Christina Baek

Homepage: kebaek.github.io
Email: kbaek@cs.cmu.edu
Mail: 8227 Gates Hillman, CMU, Pittsburgh, PA

Education

Carnegie Mellon University, Advised by Zico Kolter, Aditi Raghunathan — Aug. 2021– Present
Ph.D. in Machine Learning

University of California, Berkeley, Advised by Yi Ma — Aug. 2020 – Jun. 2021
5th Year M.S. in Electrical Engineering and Computer Science; Mathematics Breadth

University of California, Berkeley — Aug. 2016 – Jun. 2020
B.S. in Electrical Engineering and Computer Science; Minor in Bioengineering

Job Experience

Google Research Advised by Hossein Mobahi, Behnam Neyshabur — May 2022 - Aug. 2022
Summer Intern

- 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 — Jan. 2020 - Dec. 2021
Research Assistant

- Designed an efficient reformulation of the Maximal Coding Rate Reduction loss. Published in CVPR 2022.
- Theoretically analyzed the improvements in computational complexity when agents are provided 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 — Jan. 2019 - Jun. 2019
Research Assistant

- 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.

Preprints

[1] **Test-Time Adaptation Induces Stronger Accuracy and Agreement-on-the-Line**
Eungyeup Kim, Mingjie Sun, **Christina Baek**, Aditi Raghunathan, Zico Kolter
Under Submission, 2024

Publications

⋆ denotes equal contribution

[1] **Why is SAM Robust to Label Noise?** [arxiv]
Christina Baek, Zico Kolter, Aditi Raghunathan
International Conference on Learning Representations (ICLR), 2024 + International Conference in Machine Learning (ICML) SCIS Workshop 2023.

[2] **Predicting the Performance of Foundation Models via Agreement-on-the-Line** [arxiv]
Aman Mehra, Rahul Saxena, Taeyoun Kim, **Christina Baek**, Zico Kolter, Aditi Raghunathan
Neural Information Processing Systems (NeurIPS) DistShift Workshop, 2023.

[3] **On the Joint Interaction of Models, Data, and Features** [arxiv]
Yiding Jiang, **Christina Baek**, Zico Kolter
International Conference on Learning Representations (ICLR), 2024 (Oral, 1.5% of accepted papers)

[4] **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, 2.1% of accepted papers) + International Conference in Machine Learning (ICML) Principles of Distribution Shift Workshop 2022

[5] **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

[6] **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, 16% of accepted papers)

[7] **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

[8] **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)

[9] **The Landscape of Genetic Content in the Gut and Oral Human Microbiome** [pubmed]
Braden Tierney, Zhen Yang, Jacob Luber, Marc Beaudin, Marsha Wibowo, **Christina Baek**, Chirag Patel, Aleksandar Kostic
Cell Host and Microbe, 2019

[10] **Ubiquitin specific peptidase 11 (USP11) enhances TGFβ-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

[11] **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, Katsuhiro 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.

Selected Talks

ML Collective [Deep Learning: Classics and Trends] August 2022
Talk Title: Agreement-on-the-line: Predicting the performance of models under distribution shift.

Service

Workshop on Mathematics of Modern Machine Learning (M3L) NeurIPS 2023
Member of organizing committee.

OOD Generalization and Robustness Reading Group 2021-Present
Created and host a CMU reading group focused on machine learning under distribution shift.

Teaching

CS10-725 Convex Optimization Spring 2023
Content TA: Held weekly office hours and wrote solutions. Instructor: Yuanzhi Li, Siva Balakrishnan

CS15-884 Theoretical and Empirical Foundations of Modern Machine Learning Fall 2022
Head TA: Held weekly office hours and wrote homework. Instructor: Aditi Raghunathan

CS189/289A Introduction to Machine Learning Summer 2019 – Spring 2021

Content TA, Spring 2021: Designed exam questions, held discussion sections. Instructor: Jonathan Shewchuk.
Project-Lead TA, Fall 2020: 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.
Head TA, Spring 2020: Lead course staff, wrote supplementary material. Instructor: Jonathan Shewchuk.
Content TA, Summer 2019: Designed exam questions, held discussion sections. Instructor: Jonathan Shewchuk.

CS170 Efficient Algorithms and Intractable Problems Fall 2019
Reader: Held weekly office hours. Instructor: Satish Rao.

CS70 Discrete Mathematics and Probability Theory Spring 2018
Mentor: Prepared students for exams for UC Berkeley's Computer Science Mentors.

Honors & Scholarships

Jane Street Graduate Research Fellowship 2023
Finalist.

CMU Presidential Fellowship in Machine Learning 2021
Awarded to 1 student per graduate school application cycle.

Outstanding GSI Award 2021
Awarded by UC Berkeley for outstanding work in teaching on campus.

Koret Research Scholarship 2020
Received \$4000 *from UC Berkeley to conduct my proposed research with Professor Yi Ma over Summer 2020*

Thermo Fisher Scientific Scholarship 2016-2020
Received $\$20,000$ *for scholastic excellence.*

Eta Kappa Nu Honors Society 2018
National Electrical Engineering and Computer Science Honors Society.

Tau Beta Pi Engineering Honors Society 2017
National Engineering Honors Society.

Regents' and Chancellor's Scholarship 2016
Awarded to $< 2\%$ *of entering class for creativity and leadership.*

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