Karsten Roth

karroth.com | karsten.rh1@gmail.com | karsten-roth | confusezius

Languages: German (native), English & Mandarin (fluent), French (intermediate)

Education

PhD Machine Learning — Tübingen, Germany
ELLIS & IMPRS-IS, University of Tübingen — *since May 2021*
ELLIS Co-Supervisors: Prof. Zeynep Akata (University of Tübingen), Prof. Oriol Vinyals (Google DeepMind, UCL).
Research interests: Facilitating representation learning under distribution shifts, e.g. continual or multimodal learning, as well as disentangled and metric representation learning. My research also focuses on foundation models, both on improved and federated training perspectives and the possibilities of lifelong adaptation.

BSc & MSc Physics — Heidelberg, Germany
Heidelberg University, Grade: 1.1/4.0 (Best: 1.0) — *2014 – 2021*
Supervisors: Prof. Björn Ommer (now LMU Munich)
Broad range of courses in theoretical and experimental physics (with focus on solid state physics), pure mathematics as well as specialization courses in advanced machine learning, optimization theory, computer vision and medical deep learning. BSc thesis on CT tumor segmentation, MSc thesis on representation learning for visual similarity models.

Selected Research Experience

Google DeepMind ELLIS Exchange & PhD Student Researcher — London, UK — April to Sep 2024
Planned ELLIS exchange and PhD student researcher position with Olivier Henaff and Oriol Vinyals working on large-scale multimodal foundation models.

Meta AI Research Scientist Intern — Paris, France — May 2022 to Oct 2022
Research Scientist intern at Meta AI with Diane Bouchacourt, Pascal Vincent and Mark Ibrahim working disentangled representation learning under correlation shifts. Published at ICLR 2023.

Amazon AWS Research Intern — Tübingen, Germany — Oct 2020 to Mar 2021
Research intern at the Amazon AWS Research Lablet with Peter Gehler, Thomas Brox and Bernhard Schölkopf working on weakly supervised (*cold-start*) industrial anomaly detection. Published at CVPR 2022.

Vector Institute Research Intern — Toronto, Canada — May 2020 to Sep 2020
Research intern at Vector with Marzyeh Ghassemi. Worked on (incremental) few- and zero-shot learning, both fundamentally and applied to medical tasks. Publications at ICML and NeurIPS 2021.

MILA Research Intern — Montreal, Canada — Sep 2019 to Mar 2020
Research intern at MILA (Montreal Institute for Learning Algorithms) with Joseph Paul Cohen and Yoshua Bengio. Unsupervised and transfer learning for 3D CT data and Deep Metric Learning. Published at ICML/ECCV 2020.

Awards & Community Services

Qualcomm Innovation Fellowship Recipient 2023 (Europe) for my work on continual adaptation in vision-language foundation models, alongside 40,000$ research funding.

Best Paper Award at the Interpolate@NeurIPS workshop.

Outstanding Reviewer for CVPR '22 + '23 & ECCV 2022. Reviewer ICCV, NeurIPS, ICLR, ICML & TPAMI.

EMVA Young Professional Award endowed by the European Machine Vision Association for outstanding work in machine vision, alongside 2,000$ prize money.

PhD Fellowship Offers for MIT, Oxford, Max Planck ETH Center for Learning Systems (*declined*)

Heidelberg Life-Science Student Mentorship since 2016, where I introduce and mentor high school students on machine learning and biomathematical topics to encourage early interest in a STEM career.

Selected Publications

[1] **Karsten Roth***, Lukas Thede*, A. Sophia Koepke, Oriol Vinyals, Olivier Henaff, Zeynep Akata.
"Fantastic Gains and Where to Find Them: On the Existence and Prospect of General Knowledge Transfer between Any Pretrained Model.".
Spotlight at *The International Conference on Learning Representations (ICLR), Vienna, Austria*, 2024

[2] Shyamgopal Karthik*, **Karsten Roth***, Massimilano Mancini, Zeynep Akata.
"Vision-by-Language for Training-Free Compositional Image Retrieval".
In *The International Conference on Learning Representations (ICLR), Vienna, Austria*, 2024

[3] **Karsten Roth***, Jae Myung Kim*, A. Sophia Koepke, Oriol Vinyals, Cordelia Schmid, Zeynep Akata.
"Waffling around for Performance: Visual Classification with Random Words and Broad Concepts".
In *The International Conference on Computer Vision (ICCV), Paris, France*, 2023

[4] **Karsten Roth**, Mark Ibrahim, Zeynep Akata, Pascal Vincent*, Diane Bouchacourt*.
"Disentanglement of Correlated Factors with Hausdorff Factorized Support".
In *International Conference on Learning Representations (ICLR), Kigali, Rwanda*, 2023

[5] Zafir Stojanovski*, **Karsten Roth***, Zeynep Akata.
"Momentum-based Weight Interpolation of Strong Zero-Shot Models for Continual Learning".
Best Paper at *INTERPOLATE@NeurIPS 2022, New Orleans, USA*

[6] **Karsten Roth**, Latha Permula, Joaquin Zepeda, Bernhard Schölkopf, Thomas Brox, Peter Gehler.
"Towards Total Recall in Industrial Anomaly Detection".
In *The Conference on Computer Vision and Pattern Recognition (CVPR), New Orleans, USA*, 2022

[7] **Karsten Roth**, Oriol Vinyals, Zeynep Akata
"Integrating Language-Guidance into Vision-based Deep Metric Learning".
Oral at *The Conference on Computer Vision and Pattern Recognition (CVPR), New Orleans, USA*, 2022

[8] **Karsten Roth**, Oriol Vinyals, Zeynep Akata.
"Non-Isotropy Regularization for Deep Metric Learning".
In *The Conference on Computer Vision and Pattern Recognition (CVPR), New Orleans, USA*, 2022

[9] Timo Milbich*, **Karsten Roth***, Samarth Sinha, Ludwig Schmidt, Marzyeh Ghassemi, Björn Ommer.
"Characterizing Generalization under Out-Of-Distribution Shifts in Deep Metric Learning".
In *34th Conference on Neural Information Processing Systems (NeurIPS 2021), Vancouver, Canada*, 2021

[10] **Karsten Roth***, Timo Milbich*, Samarth Sinha, Prateek Gupta, Björn Ommer, Joseph Paul Cohen.
"Revisiting Training Strategies and Generalization in Deep Metric Learning".
In *Proceedings of the 37th International Conference on Machine Learning, Online, PMLR 119*, 2020.

Selected Published Coding Projects

Software Proficiency: Python + Science Packages, PyTorch & Tensorflow, Git, LaTeX

[1] "Industrial Visual Defect Detection using PatchCore". Link. [*Python, PyTorch*]
Scalable and efficient implementation of PatchCore and other visual defect detection methods. As of Oct 2023 the second-most forked repository in Amazon Science.

[2] "Large-Scale Realistic Disentangled Representation Learning". Link. [*Python, PyTorch*]
Inclusion of various disentangled representation learning methods, benchmarks and architectures, alongside modules for training under different forms of correlation and recombination shifts. Set up to allow for effective studies on large compute if available.

[3] "First Repository for Comparable Deep Metric Learning and Method Inspection". Link. [*Python, PyTorch*]
Released in 2019, this was the first repository to incorporate a large collection of Deep Metric Learning methods and benchmarks for fair and comparable method evaluation. As of Oct 2023 with 550+ stars.