Georg Wölflein

I am a PhD student in computer vision who is passionate about both theory and practice. I have five years of computer vision experience in industry, and in my PhD, I am applying computer vision techniques to digital pathology to improve the quality of kidney cancer prognoses based on medical images. I am always excited to apply my knowledge to new problems, not only in terms of developing new computer vision models, but also seeing that these models are deployed efficiently and have a real-world impact.

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

Jan-Mar 2023 — **PhD placement**, *Lay Summaries Ltd*, Glasgow, Scotland
Developed a NLP pipeline for automatically generating lay summaries of clinical trials in a 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%.
- Implemented real-time object detection on video streams using TensorFlow.

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, TensorFlow, Keras, JAX, Docker, Apache Spark, Splunk, mongodb, Postgres, React
Languages — German, English *(mother tongue)*; French *(B1)*

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
2017 — Subject awards for mathematics and computer science
2010 – 2017 — 12x High Honour Roll (GPA over 6.0 of 7) at Dresden International School

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scholar

Publications

Unpublished preprints

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, 2023

Conference papers

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

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)

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)

Talks

Apr 2022 **KATY EU Project**
High-plex data reveal novel insights into the tumour microenvironment of clear cell renal cell carcinoma (presented 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. The system improves the state of the art error rate by a factor of 23 and includes a one-shot transfer learning approach to adapt to an unseen chess set based on just two images.

2020 **Recap: configuration management for reproducible research**, *Python package*
Research should be reproducible. Especially in deep learning, it is important to keep track of hyper-parameters 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 and academic writing skills whilst learning a lot about neural networks and machine learning. The report is available here, and a paper is currently in preparation.

*equal contribution

Courses and training

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)*.

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.