Christoph Reich

Academic Curriculum Vitæ

(withheld)
c.reich@tum.de
christophreich1996.github.io
ChristophR1996
Christoph Reich
Christoph Reich
ChristophReich1996

Research Interests

General Interests — Computer Vision, Machine Learning, Representation Learning, and Unsupervised Learning

Education

since 12.2023 — **ELLIS Ph.D. Student**
Technical University of Munich, Technische Universität Darmstadt, University of Oxford, Germany & UK
Supervised by Daniel Cremers (CVG), Stefan Roth (VisInf), and Christian Rupprecht (VGG)
Research on unsupervised scene understanding by exploring depth and motion cues

10.2020 - 11.2023 — **Master of Science Autonomous Systems (Computer Science)**
Technische Universität Darmstadt, Germany
Final grade average: 1.4 (scale 1.0-5.0, 1.0 best); Major: Machine Learning & Computer Vision

10.2016 - 10.2020 — **Bachelor of Science Information Systems Technology**
Technische Universität Darmstadt, Germany
Final grade average: 2.3 (scale 1.0-5.0, 1.0 best); Major: Machine Learning

since 10.2016 — **Bachelor of Science Electrical Engineering**
Technische Universität Darmstadt, Germany
Secondary studies (ongoing); Major: Communication Technology & Sensor Systems

08.2013–07.2016 — **College Entrance Qualification (Fachhochschulreife)**
Vocational College Leverkusen-Opladen, Germany
Final grade average: *"very good"*

08.2013–07.2016 — **Certified Electrical Engineering Assistant**
Vocational College Leverkusen-Opladen, Germany
Final examination grade: *"very good"*

Research & Work Experience

10.2022 - 11.2023 — **Research Assistant**
NEC Laboratories America, Inc., *Princeton, New Jersey, US (remote)*
- Research on learning to control image/video codecs for deep vision models, two first-author papers
- Continuing research on biomed. image analysis (SOS Lab), two first-author papers (ICCVW & EMBC)
- Ongoing research cooperation with TU Darmstadt (SOS Lab), financially supported by NEC Labs

07.2022 - 10.2022 — **Research Intern**
NEC Laboratories America, Inc., *Princeton, New Jersey, US (remote)*
- Computer vision summer research internship at the machine learning and systems department
- Research on video compression for deep vision models and self-supervised learning for video understanding

09.2019 - 06.2022 — **Student Research and Teaching Assistant**
Self-Organizing Systems Lab *(formerly BCS Lab), Technische Universität Darmstadt, Germany*
- Research on 2D/3D segmentation and generative adversarial networks for biomedical imagery
- Multiple peer-reviewed articles published, two papers as the first author (BMVC & MICCAI)
- Teaching assistant for medical-technology lab (developing and supervising Matlab exercises)

04.2018 - 04.2020 — **Working Student**
Bosch Rexroth, *Lohr am Main/Darmstadt, Germany*
- Working student at the human resource department for university relations
- Planning and executing cooperation events at TU Darmstadt, such as guest lectures
- Programming of a mobile application for visualizing company locations (Python/C++)

12.2017 - 08.2018 — **Student Teaching Assistant**
Mathematics Department, *Technische Universität Darmstadt, Germany*
- Teaching assistant for developing math I & II exercises with electrical engineering use-case

10.2017 - 03.2018 — **Student Teaching Assistant**
Electrical Power Supply with Integration of Renewable Energy Institute,
Technische Universität Darmstadt, Germany
- Teaching assistant for electrical engineering I lecture (first-semester lecture)
- Supervising two exercise groups of up to 30 students and correcting as well as presenting exercises

08.2015 **Electrical Engineering Intern**
Technische Hochschule Köln *(Gummersbach), Germany*
- Basic microcontroller programming in C
- Assisting the development of electrical engineering lab exercises

Peer-Reviewed Publications

[arXiv, 2023] **C. Reich**, B. Debnath, D. Patel, O. Po, T. Prangemeier, D. Cremers, and S. Chakradhar, "Deep Video Codec Control", **currently under review**, arxiv:2308.16215, 2023 [paper]

[WACV, 2024] **C. Reich**, B. Debnath, D. Patel, and S. Chakradhar, "Differentiable JPEG: The Devil is in the Details", *IEEE/CVF Winter Conference on Applications of Computer Vision (WACV)*, 2024, [paper], [project page], [code], **Code merged into the Kornia library**

[ICCVW, 2023] **C. Reich**, T. Prangemeier and H. Koeppl, "The TYC Dataset for Understanding Instance-Level Semantics and Motions of Cells in Microstructures", *IEEE/CVF International Conference on Computer Vision Workshops (ICCVW)*, 2024, [paper] [project page] [code] [dataset]

[EMBC, 2023] **C. Reich***, T. Prangemeier*, A. O. Françan and H. Koeppl, "An Instance Segmentation Dataset of Yeast Cells in Microstructures", in *Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*, 2023, (*equal contribution), [paper] [project page] [code] [dataset]

[EMBC, 2023] **C. Reich**, M. Rohr, T. Kircher C. Hoog Antink, "On the Atrial Fibrillation Detection Performance of ECG-DualNet", in *Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*, short paper, 2023, [paper]

[BMVC, 2021] **C. Reich**, T. Prangemeier, O. Cetin and H. Koeppl, "OSS-Net: Memory Efficient High Resolution Semantic Segmentation of 3D Medical Data", in *British Machine Vision Conference (BMVC)*, 2021, [paper] [project page] [code] [slides] [talk]

[MICCAI, 2021] **C. Reich***, T. Prangemeier*, C. Wildner and H. Koeppl, "An Instance Segmentation Dataset of Yeast Cells in Microstructures", in *Medical Image Computing and Computer-Assisted Intervention (MICCAI)*, 2021, (*equal contribution), [paper] [project page] [code] [dataset] [poster] [slides]

[CinC, 2023] M. Rohr, T. Schilke, L. Willems, **C. Reich**, S. Dill, G. Güney, C. Hoog Antink, "Transformer Network with Time Prior for Predicting Clinical Outcome from EEG of Cardiac Arrest Patients", *50th Computing in Cardiology Conference*, 2023, [paper]

[Physiol. Meas., 2022] M. Rohr, **C. Reich**, A. Höhl, T. Lilienthal, T. Dege, F. Plesinger, V. Bulkova, G. Clifford, M. Reyna, and C. Hoog Antink, "Exploring Novel Algorithms for Atrial Fibrillation Detection by Driving Graduate Level Education in Medical Machine Learning", *Physiological Measurement*, 2022, [paper] [code]

[SPIE Med. Im. 2022] A. G. Gul*, O. Cetin*, **C. Reich**, N. Flinner, T. Prangemeier and H. Koeppl, "Histopathological Image Classification based on Self-Supervised Vision Transformer and Weak Labels", *SPIE Medical Imaging: Digital and Computational Pathology*, abstract peer-reviewed, 2022, (*equal contribution), [paper] [code]

[Biosystems 2022] T. Prangemeier, C. Wildner, A. O. Françani, **C. Reich** and H. Koeppl, "Yeast Cell Segmentation in Microstructured Environments with Deep Learning", in *Biosystems*, 2022, [paper] [code]

[BIBM 2020] T. Prangemeier, **C. Reich** and H. Koeppl, "Attention-Based Transformers for Instance Segmentation of Cells in Microstructures", in *IEEE International Conference on Bioinformatics and Biomedicine (BIBM)*, 2020, [paper] [code]

[CIBCB 2020] T. Prangemeier, C. Wildner, A. O. Françani, **C. Reich** and H. Koeppl, "Multiclass Yeast Segmentation in Microstructured Environments with Deep Learning", in *IEEE Conference on Computational Intelligence in Bioinformatics and Computational Biology (CIBCB)*, 2020, [paper]

Patents

2023 **C. Reich**, B. Debnath, D. Patel and S. Chakradhar, "A Method for Designing Differentiable JPEG", *US Patent (IR No. 23022)* (**in examination**), 2023

2023 **C. Reich**, B. Debnath, D. Patel, O. Po and S. Chakradhar, "Implementation: From IR 22093 A System for Learning to Control the Video Codec for Deep Learning Analytics", *US Patent (IR No. 22105 & 23033)* (**in examination**), 2023

2023 **C. Reich**, B. Debnath, D. Patel, O. Po and S. Chakradhar, "A System for Learning to Control the Video Codec for Deep Learning Analytics", *US Patent (IR No. 22093)* (**in examination**), 2023

Theses & Other Research Projects

04.2020 - 10.2020 **Deep Image Codec Control for Vision Models (Master Thesis)**
Technische Universität Darmstadt, Visual Inference Lab
Bachelor thesis supervised by Prof. Stefan Roth and Oliver Hahn, [thesis]

04.2021 - 07.2021 **ECG-DualNet: Atrial Fibrillation Classification in Electrocardiography using Deep Learning**
*Technische Universität Darmstadt, KIS*MED Lab*
Project seminar supervised by Prof. C. Hoog Antink and Maurice Rohr, [report] [code] [slides]

04.2020 - 10.2020 **Generation and Simulation of Yeast Microscopy Imagery with Deep Learning (Bachelor Thesis)**
Technische Universität Darmstadt, Self-Organizing Systems Lab
Bachelor thesis supervised by Prof. Heinz Koeppl, Tim Prangemeier and Christian Wildner, **Thesis Award 2020 of the Centre for Synthetic Biology**, [thesis]

04.2020 - 07.2020 **DeepFovea++: Reconstruction and Super-Resolution for Natural Foveated Rendered Videos**
Technische Universität Darmstadt, AI & ML Lab
Course project (group project) deep learning supervised by Prof. Kristian Kersting, [code] [slides] [report]

10.2019 - 03.2020 **Scalable 3D Semantic Segmentation for Gun Detection in CT Scans**
Technische Universität Darmstadt, Visual Inference Lab
Project lab (group project) deep learning in computer vision supervised by Prof. Stefan Roth and Faraz Saeedan, [arxiv] [code]

04.2019 - 10.2019 **Convolutional Neural Network Application for Cell Segmentation in Biological Research**
Technische Universität Darmstadt, Self-Organizing Systems Lab
Project seminar supervised by Prof. Heinz Koeppl, Tim Prangemeier and Christian Wildner, [report]

Open Source Contributions

01.2023 **Cauchy, Charbonnier, Geman-McClure, and Welsch Loss Reimplementation**
Reimplementation of multiple common regression losses,
Code merged into the Kornia library, [pull request]

04.2022 - 05.2022 **MaxViT Reimplementation**
Reimplementation of the paper "MaxViT: Multi-Axis Vision Transformer" by Tu *et al.*, [code]

04.2022 **Lovász-Hinge/Softmax Loss Reimplementation**
Reimplementation of the Lovász-Hinge and Lovász-Softmax loss for segmentation,
Code merged into the Kornia library, [pull request] [release]

01.2022 - 04.2022 **Swin Transformer V2 Reimplementation**
Reimplementation of the paper "Swin Transformer V2: Scaling Up Capacity and Resolution" by Liu *et al.*,
Code merged into the PyTorch Image Models library (timm) by Ross Wightman, [code] [release]

03.2021 - 05.2021 **2D/3D Involution Reimplementation**
Reimplementation of the paper "Involution: Inverting the Inherence of Convolution for Visual Recognition" by Li *et al.*, [code]

04.2020 - 05.2020 **ToeffiPy a PyTorch like Autograd/Deep Learning Library Based only on NumPy**
Implementation of a deep learning library from scratch with NumPy for educational purposes, [code]

03.2020 - 05.2020 **Semantic Pyramid for Image Generation PyTorch Reimplementation**
Reimplementation of the paper "Semantic Pyramid for Image Generation" by Shocher *et al.*, [code]

Language Skills

German Native language **English** Good knowledge (C1/C2 level)

Reviewing, Awards, Grants, *etc.*

Reviewing
- IEEE/CVF Winter Conference on Applications of Computer Vision 2024 (outstanding reviewer award)
- IEEE Transactions on Medical Imaging (since 2022)
- International Conference of the IEEE Engineering in Medicine & Biology Society 2023
- IEEE International Conference on Bioinformatics and Biomedicine 2022
- Co-reviewing for ICML 2024 (with Simone Schaub-Meyer)
- Co-reviewing for CVPR 2024 (with Simone Schaub-Meyer)
- Co-reviewing for the International Journal of Computer Vision 2023 (with Biplob Debnath)
- Co-reviewing for BMVC 2021 (with Prof. Koeppl, outstanding reviewer award)
- Co-reviewing for Bioinformatics Oxford 2021 (with Prof. Koeppl & Tim Prangemeier)

Awards & Grants
- Outstanding reviewer award WACV 2024
- NEC Labs America, Inc. research gift grant, in cooperation with SOS-Lab (TU Darmstadt), 2022
- Papers with Code (Meta AI) Contributor Award, 2022
- PyTorch Lightning DevCon travel scholarship, 2022
- Bachelor Thesis Award 2020 of the Centre for Synthetic Biology
- Students@Bosch member

Contributions to Open-Source Projects
- PyTorch Image Models library (timm)
- Kornia (Differentiable Computer Vision Library based on PyTorch)
- Minor fixes to: torchvision & MMSegmentation

Programming Python, C/C++, CUDA, Java, Matlab

Tools PyTorch, Kornia, Timm, PyTorch Lightning, NumPy, SciPy, OpenCV, Matplotlib, Triton, TensorFlow, Scikit-Learn, Eigen, Docker, GIT, LaTeX, TikZ

Christoph Reich, February 20, 2024