Jaehoon Lee

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Experience

Google Brain Mountain View, CA
Research Scientist, July 2019 - Current
AI Resident, July 2017 - July 2019
Research on wide neural networks and scientific study of deep neural network optimization methods

University of British Columbia Vancouver, Canada
Postdoctoral Research Fellow in string theory group, September 2015 - June 2017
Research on conformal field theories and their holographic dual properties

CERN, European Organization for Nuclear Research Geneva, Switzerland
Summer Student Program, Summer 2008
Research in supersymmetric particle signal analysis using Python and ROOT

Education

Massachusetts Institute of Technology Cambridge, MA
Ph. D. in Theoretical Physics, 2015.
Thesis: "Studies of superconformal field theories using GLSM and conformal bootstrap"

Seoul National University Seoul, South Korea
B.Sc., Physics and Mathematics, 2009.

Harvard University Cambridge, MA
Visiting Undergraduate Student, 2008.

Research Interests

Machine Learning and Artificial Intelligence

Interplay between physics and machine learning

Scientific and principled study of deep neural networks

Theoretical Physics

Quantum Field Theory, String Theory, Condensed Matter Physics

List of Publications

[Google Scholar (https://goo.gl/akC77m). $*$ denotes equal contribution.]

Finite Versus Infinite Neural Networks: an Empirical Study **Jaehoon Lee**, Samuel S Schoenholz, Jeffrey Pennington, Ben Adlam, Lechao Xiao, Roman Novak, Jascha Sohl-Dickstein, arXiv:2007.15801

Exploring the Uncertainty Properties of Neural Networks' Implicit Priors in the Infinite-Width Limit Ben Adlam*, **Jaehoon Lee***, Lechao Xiao*, Jeffrey Pennington, Jasper Snoek, ICML Workshop on Uncertainty & Robustness in Deep Learning 2020

On the infinite width limit of neural networks with a standard parameterization Jascha Sohl-Dickstein, Roman Novak, Samuel S Schoenholz, **Jaehoon Lee**, arXiv:2001.07301

Neural Tangents: Fast and easy infinite neural networks in python Roman Novak, Lechao Xiao, Jiri Hron, **Jaehoon Lee**, Alexander A Alemi, Jascha Sohl-Dickstein, Samuel S. Schoenholz, International Conference on Learning Representations (ICLR) 2020, arXiv:1912.02803, https://github.com/google/neural-tangents

On Empirical Comparisons of Optimizers for Deep Learning Dami Choi, Christopher J. Shallue, Zachary Nado, **Jaehoon Lee**, Chris J. Maddison, George E. Dahl arXiv:1910.05446

Wide Neural Networks of Any Depth Evolve as Linear Models Under Gradient Descent, **Jaehoon Lee***, Lechao Xiao*, Samuel S. Schoenholz, Yasaman Bahri, Jascha Sohl-Dickstein, Jeffrey Pennington, Neural Information Processing Systems (NeurIPS) 2019, arXiv:1902.06720

Measuring the Effects of Data Parallelism on Neural Network Training, Christopher J. Shallue*, **Jaehoon Lee***, Joe Antognini, Jascha Sohl-Dickstein, Roy Frostig, George E. Dahl, Journal of Machine Learning Research (JMLR) 2019, arXiv:1811.03600

Gaussian Process Predictions from Gradient Descent Training of Wide Neural Networks, **Jaehoon Lee***, Lechao Xiao*, Jascha Sohl-Dickstein, Jeffrey Pennington, BayLearn 2018, NeurIPS Bayesian Deep Learning Workshop 2018

Bayesian Deep Convolutional Neural Networks with Many Channels are Gaussian Processes, Roman Novak, Lechao Xiao, **Jaehoon Lee***, Yasaman Bahri*, Greg Yang, Jiri Hron, Daniel A. Abolafia, Jeffrey Pennington, Jascha Sohl-Dickstein, ICLR 2019, arXiv:1810.05148

Deep Neural Networks as Gaussian Processes, **Jaehoon Lee***, Yasaman Bahri*, Samuel S. Schoenholz, Roman Novak, Jeffrey Pennington, Jascha Sohl-Dickstein, ICLR 2018, arXiv:1711.00165, code available at `github/brain-research/nngp`

Deep Neural Networks and Deep Gaussian Process **Jaehoon Lee***, Yasaman Bahri*, Samuel S. Schoenholz, Roman Novak, Jeffrey Pennington, Jascha Sohl-Dickstein, BayLearn 2017 (Best poster)

[For papers below, author order is alphabetical as customary in high energy physics]

3d $\mathcal{N} = 2$ minimal SCFTs from Wrapped M5-branes, Jin-Beom Bae*, **Jaehoon Lee***, Dongmin Gang*, JHEP 1708 (2017) 118

Entanglement entropy from one-point functions in holographic states, Matt Beach*, **Jaehoon Lee***, Charles Rabideau*, Mark van Raamsdonk* JHEP 1606 (2016) 085

Studies of superconformal field theories using GLSM and conformal bootstrap, **Jaehoon Lee**, Massachusetts Institute of Technology (Ph.D. Thesis), 2015

Exact Correlators of BPS Operators From the 3D Superconformal Bootstrap, Shai Chester*, **Jaehoon Lee***, Silviu Pufu* and Ran Yacoby* JHEP 1503 (2015) 130

The $\mathcal{N} = 8$ Superconformal Bootstrap in Three Dimensions, Shai Chester*, **Jaehoon Lee***, Silviu Pufu* and Ran Yacoby* JHEP 1409 (2014) 143

Glassy Slowdown and Replica-Symmetry-Breaking Instantons, Allan Adams*, Tarek Anous*, **Jaehoon Lee*** and Sho Yaida* Phys. Rev. E 91, 032148 (2015)

Linking Dynamical Heterogeneity to Static Amorphous Order, Patrick Charbonneau*, Ethan Dyer*, **Jaehoon Lee*** and Sho Yaida* J. Stat. Mech. (2016) 074004

Algebra of Majorana Doubling, **Jaehoon Lee***, Frank Wilczek*, Phys. Rev. Lett. 111, 226402 (2013)

GLSMs for non-Kähler Geometries, Allan Adams*, Ethan Dyer* and **Jaehoon Lee***, JHEP 01 (2013) 044

Scholarship and Awards

Samsung scholarship for graduate studies, $250K for 5 years	2009-2014
Republic of Korea presidential science scholarship for undergraduate studies $40K for 4 years	2003-2009
Scholarship for distinguished undergraduates, Korea foundation for advanced studies	2007-2009
Korea national collegiate math competition, bronze prize	2007

Services

Reviewer for Journal of Machine Learning Research (JMLR), Pattern Recognition Letters, Neural Computation	
Organizer for ICML Workshop on Theoretical Physics for Deep Learning	2019
Reviewer for Neural Information Processing Systems (NeurIPS)	2018, 2019, 2020
Reviewer for International Conference on Machine Learning (ICML)	2018, 2019
Organizer for Aspen Winter Physics Conference on Theoretical Physics and Machine Learning	2019
Reviewer for International conference on Learning Representations (ICLR)	2019, 2020
Reviewer for International Conference on Machine Learning (ICML) workshop on non-convex optimization	2018
Organizer for Vancouver Deep Learning Study Group	2016-2017
Organizer for MIT Center for Theoretical Physics Graduate Student Lunch Club	2009-2010

Talks

2019 Apr MSR Physics Meets Machine Learning Workshop Breakout Session Lead, *Understanding Deep Learning*

2019 Apr Advanced Workshop on Accelerating the Search for Dark Matter with Machine Learning, *Deep Neural Networks as Gaussian Processes*

2019 Mar DeepMind tutorial, *A tutorial on overparameterized neural networks: Gaussian processes, the neural tangent kernel, and equivalence to linear systems*

2019 Feb HEP-AI Journal club, *Understanding Wide Neural Networks*

2018 Dec NeurIPS Workshop on Bayesian Deep Learning 2018, Poster, *Gaussian Predictions from Gradient Descent Training of Wide Neural Networks*

2018 Dec Google Brain Research Seminar, *Everything you wanted to know about batch size but were afraid to ask*

2018 Oct BayLearn 2018, Poster, *Gaussian Process Predictions from Gradient Descent Training of Wide Neural Networks*

2018 Mar Google Brain Research Seminar, *Deep Neural Networks as Gaussian Processes*

2017 Dec NeurIPS Workshop on Bayesian Deep Learning 2017, Poster, *Deep Neural Networks as Gaussian Processes*

2017 Oct BayLearn 2017, Poster (best poster), *Deep Neural Networks and Deep Gaussian Process*

2017 Aug HEP-AI Journal club, *K-FAC (Kronecker-factored Approximate Curvature)*

2016 Nov UBC String group meeting, *3d* $\mathcal{N} = 2$ *minimal SCFTs from Wrapped M5-branes*

2015 Oct UBC String group meeting, *Overview of conformal bootstrap*

2014 Sep MIT String Club, *3D CFTs and* $\mathcal{N} = 8$ *superconformal bootstrap*

2014 Apr MIT CTP Graduate Student Lunch Club, *Old but new method for studying CFTs*

2014 Apr MIT String Club, *Conformal bootstrap approach*

2014 Mar KIAS, Physics Seminar, Seoul, Korea, *Recent progress in conformal bootstrap*

2014 Mar SNU, CTP Particle Physics Seminar, Seoul, Korea, *Recent progress in conformal bootstrap*

2011 Apr MIT CTP Graduate Student Lunch Club, *How to use gauge theories to study CY geometries*

2011 Spring MIT Fivebranes and Knots Study Group, *Intro to Khovanov homology : Categorification of Jones Polynomial*

Teaching

Mastering Quantum Mechanics, 8.05x, Massachussets Institute of Technology (via edX)
Fall 2014-Summer 2015, Full TA for Professor Barton Zwiebach

Physics I, 8.01, Massachussets Institute of Technology
Fall 2013, Full TA for Professor Vladan Vuletic

General Relativity, 8.962, Massachussets Institute of Technology
Spring 2013, Grader for Professor Edward Farhi and Alan Guth

Relativisitic Quantum Field Theory I, 8.323, Massachussets Institute of Technology
Spring 2012, Grader for Professor Washington Taylor

Independent Coursework

Deep learning nanodegree foundation(Udacity, 2017); Deep Learning(Goodfellow-Bengio-Courville, independent study); Neural Networks for Machine Learning(G.Hinton, UT Coursera, 2016); Learning from Data(CaltechX, 2016); Convolutional Neural Network for Visual Recognition(Stanford CS231n, independent study); Deep Learning(Udacity, 2016); Neural networks and Deep Learning(M.Nielsen's online book, 2016); Intro to Artificial Intelligence(Stanford Udacity, 2016); Machine Learning(Stanford Coursera, 2016); Design and Analysis of Algorithms I(Stanford Coursera, 2015); Artificial Intelligence(BerkeleyX, 2015); Scalable Machine Learning(BerkeleyX, 2015); Intro to Computational Thinking and Data Science(MITX, 2015); Aerial Robotics(UPenn Coursera, 2016); Intro to IoT and Embedded Systems/with Raspberry Pi(UCI Coursera, 2015); Systems Biology(MIT, 2012); Understanding Brain(SNU, 2004)

Skills

Programming: Python, Matlab, Mathematica; Basics of C/C++;
ML Libraries: JAX, Tensorflow, Scikit-learn

Last updated: August 25, 2020