Jimmy Hyun Jin Kim

Present Address
(redacted)
(redacted)

(redacted)
(redacted)
https://biophysics.princeton.edu/people/jimmy-kim

Permanent Address
(redacted)

Education

Northwestern University, Evanston, IL. 2015-2020 (expected)
Ph.D. Candidate, Physics. (Advisor: David J. Schwab)
CGPA: 3.928

University of Toronto, Toronto, ON. 2011-2015
Honours B.Sc. with High Distinction, Mathematics and Physics Specialist.
CGPA: 3.97

Visiting Student at Initiative for the Theoretical Sciences	2018-present
Graduate Student Researcher at Center for the Physics of Biological Function	2017-present
IDEAS Traineeship at Northwestern University	2017-present
RSG Research Communication Program at Northwestern University	2017
Cargese Summer School on Theoretical Biophysics	2017
Ontario Summer School on High Performance Computing	2015

Certificates

Databases and SQL for Data Science (IBM)	2019
Neural Networks for Machine Learning (Coursera)	2017
Computational Neuroscience (Coursera)	2017
Integrated Data Science (Northwestern University)	2017
Machine Learning (Coursera)	2016
High Performance Computing (SciNet)	2015
Scientific Computing (SciNet)	2015

Awards

The Hymie and Roslyn Mida Student Award in Theoretical Physics	2015
Trinity College Provost's Scholar	2015
NSERC Undergraduate Student Research Award	2013,2014
Dean's List Scholar	2012,2013,2014
The Coxeter Scholarship in Mathematics	2013
The William Ramsay Scholarship in Physics	2013
The Harry Boxen Memorial Scholarship in Physics	2013
Chancellor's Scholarship	2012,2013
Dr. John Knowles Colling Memorial Scholarship	2012
Summer Undergraduate Research Fellowship	2012
University of Toronto Scholar	2011
The Wasteneys Admission Scholarship	2011

Experience

Teaching Assistant at Northwestern University (Sep. 2016 - June 2018)

- Led discussion sessions consisting of 10-50 students, held office hours, and graded tests.
- Subjects included classical mechanics, electromagnetism, and special relativity.

Current Projects

Dynamical mean field theory of recurrent networks

- We seek to use mean field theory to study the dynamical properties of recurrent networks, particularly relating to the nature of time updates and the role of gating.
- Preliminary experiments suggest that continuously updated recurrent networks have much richer capacity than discrete networks.

Dynamics of multi-agent reinforcement learning in game theory

- We built a platform for multi-agent reinforcement learning using PyTorch.
- We characterized the dynamical landscape of multi-agent reinforcement learning in terms of the exploration-exploitation tradeoff parameter and discovered that criticality plays a crucial role in inducing cooperation.

Past Projects

Visualizing neural decoding with head direction cells

- We built an interactive visual demonstration of neural decoding process in head direction cells using HTML, CSS, and JavaScript (D3.js).
- The product has been used as an aid for explaining research results to people outside the field.

Soccer Success: ML for predicting the outcome of soccer matches

- We built a pipeline for predicting the outcome of soccer matches by using in-game stats from the FIFA video game franchise as features for machine learning.
- Weka as well as a custom Python script was used to implement machine learning functionalities.
- Submitted as the final project for a machine learning course where it was graded 20.1/20 [sic].

Superlinear precision and memory in neural coding

- We analytically derived optimal scaling relations in sensory and memory networks and developed simulations in both Python and MATLAB to numerically confirm the theoretical results.
- We discovered that superlinear scaling of precision is possible in spite of the failure of the Cramer-Rao bound given by the Fisher Information.
- Publication in preparation.

Neuronal tracking and activity measurement in C. elegans

- We developed image processing platform in MATLAB for tracking and quantifying fluorescence intensity (proxy for activity) from multiple neurons in *C. elegans*.
- The platform has been used to discover a previously unknown neural circuitry.
- Results published in eLife.

Volunteering/ Outreach

Judge, High School Project Showcase at Northwestern University	2018
Mentor, Physics Mentorship Program at University of Toronto	2017-2018
Demonstrator, 100 in 1 Day	2014
Demonstrator, Science Rendezvous	2012,2014

Publications

Pan-neuronal screening in Caenorhabditis elegans reveals assymetric dynamics of AWC neurons is critical for thermal avoidance behavior.
Authors: I. Kotera, N.A. Tran, D. Fu, **J.H.J. Kim**, J.B. Rodgers, W.S. Ryu
eLife **5**, e19021 (2016)

Posters

"Dynamics of Multi-Agent Reinforcement Learning", Dynamics Days 2019

Talks

"Dynamics of Reinforcement Learning in Game Theory", APS March Meeting	2019
"Optimizing population coding and short term memory", APS March Meeting	2018
"Optimal neural coding and short term memory", SIAM Bridging the Gap	2018
"Too much precision can be bad", Seven Minutes of Science	2017

Languages

(fluent) English, Korean, Python, MATLAB, Mathematica
(basic) SQL, HTML, CSS, JavaScript, C++, Visual Basic