Peter Hirsch

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EXPERIENCE

RESEARCH SCIENTIST | BIOMEDICAL IMAGE ANALYSIS LAB
10/2018-12/2023 | MDC for Molecular Medicine Berlin, Germany
VISITING STUDENT RESEARCHER at HHMI Janelia (USA, 2019 - 2024)

- development of a novel method for the segmentation of sophisticated shapes [11]
- development of an auxiliary loss to boost segmentation performance of baseline methods to state-of-the-art performance [12, 17]
- theoretical analysis of an intrinsic property of CNNs and its practical effects for tile & stitch prediction [9, 18]
- development of a novel cell tracking method for the reconstruction of whole-embryos lineages [5, 6, 14, 15]
- co-author of a book chapter on cell tracking [8]
- creation of a real-world benchmark dataset for the segmentation of long-range thin structures incl. baselines and custom metrics [1, 16]
- fellow of the MDC-NYU PhD exchange program
- short-term research stay at the Technion (Israel, 2022): multi-agent reinforcement project on operating the energy grid in a smart way
- reviewed papers for CVPR, ICLR, Neurips, ECCV, ICML, MICCAI

CONTRACTOR | HHMI JANELIA
06/2022 - 08/2022 | Ashburn, USA

- refactoring of cell tracking code base, migration to PyTorch, adding documentation, improving test coverage, creating tutorials

RESEARCH ASSISTANT, VISUAL LEARNING LAB
02/2018 - 08/2018 | University of Heidelberg, Germany
in cooperation with the Max Planck Institute Dresden (MPI-CBG)

- development of an automated control system for a scanning tunneling microscope based on deep reinforcement learning using Python and Tensorflow [13]

RESEARCH ASSISTANT | COMPILER CONSTRUCTION LAB
04/2015 - 04/2018 | Dresden University of Technology, Germany

- development and implementation of fault tolerance techniques in clang and LLVM using C++ and in-depth assessment of the generated assembly code

STUDENT ASSISTANT | COMPUTER GRAPHICS LAB
10/2012 - 10/2013 | Bauhaus-University Weimar, Germany

- implementation of various computer graphic and visualization algorithms using C++ and OpenGL

EDUCATION

DR. RER. NAT. in Computer Science
magna cum laude
2023 | HU Berlin, Germany

M.Sc. in Computer Science
2017 | TU Dresden, Germany

B.Sc. in Computer Science and Media
2013 | BU Weimar, Germany

SKILLS

General:

• machine learning • computer vision • supervised learning • reinforcement learning • self-supervised learning • global optimization • tracking • segmentation • classification • large scale datasets/data processing • compiler construction • visualization • HPC • multi-GPU • multiprocessing

Programming:

• advanced: – Python – C/C++
• familiar: – OpenGL/GLSL – CUDA
• basic: – R – Julia – HTML/CSS – Haskell

Technologies:

• PyTorch • Tensorflow • linux • git • terminal/shell • emacs • gurobi • LaTeX

Languages:

• German: native
• English: fluent
• Spanish/Arabic: beginner

RESEARCH AND PUBLICATIONS

Papers

[1] Mais*, **Hirsch*** et al., FISBe: A real-world benchmark dataset for instance segmentation of long-range thin filamentous structures, accepted at **CVPR 2024**
[2] Graham et al., CoNIC Challenge: Pushing the frontiers of nuclear detection, segmentation, classification and counting, Medical Image Analysis, 2023
[3] Reinke et al., Common Limitations of Image Processing Metrics: A Picture Story, arXiv, 2023
[4] Rumberger et al., ACTIS: Improving data efficiency by leveraging semi-supervised Augmentation Consistency Training for Instance Segmentation, BIC workshop at ICCV 2023
[5] **Hirsch** et al., Tracking by Weakly-Supervised Learning and Graph Optimization for Whole-Embryo C. Elegans lineages, **MICCAI 2022**
[6] Malin-Mayor et al., Automated reconstruction of whole-embryo cell lineages by learning from sparse annotations, **Nat. Biotech.** 2022
[7] Rumberger*, Baumann*, **Hirsch*** et al., Panoptic segmentation with highly imbalanced semantic labels, ISBIC 2022
[8] **Hirsch** et al., Chapter 20 - Mathematical and bioinformatic tools for cell tracking, Academic Press, 2022
[9] Rumberger*, Yu*, **Hirsch*** et al., How Shift Equivariance Impacts Metric Learning for Instance Segmentation, **ICCV 2021**
[10] Mais et al., PatchPerPixMatch for Automated 3d Search of Neuronal Morphologies in Light Microscopy, bioRxiv, 2021
[11] Mais*, **Hirsch*** et al., PatchPerPix for Instance Segmentation, **ECCV 2020**
[12] **Hirsch** et al., An Auxiliary Task for Learning Nuclei Segmentation in 3D Microscopy Images, **MIDL 2020**
[13] Krull*, **Hirsch*** et al., Artificial-intelligence-driven scanning probe microscopy, **Nat. Communications Physics**, 2020

Datasets

[14] Santella et al., 3D+time nuclei tracking dataset of confocal fluorescence microscopy time series of C. elegans embryos. 2022
[15] Christensen et al., 3D+time nuclei tracking dataset of diSPIM lightsheet fluorescence microsc. time series of C. elegans embryos. 2022
[16] Mais* , **Hirsch*** et al., FISBe: A real-world benchmark dataset for inst. segmentation of long-range thin filamentous structures. 2024

Posters and Competitions

[17] **Hirsch** and Kainmüller, An Auxiliary Task for Learning Nuclei Segmentation in 3D Microscopy Images, Frontiers in Imaging Science II. Janelia Research Campus, 2019
[18] **Hirsch*** , Rumberger* et al., What can go wrong with the tile & stitch, CBIAS 2021, runner-up best poster
[19] Rumberger* , Baumann* et al., CoNIC: Colon Nuclei Identification and Counting Challenge 2022, 2nd place segmentation and classification challenge