Nils Eckstein

portfolio | mail | scholar

EDUCATION

ETH ZÜRICH & HHMI JANELIA
PhD - Machine Learning
2021 | Zurich, CH & Ashburn, US

ETH ZÜRICH
MSc in Physics
2016 | Zurich, CH

ETH ZÜRICH
BSc in Physics
2014 | Zurich, CH

HEILIG GEIST GYMNASIUM
Matura
2011 | Menden, GER

LINKS

Github:// **nilsec**
LinkedIn:// **nilsec**
Twitter:// **@BobQubit**

SELECTED COURSES

Models of Computation
(Teaching Asst.)
Graphical Models for Computer Vision
Quantum Information Processing
Numerical Methods
Progr. Techniques for Sci. Simulations
Analysis I/II
Complex Analysis
General Relativity
Cosmology

SKILLS

PROGRAMMING

Over 5000 lines:
• Python • Shell • LaTeX
Familiar:
• C++ • CSS • Javascript

TECHNOLOGIES

• PyTorch • Tensorflow • Docker
• Singularity • Azure • Gurobi
• MongoDB

GENERAL

• Deep Learning • Computer Vision
• Discrete Optimization
• Generative Models
• Tracking • DNN Interpretability
• Large Scale Data Processing
• Image Classification
• Image Segmentation • Statistics
• Math • Physics • Neuroscience

EXPERIENCE

NOVARTIS | AI4LIFE Resident
2021 - 2022 | Basel, CH

- Conceptualized and led an independent research project within the Novarits AI Innovation Lab.
- Developed a novel method for Neural Network Interpretability based on Disentangled Representation Learning.

PHD RESEARCH | ETH Zürich & HHMI Janelia
2016 – 2021 | Zürich, CH & Ashburn, US

- Development of novel deep learning computer vision algorithms for large scale biomedical datasets.
- Developed a method for the prediction of neurotransmitters from images of synapses. First thought impossible, this method is now able to determine a crucial property of synapses at scale. It replaces highly complex manual procedures, that involve genetic tools, with a simple image classification algorithm. It has since been used in numerous publications, including the first full map of the nervous system of the fruit fly (LINK), and simplified the workflow of research groups around the world.
- Developed a novel computer vision algorithm for tracking of sub-cellular structures (microtubules) in various electron microscopy datasets at scale, combining deep learning with discrete optimisation on graphs. This work contributed to the reconstruction of a full cell at nanometer resolution, arguably the most accurate map of a cell to date (LINK).
- Developed a novel neural network interpretability method that is better suited for understanding fine grained class differences as learned by a deep neural network. In particular for image domains where humans have little to no visual priors, such as biomedical datasets. Subsequently, we used this method to uncover hitherto unknown morphological features of biological structures, thus generating new scientific knowledge in a semi automated way.

PUBLICATIONS

[1] Eckstein et al. - Discriminative Attribution from Paired Images, accepted at BIC workshop at ECCV 2022.
[2] Eckstein et al. - Microtubule Tracking in Electron Microscopy Volumes, MICCAI 2020, Lecture Notes in Computer Science, vol 12265.
[3] Eckstein et al. - Neurotransmitter Classification from Electron Microscopy Images at Synaptic Sites in Drosophila, bioRxiv 2020.06.12.148775.
[4] Heinrich et al. - Whole-cell organelle segmentation in volume electron microscopy, Nature 2021.
[5] Li et al. - The connectome of the adult Drosophila mushroom body provides insights into function, eLife 2020.
[6] Buhmann et al. - Synaptic partner prediction from point annotations in insect brains, MICCAI 2018.
[7] Baker et al. - Neural network organization for courtship-song feature detection in Drosophila, Current Biology 32 (15), 3317-3333. e7.

AWARDS

2020 MICCAI 2020 Young Scientist Award
2011 DPG Abiturpreis for exceptional performance in physics