulting in up to 95% smaller models without loss of performance, and thus strong gains in energy and run time efficiency.

10. **Lapuschkin**, Wäldchen, Binder, Montavon, Samek and Müller (2019).
    "Unmasking Clever Hans Predictors and Assessing what Machines Really Learn".
    In: *Nature Communications* 10:1069.
    One of the first papers to rigorously perform model- and data analysis through the lens of XAI, adding a voice of caution to the ongoing excitement about machine intelligence.