

Kyle Luther

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🏠 kyleluther.github.io

🔍 Google Scholar

I'm a researcher and an engineer, and I want to create the next generation of artificial intelligence systems.

🎓 EDUCATION

Princeton University 2016 - 2022

Ph.D. in Physics

Advisor: H. Sebastian Seung

University of California Berkeley 2014 - 2016

Bachelor of Arts in Physics GPA: 4.0/4.0

Highest Distinction in General Scholarship

Folsom Lake Community College 2012 - 2014

Associate Degree GPA: 4.0/4.0

💻 PROGRAMMING SKILLS

5+ years experience Python, PyTorch, Numpy/SciPy, Scikit-learn, Scikit-image, Matplotlib

1+ years experience Jax, Jupyter

Used in research C/C++, CUDA, OpenCV, Pillow

🏛️ RESEARCH

Postdoctoral Researcher in Sebastian Seung's Lab at Princeton 2022-present

Group led by H. Sebastian Seung

Diffusion models for science Can we use diffusion models to provide us multiple hypotheses to computational imaging problems like computed tomography? More generally do diffusion models provide a solution to scientist's long standing goal of making Bayesian machine learning mainstream?

Invariant representation learning in the brain I am exploring a class of non-backpropagation-powered learning algorithms that pose learning as a game between competing features. Can we dethrone backprop as the universally accepted gold-standard way to train a neural network?

Electron tomography at scale Working on serial section electron tomography applied to large scale brain imaging. We use convolutional networks to reduce the number of images required to perform 3D tomographic reconstructions, and thus improve the imaging throughput.

Graduate Researcher in Sebastian Seung's Lab at Princeton 2017-2022

Group led by H. Sebastian Seung

3D image segmentation via deep metric learning Performed automated neuron segmentation with convolutional networks in 3D microscope images. Created software for data augmentation of 3D images (*augmentem*).

Unsupervised learning Analyzed brain-inspired models of unsupervised learning (*sparse coding, correlation game*). Devised and implemented novel brain-inspired models of unsupervised learning (*kernel similarity matching, invariant subspace features*).

Manifold learning Devised and implemented a novel manifold learning algorithm posed as a two player game (*embedding game*).

Initialization of deep networks Analyzed the impact of Batch Normalization on deep network initialization and devised a novel initialization scheme inspired by the analysis.

Undergraduate Researcher in Saul Perlmutter's Lab at UC Berkeley 2014-2016

Group led by Saul Perlmutter

Star-finder software Created software to find recently exploded supernovae in satellite images. The key component of this software relied on a random forest classifier applied to hand-crafted features inside image patches.

Undergraduate Researcher in Jonathan Fortney's Lab at UC Santa Cruz summer 2014

Group led by Johnathan Fortney

Radiative transfer software Optimized code used to calculate radiative transfer through exoplanetary atmospheres. Optimization performed by transcribing key components of python code into C.

PUBLICATIONS

Journal & Conference Publications

Sensitivity of sparse codes to image distortions

Neural Computation, 2022

K Luther, HS Seung

Kernel similarity matching with Hebbian neural networks

Neurips, 2022

K Luther, HS Seung

Learning and segmenting dense voxel embeddings for 3D neuron reconstruction

IEEE Transactions on Medical Imaging, 2021

K Lee, R Lu, **K Luther**, HS Seung

Reexamining the principle of mean-variance preservation for neural network initialization

Physical Review Research, 2020

K Luther, HS Seung

Unsupervised learning by a softened correlation game: duality and convergence

53rd Asilomar Conference on Signals, Systems, and Computers, 2019

K Luther, R Yang, HS Seung

Learning metric graphs for neuron segmentation in electron microscopy images

16th IEEE ISBI Conference, 2019

K Luther, HS Seung

The discovery of a gravitationally lensed supernova Ia at redshift 2.22

The Astrophysical Journal, 2018

D Rubin, B Hayden, X Huang, G Aldering, R Amanullah, K Barbary, K Boone, M Brodwin, SE Deustua, S Dixon, P Eisenhardt, AS Fruchter, AH Gonzalez, A Goobar, RR Gupta, I Hook, MJ Jee, AG Kim, M Kowalski, CE Lidman, E Linder, **K Luther**, J Nordin, R Pain, S Perlmutter, Z Raha, M Rigault, P Ruiz-Lapuente, CM Saunders, C Sofiatti, AL Spadafora, SA Stanford, D Stern, N Suzuki, SC Williams

Characterizing transiting exoplanet atmospheres with JWST

The Astrophysical Journal, 2016

TP Green, MR Line, C Montero, JJ Fortney, J Lustig-Yaeger, **K Luther**

Preprints

3D reconstruction of cell nuclei in a full Drosophila brain

bioRxiv, 2021

S Mu, S Yu, NL Turner, CE McKellar, S Dorckenwald, F Collman, S Koolman, M Moore, S Morejohn, B Silverman, K Willie, R Willie, D Bland, A Burke, Z Ashwood, **K Luther**, M Castro, O Ogedengbe, W Silversmith, J Wu, A Halageri, T Macrina, N Kemnitz, M Murthy, HS Seung

Stacked unsupervised learning with a network architecture found by supervised meta-learning

Arxiv, 2022

K Luther, HS Seung

TEACHING

Neural Networks: Theory and Applications (COS 485)

Assistant in Instruction, Spring 2018, 2019