Georg Wölflein

PhD student in deep learning for medicine with five years of industry experience in computer vision and a strong software engineering background. Passionate about both theory and practice, my research focuses on computer vision for computational pathology as well as LLM agents for medicine.

Education

since Aug 2021 — **Doctor of Philosophy (PhD), Computer Science**, *University of St Andrews*, Scotland.
My PhD is under the supervision of Dr Ognjen Arandjelović and lies at the intersection of deep learning and computer vision for computational pathology, funded by the NHS.

Sep 2017 – Jun 2021 (2nd year direct entry) — **Master in Science (MSci), Computer Science**, *University of St Andrews*, Scotland.
First-Class Honours, GPA: 95%
Master's thesis: "Determining chess game state from an image" (grade: 20.0/20).
Honours level courses include machine learning, AI principles & practice, language & computation, data-intensive systems, information visualisation, concurrency & multi-core architectures, constraint programming, software architecture, software engineering, complexity, OS, databases, data encoding, component technology, logic, software verification, compiler design & implementation.

2005 – 2017 — **International Baccalaureate and Abitur**, *Dresden International School*, Germany.
IB Diploma: 40 points, German Abitur: 1.3
Valedictorian. Higher level subjects: maths, physics, computer science.

Experience

since Nov 2024 — **Researcher**, *Else Kröner Fresenius Center for Digital Health (EKFZ)*, Dresden, Germany
I am a Postdoc at Kather Lab at EKFZ for Digital Health, working on LLM agents in medicine and deep learning for digital pathology.

Jul-Oct 2024 — **Research Intern**, *Google*, London, UK
Conducted comprehensive evaluation of FitBit's activity recognition model, focusing on performance across diverse activity classes and demographic groups. Identified and quantified key failure modes, performed an in-depth analysis of root causes, and communicated actionable recommendations for model improvement to cross-functional teams.

Jul-Sep 2023 — **Research Intern**, *Else Kröner Fresenius Center for Digital Health (EKFZ)*, Dresden, Germany
During an internship at Prof Jakob Kather's Clinical AI research group at EKFZ for Digital Health (Dresden University of Technology), I developed a novel multi-zoom deep learning model for whole slide image classification, performed an extensive benchmarking study of self-supervised feature extractors in histopathology (now published at ECCV), and participated in various LLM-related projects.

Jan-Mar 2023 — **PhD Placement**, *Lay Summaries Ltd*, Glasgow, Scotland
Developed a NLP pipeline for automating the generation of lay summaries of EU clinical trials in a part-time PhD placement funded by The Data Lab.

May 2018 – May 2022 — **Working Student – Computer Vision**, *Robotron Datenbank-Software*, Dresden, Germany
Gained practical experience in deep learning and software engineering by developing deep learning models and deploying them to production in the Realtime Computer Vision (RCV) department.
- Designed and implemented containerised infrastructure for automatically training, evaluating, and deploying TensorFlow and PyTorch models for industrial use cases.
- Selected and trained deep learning models for various industrial use cases, including a system for a car manufacturer that reduced the error rate of detecting faulty parts by 90%.

Jun-Aug 2019 — **Software Engineering Intern**, *J.P. Morgan*, Glasgow, Scotland
Developed a data visualisation and reporting dashboard for an automated testing framework using Python, React, TypeScript, and SQL that gave the team new insights. Gained hands-on experience with Scrum, working in a team, and prioritising requirements from different stakeholders.

Skills

Programming	Python, C/C++, Java, SQL, JavaScript, TypeScript, Haskell, C#, LaTeX
Technologies	PyTorch, Triton, TensorFlow, Keras, JAX, Docker, Dask, Apache Spark, Postgres, React
Languages	German, English *(mother tongue)*; French *(B1)*

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scholar

Prizes and awards

2020 Adobe Prize (£750) for the highest GPA in Senior Honours Computer Science

2018 – 2021 4x Dean's List Award of Academic Excellence at the University of St Andrews

2017 Valedictorian at Dresden International School; subject awards for maths and computer science

2010 – 2017 12x High Honour Roll (GPA over 6.0 of 7) at Dresden International School

Publications

Under review

2024 D. Ferber, L. Hilgers, I. C. Wiest, M.-E. Leßmann, J. Clusmann, P. Neidlinger, J. Zhu, **G. Wölflein**, J. Lammert, M. Tschochohei, H. Böhme, D. Jäger, M. Aldea, D. Truhn, C. Höper, and J. N. Kather, *End-to-end clinical trial matching with large language models*, under review, Jul. 2024. (link)

G. Wölflein, D. Ferber, A. R. Meneghetti, O. S. M. El Nahhas, D. Truhn, Z. I. Carrero, D. J. Harrison, O. Arandjelović, and J. N. Kather, *Benchmarking pathology feature extractors for whole slide image classification*, under review, Jun. 2024. (link)

D. Ferber, O. S. M. El Nahhas, **G. Wölflein**, I. C. Wiest, J. Clusmann, M.-E. Leßman, S. Foersch, J. Lammert, M. Tschochohei, D. Jäger, M. Salto-Tellez, N. Schultz, D. Truhn, and J. N. Kather, *Autonomous artificial intelligence agents for clinical decision making in oncology*, under review, Apr. 2024. (link)

2023 **G. Wölflein**, L. C. Magister, P. Liò, D. J. Harrison, and O. Arandjelović, *Deep multiple instance learning with distance-aware self-attention*, under review, May 2023. (link)

Conference papers

2025 M. Ligero, T. Lenz, **G. Wölflein**, O. S. M. El Nahhas, D. Truhn, and J. N. Kather, "Abnormality-driven representation learning for radiology imaging," in *International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI)*, accepted, Sep. 2025. (link)

G. Wölflein, D. Ferber, D. Truhn, O. Arandjelović, and J. N. Kather, "LLM agents making agent tools," in *Annual Meeting of the Association for Computational Linguistics (ACL)*, accepted, Jul. 2025. (link)

T. Lenz, P. Neidlinger, M. Ligero, **G. Wölflein**, M. van Treeck, and J. N. Kather, "Unsupervised foundation model-agnostic slide-level representation learning," in *IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, accepted, Jun. 2025. (link)

2024 O. S. M. El Nahhas, **G. Wölflein**, M. Ligero, T. Lenz, M. van Treeck, F. Khader, D. Truhn, and J. N. Kather, "Joint multi-task learning improves weakly-supervised biomarker prediction in computational pathology," in *International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI)*, Springer Nature Switzerland, Oct. 2024, pp. 254–262. (link)

G. Wölflein, D. Ferber, A. R. Meneghetti, O. S. M. El Nahhas, D. Truhn, Z. I. Carrero, D. J. Harrison, O. Arandjelović, and J. N. Kather, "A good feature extractor is all you need for weakly supervised pathology slide classification," in *European Conference on Computer Vision (ECCV)*, BioImage Computing Workshop (oral), Springer, Sep. 2024. (link)

2023 **G. Wölflein**, I. H. Um, D. J. Harrison, and O. Arandjelović, "HoechstGAN: Virtual lymphocyte staining using generative adversarial networks," in *Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision (WACV)*, Jan. 2023, pp. 4997–5007. (link)

Journal articles

*equal contribution

2024 D. Ferber, **G. Wölflein**, I. C. Wiest, M. Ligero, S. Sainath, N. G. Laleh, O. S. M. El Nahhas, G. Müller-Franzes, D. Jäger, D. Truhn, and J. N. Kather, "In-context learning enables multimodal large language models to classify cancer pathology images," *Nature Communications*, vol. 15, no. 1, p. 10 104, Nov. 2024. (link)

O. S. M. El Nahhas, M. van Treeck, **G. Wölflein**, M. Unger, M. Ligero, T. Lenz, S. J. Wagner, K. J. Hewitt, F. Khader, S. Foersch, D. Truhn, and J. N. Kather, "From whole-slide image to biomarker prediction: End-to-end weakly supervised deep learning in computational pathology," *Nature Protocols*, Sep. 2024. (link)

D. Ferber, I. C. Wiest, **G. Wölflein**, M. P. Ebert, G. Beutel, J.-N. Eckardt, D. Truhn, C. Springfeld, D. Jäger, and J. N. Kather, "GPT-4 for information retrieval and comparison of medical oncology guidelines," *NEJM AI*, vol. 1, no. 6, AIcs2300235, May 2024. (link)

2023 **G. Wölflein***, I. H. Um*, D. J. Harrison, and O. Arandjelović, "Whole-slide images and patches of clear cell renal cell carcinoma tissue sections counterstained with Hoechst 33342, CD3, and CD8 using multiple immunofluorescence," *Data*, vol. 8, no. 2, Feb. 2023. (link)

2022 R. De Filippis*, **G. Wölflein***, I. H. Um, P. D. Caie, S. Warren, A. White, E. Suen, E. To, O. Arandjelović, and D. J. Harrison, "Use of high-plex data reveals novel insights into the tumour microenvironment of clear cell renal cell carcinoma," *Cancers*, vol. 14, no. 21, Nov. 2022. (link)

2021 **G. Wölflein** and O. Arandjelović, "Determining chess game state from an image," *Journal of Imaging*, vol. 7, no. 6, Jun. 2021. (link)

Abstracts

2023 D. Alouges, **G. Wölflein**, I. H. Um, D. Harrison, O. Arandjelović, C. Battail, and S. Gazut, *Performance comparison between federated and centralized learning with a deep learning model on Hoechst stained images*, ISMB/ECCB Abstracts, Jul. 2023. (link)

Datasets

2022 **G. Wölflein**, I. H. Um, D. J. Harrison, and O. Arandjelović, *Whole slide images and patches of clear cell renal cell carcinoma counterstained with multiple immunofluorescence for Hoechst, CD3, and CD8*, BioImage Archive, Dec. 2022. (link)

2021 **G. Wölflein** and O. Arandjelović, *Dataset of rendered chess game state images*, Open Science Foundation, May 2021. (link)

Invited talks

Mar 2025 **Center for Scalable Data Analytics and Artificial Intelligence (SCADS.AI), Dresden**
LLM agents for autonomously creating research tools in medicine and life sciences (link)

Feb 2024 **Tissue Image Analytics (TIA) Centre, University of Warwick**
A good feature extractor is all you need for weakly supervised learning in histopathology (link, video)

Apr 2022 **KATY EU Project**
High-plex data reveal novel insights into the tumour microenvironment of clear cell renal cell carcinoma (with Raffaele De Filippis)

Selected projects and coursework

2021 **Determining chess game state from an image**, *master's thesis*, grade: 20.0/20
For my master's thesis, I developed a system for identifying the chess position from a photo of a chess game using deep learning and traditional computer vision techniques, achieving a 23× reduction in error rate compared to the previous state of the art. It also includes a one-shot transfer learning approach to adapt to an unseen chess set based on just two images. This project received 100+ stars on GitHub.

2020 **Recap: configuration management for reproducible research**, *Python package*
Research should be reproducible. Especially in deep learning, it is important to keep track of hyperparameters and configurations used in experiments. I had to write similar configuration management code in several projects, so I created a Python package and published it on PyPI.

2020 **Freeing neural training through surfing**, *SH project*, grade: 19.0/20
For my undergraduate thesis, I investigated the local minimum problem in neural networks and developed a novel technique for training neural networks. Through this project, I developed independent research skills whilst learning a lot about the internals of neural networks. The report is available here.

Courses and training

Dec 2023 Focus on Peer Review, *Nature Masterclasses*.

Mar 2023 Clinicum Digitale, *Dresden University of Technology*: attended a two-week interdisciplinary spring school on medicine and technology.

Jun 2020 Deep Learning Specialisation, *Coursera*.

May 2020 PyTorch for Deep Learning and Computer Vision, *Udemy*.

Sep 2019 Mathematics for Machine Learning Specialisation, *Coursera*.

Sep 2019 TensorFlow 2.0: A Complete Guide on the Brand New TensorFlow, *Udemy*.

2013 – 2014 C/C++ Course, *Volkshochschule Dresden (Community College Dresden)*.

Service

2025 Reviewer for *MICCAI*

2024 Reviewer for *ECCV BIC*

2023 Reviewer for *CVPR* and *npj Precision Oncology*

Volunteering

2021 – 2022 **Developmental squad representive**, *University of St Andrews Volleyball Club*
I was elected to represent the recreational volleyball team within the committee and club decision-making process. This role helped me improve communication and organisational skills.

2018 – 2020 **Secretary**, *University of St Andrews Muscle and Athletics Sports Society (MASS)*
As secretary of MASS, I was in charge of coordinating meetings, writing minutes, and taking care of administrative tasks. This position has helped me develop teamwork and organisational skills.

2010 – 2017 **Volunteer firefighter**, *Freiwillige Feuerwehr Possendorf*
I am passionate about giving back to the community. Since age eleven, I was a youth fire fighter in my local fire department. In 2015, I completed the training qualification to become a member of the adult fire department, and participated in active service until I moved to Scotland in September 2017.

In my free time, I enjoy playing chess, volleyball, lifting weights, and improvising on the piano.