

# JOON KIM

joonkim1@berkeley.edu  $\diamond$  (510)-529-6091

## EDUCATION

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### University of California, Berkeley

May 2027 (Expected)

B.S. Electrical Engineering & Computer Science, GPA: 4.00/4.00

**Current:** CS274(Computational Geometry), CS194-198(Network Theory), CS294-268(LEAN4)

**TCS:** CS270(Graduate Algorithms), CS294-180(Partition Functions, **A+**), CS174(Randomized Algorithms), CS170(Algorithms, **A+**), CS177(Algorithmic Economics), CS294-284(Constraint Satisfaction Problems)

**Computational:** CS194-302(Computational Immunology, **A+**), EECS249B(Cyber-Physical Systems), CS176(Computational Biology), CS188(AI/RL)

## RESEARCH INTERESTS

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Algorithms; MCMC and Partition Functions; Combinatorial Optimization

## RESEARCH & PRESENTATIONS

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### [Foundational Theory]

#### MCMC Research

Jan. 2026 - Current

*Advised by Prof. Alistair Sinclair*

*Berkeley, CA*

- Studying the mixing time lower bound of lattice triangulation Glauber dynamics for  $\lambda > 1$  in [CMSS15]
- Attempting to improve  $T_{mix}$  from  $e^{\Omega((m+n))}$  to  $e^{\Omega((m+n)mn)}$  by bounding the conductance of the flip graph

#### Maximum Weighted Matching Research

Dec. 2025 - Current

*Advised by Prof. Satish Rao*

*Berkeley, CA*

- Extending Multiplicative Auction by [ZH25] to fully dynamic matching; identified monotonicity as a barrier
- Currently working on modifications to the auction algorithm to bypass invariant analysis in the paper

#### Sampling Spanning Trees via Entropic Independence

Oct. 2025 - Dec. 2025

*CS294-180(Partition Functions) Final Report & Student Lecture*

- Synthesized a 6-page report for sublinear time sampling of spanning trees in  $O(k \log^2 n)$  time, based on [ALV22]
- Delivered half of a 70-minute technical lecture to a graduate-level audience, motivating and explaining techniques such as marginal overestimates, isotropic transformation, MCMC, and connections to Up-Down walks

### [Interdisciplinary Studies]

#### Lawrence Berkeley Laboratory - Perlmutter Group

Sep. 2025 - Current

*Advised by Prof. Xiaosheng Huang*

*Berkeley, CA*

- Modeling the Carousel Lens using the multi-GPU GIGA-Lens ML pipeline to constrain cosmology
- Implemented and experimenting Stochastic Variational Inference with Gaussian Mixtures in high dimensions

#### Stochastic Modeling of Drug-Induced Resistance

Sep. 2025 - Dec. 2025

*CS194-302(Computational Immunology) Final Report & Presentation*

- Designed an explainable computational model for cancer drug resistance using Hill-function modulated CTMC
- Worked closely with teammates with expertise in immunology and Bio-ML; motivated the use of simple methods
- Delivered half of a 15-minute conference-style presentation to a graduate-level audience

#### Cohort Studies and MrVI

Nov. 2025

*CS194-302(Computational Immunology) Student Lecture*

- Delivered a third of a 3-hour lecture on cohort studies in immunology and MrVI as one emerging solution
- Focused on building mathematical intuition of MrVI, how it differs from scVI, and its philosophical implications

## Greedy, ILP, and Hybrid Methods for Phylogeny

Apr. 2025

*CS176(Computational Biology) Literature Review*

- Synthesized a 5-page technical review on Casasiopeia, a phylogeny framework with ILP and Greedy heuristics
- Identified motivation for the study, its main technical contributions, potential applications, and limitations.

## Berkeley AI Research - C.H.E.N. Lab

Jul. 2024 - Feb. 2025

*Advised by Prof. Irene Chen*

*Berkeley, CA*

- Designed zero-shot LLM pseudo-label pipeline to improve semi-supervised learning accuracy
- Investigated LLM agents for image labeling such as CLIP and VIT, showed results on CIFAR-100
- Worked on RadQA dataset; implemented FixMatch and a new method on a non-inference task for comparison

## JLK Group

Feb. 2024 - May 2024

*Research Intern, advised by Dr. Wi-Sun Ryu*

*Seoul, South Korea*

- Developed Federated Learning models reaching near identical performance to commercially deployed U-Net models
- Collaborated with four M.D. professionals to investigate the use of Federated Learning in medicine

## [Security & Safety]

## Runtime Verification for Safety-Critical Systems

Sep. 2025 - Current

*EECS249B(Cyber-Physical Systems) Final Project, advised by Prof. Pierluigi Nuzzo*

- Investigated distribution-free probabilistic guarantees in stochastic environments for contract-based design
- Applied Scenario Optimization (SO) to a simple autonomous vehicle example for static and runtime verification

## University of Florida REU

May 2025 - Aug. 2025

*Advised by Prof. Sandip Ray*

*Gainesville, FL*

- Explored network-level bit flipping attacks on 5G Connected and Automated Vehicles (CAV)
- Verified feasibility of bit-flipping; proposed a keystream-based shuffling that drastically lowers attack success rate
- Simulated CAV in OpenAirInterface (OAI) and proposed an error correction based defense

## Keimyung University

Feb. 2023 - Jul. 2024

*Advised by Prof. Sejin Park*

*Daegu, South Korea*

- Proposed a randomized masking Federated Learning algorithm as an obfuscation against Deep Leakage for images
- Designed experiments to compare performance-privacy trade-offs amongst SOTA defense algorithms

## TEACHING EXPERIENCE

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### CS70 Course Staff

Jan. 2026 - Current

*8-hour Undergraduate Student Instructor*

*Berkeley, CA*

- 4 hours of grading and 4 hours of discussion section assistance and OH for CS70 (Discrete Math and Probability)

### Computer Science Mentors

Aug. 2025 - Dec. 2025

*Junior Mentor*

*Berkeley, CA*

- Led a group of three undergrads in biweekly hour-long review sessions for CS70 (Discrete Math and Probability)

## PUBLICATIONS

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**J. Kim**, C. Duan, S. Ray. "Bit-Flipping Attack Exploration and Countermeasure in 5G Network." *MASS 2025*.

**J. Kim**, H. Lee, W. Ryu, et al. "In-Silo Federated Learning vs. Centralized Learning for Segmenting Ischemic Brain Lesions." *Intelligence-Based Medicine*.

**J. Kim**, S. Park. "Random Gradient Masking as a Defensive Measure to Deep Leakage in Federated Learning." *ArXiv*.

C. Duan, **J. Kim**, S. Ray. "Network-Level Bit-Flipping Attacks on CACC in 5G." *Submitted to VTC2026-Spring*.