

EDUCATION

Carnegie Mellon University, Advised by Zico Kolter, Aditi Raghunathan
Ph.D. in Machine Learning

Aug. 2021– Present

- I focus on out-of-distribution generalization and continual learning. Recently, I worked on leveraging disagreement rate between a pair of models to estimate performance of models under both distribution shift and no distribution shift. I am also interested in properly finetuning LLMs.

University of California, Berkeley, Advised by Yi Ma
5th Year M.S. in Electrical Engineering and Computer Science; Mathematics Breadth

Aug. 2020 – Jun. 2021

University of California, Berkeley
B.S. in Electrical Engineering and Computer Science; Minor in Bioengineering

Aug. 2016 – Jun. 2020

EXPERIENCE

Google Research Advised by Hossein Mobahi, Behnam Neyshabur
Summer Intern

May 2022 - Aug. 2022

- Empirically and theoretically studied the relationship between loss sharpness and generalization. Specifically investigated the robustness of an algorithm SAM (Sharpness Aware Minimization) to feature noise.

UC Berkeley Artificial Intelligence Research Lab, Advised by Yi Ma
Research Assistant

Jan. 2020 - Dec. 2021

- Focus: continual learning, dictionary learning, reinforcement learning
- Reformulated the Maximal Coding Rate Reduction loss such that the number of log determinants required does not grow linearly with the number of classes. Saw 10x faster training on Tiny-ImageNet. Published in CVPR 2022.
- Worked on a journal publication theoretically analyzing the improvements in computational complexity we observe in practice when the agent is given intermediate rewards in reinforcement learning tasks. Published in JAIR 2022.
- Showed that ReduNet, a network constructed by forward propagation, performs significantly better on class incremental learning tasks than deep networks trained by backpropagation. Worked on global convergence proofs of loss functions over the Steifel manifold. Published in CVPR 2021.

UC Berkeley Molecular Cell Biomechanics Lab, Advised by Mohammad Mofrad
Research Assistant

Jan. 2019 - Jun. 2019

- Designed convolutional neural networks to predict the punctual stress during unfolding in molecular dynamics simulations of double globule tethered proteins. Discovered patterns between punctual stress and a protein's secondary structure during protein unfolding.

Harvard Medical School, Department of Biomedical Informatics, Advised by Chirag Patel
Intern for Summer Institute of Bioinformatics

Jun. 2017 - Aug. 2017

- Created a database of annotated microbiome studies that use whole-genome sequencing <https://microbial-genes.bio>. Published in Cell Host and Microbe, 2019.
- Built a pipeline in R that conducts a metagenome-wide association study of microbiome data and outputs significant genetic/functional markers.

UC San Diego, Department of Medicine, Advised by John Chang
Research Assistant

Jun. 2016 – Jan. 2017

- Studied the role of TGF β pathway in cancer. Showed that modulating USP11 expression altered the stability of TGF β receptor type 2 (TGFBR2) and TGF β downstream signaling in human breast cancer cells. Published in Molecular Cancer Research, 2018.

PUBLICATIONS

* denotes equal contribution

- [1] **Agreement-on-the-line: Predicting the Performance of Neural Networks under Distribution Shift** [\[arxiv\]](#)
Christina Baek, Yiding Jiang, Aditi Raghunathan, Zico Kolter
Neural Information Processing Systems (NeurIPS), 2022 (Oral) + International Conference in Machine Learning (ICML) Principles of Distribution Shift Workshop 2022

- [2] **Efficient Maximal Coding Rate Reduction by Variational Forms** [\[arxiv\]](#)
Christina Baek*, Ziyang Wu*, Kwan Ho Ryan Chan, Tianjiao Ding, Yi Ma, Benjamin D. Haeffele
Conference of Computer Vision and Pattern Recognition (CVPR), 2022
- [3] **Assessing Generalization of SGD via Disagreement** [\[arxiv\]](#)
Yiding Jiang*, Vaishnavh Nagarajan*, **Christina Baek**, J. Zico Kolter
International Conference in Machine Learning (ICML) Workshop on Overparameterization: Pitfalls & Opportunities, 2021 + International Conference on Learning Representations (ICLR), 2022 (Spotlight)
- [4] **Computational Benefits of Intermediate Rewards for Hierarchical Planning** [\[arxiv\]](#)
Yuexiang Zhai, **Christina Baek**, Zhengyuan Zhou, Jiantao Jiao, Yi Ma
Journal of Artificial Intelligence Research (JAIR), 2022
- [5] **Incremental Learning via Rate Reduction** [\[arxiv\]](#)
Ziyang Wu*, **Christina Baek***, Chong You, Yi Ma
Conference of Computer Vision and Pattern Recognition (CVPR), 2021 + International Conference in Machine Learning (ICML) Workshop on Theory and Foundation of Continual Learning 2021 (Oral)
- [6] **The Landscape of Genetic Content in the Gut and Oral Human Microbiome** [\[pubmed\]](#)
Braden Tierney, Zhen Yang, Jacob Lubner, Marc Beaudin, Marsha Wibowo, **Christina Baek**, Chirag Patel, Aleksandar Kostic
Cell Host and Microbe, 2019
- [7] **Ubiquitin specific peptidase 11 (USP11) enhances TGF β -induced epithelial-mesenchymal plasticity and human breast cancer metastasis** [\[pubmed\]](#)
Daniel Garcia, **Christina Baek**, M Valeria Estrada, Tiffani Tysl, Eric Bennett, Jing Yang, John Chang.
Molecular Cancer Research, 2018
- [8] **Inhibition of Spontaneous and Experimental Lung Metastasis of Soft-Tissue Sarcoma by Tumor-Targeting Salmonella typhimurium A1-R** [\[pubmed\]](#)
Shinji Miwa, Yong Zhang, **Kyung-Eun Baek**, Fuminari Uehara, Shuya Yano, Mako Yamamoto, Yukihiko Hiroshima, Yasunori Matsumoto, Hiroaki Kimura, Katsuhiko Hayashi, Norio Yamamoto, Michael Bouvet, Hiroyuki Tsuchiya, Robert Hoffman, Ming Zhao.
Oncotarget, 2014

EDITOR

- [1] **High-Dimensional Data Analysis with Low-Dimensional Models: Principles, Computation, and Applications**
Yi Ma, John Wright
Cambridge University Press.

TEACHING

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| <p>CS15-884 Theoretical and Empirical Foundations of Modern Machine Learning</p> <p><u>Head TA</u>: Held weekly office hours and organized class content.</p> <p>CS189/289A Introduction to Machine Learning</p> <p><u>Content TA, Spring 2021</u>: Designed exam questions, held discussion sections. Instructor: Jonathan Shewchuk.</p> <p><u>Project-Lead TA, Fall 2020</u>: Designed the final project, studying a machine-learning perspective of the night sky and the evolution of our understanding of it across cultures and time. Instructor: Anant Sahai.</p> <p><u>Head TA, Spring 2020</u>: Lead course staff, wrote supplementary material. Instructor: Jonathan Shewchuk.</p> <p><u>Content TA, Summer 2019</u>: Designed exam questions, held discussion sections. Instructor: Jonathan Shewchuk.</p> <p>CS170 Efficient Algorithms and Intractable Problems</p> <p><u>Reader</u>: Held weekly office hours and designed homework rubrics. Instructor: Satish Rao.</p> <p>CS70 Discrete Mathematics and Probability Theory</p> <p><u>Mentor</u>: Held mini-discussion sections for a group of 4 students. Prepared students for exams. This was a part of UC Berkeley's Computer Science Mentors club.</p> | <p>Fall 2022</p> <p>Summer 2019 – Spring 2021</p> <p>Spring 2018</p> |
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HONORS & SCHOLARSHIPS

CMU Presidential Fellowship in Machine Learning <i>Awarded to 1 student per graduate school application cycle.</i>	2021
Outstanding GSI Award <i>Awarded by UC Berkeley for outstanding work in teaching on campus.</i>	2021
Koret Research Scholarship <i>Received \$4000 from UC Berkeley to conduct my proposed research with Professor Yi Ma over Summer 2020</i>	2020
Thermo Fisher Scientific Scholarship <i>Received \$20,000 for scholastic excellence.</i>	2016-2020
Eta Kappa Nu Honors Society <i>National Electrical Engineering and Computer Science Honors Society.</i>	2018
Tau Beta Pi Engineering Honors Society <i>National Engineering Honors Society.</i>	2017
Regents' and Chancellor's Scholarship <i>Awarded to < 2% of entering class for creativity and leadership.</i>	2016

RELEVANT COURSEWORK

STAT 240: Robust Statistics	STAT 210: Theoretical Statistics
EE 229: Information Theory	EE 227C: Convex Optimization
CS 285: Deep Reinforcement Learning	CS 288: Natural Language Processing
CS 270: Combinatorial Algorithms	MATH 140: Differential Geometry
MATH 104: Intro to Real Analysis	BIOE 145: Intro to Machine Learning in Computational Biology