JOON KIM

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RESEARCH INTERESTS

Theoretical Computer Science: randomized algorithms, Markov chain mixing times, dynamic graph algorithms

EDUCATION

University of California, Berkeley May 2027 (Expected)
B.S. Electrical Engineering & Computer Science, GPA: 4.00/4.00
Current: EECS191A (Quantum Computing I), CS294-314 (Forecasting)
TCS: CS270(Graduate Algorithms), CS294-180(Partition Functions, $\mathbf{A}^+$), CS194-198(Network Theory, $\mathbf{A}^+$), CS174(Randomized Algorithms), CS170(Algorithms, $\mathbf{A}^+$), CS177(Algorithmic Econ), CS294-284(CSP & PCP)
Applied/Computational: CS274(Comp. Geometry), CS294-268(Lean4), EECS249B(Cyber-Physical Systems), CS194-302(Comp. Immunology, $\mathbf{A}^+$), CS176(Comp. Biology), CS188(AI/RL), CS61C(Computer Architecture)

PUBLICATIONS

J. Kim, W. Lin, M. Low, P. Nuzzo. "Data-Driven Verification and Parameter Synthesis for Stochastic Signal Temporal Logic Specifications." *DATE2027*

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

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." *Preprint, ArXiv.*

EXPERIENCES & PROJECTS

MCMC Mixing Time 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]
· Writing up a proof of $T_{mix} \in e^{\Omega((m+n)mn)}$ by bounding the conductance of the flip graph for square lattices

Approximate Dynamic Matching Research Dec. 2025 - Current
Advised by Prof. Satish Rao *Berkeley, CA*

· Extending Multiplicative Auction by [ZH25] to fully dynamic matching; identified potential hardness via OMv
· Obtained a linear-time $(1/2 + \delta)$ vertex-update dynamic matching, resolving an open question in [LMSV22]

SCALE Lab Sep. 2025 - Current
EECS249B(Cyber-Physical Systems) Final Project, advised by Prof. Pierluigi Nuzzo *Berkeley, CA*

· Investigated distribution-free probabilistic guarantees in stochastic environments for contract-based design
· Studied Scenario Optimization (SO) and Conformal Prediction (CP) for statistical verification and synthesis
· Accepted to *DATE2027* on data-driven verification and synthesis methods for probabilistic contracts

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
· Experimenting with high-dimensional Stochastic VI (GMM, Dirichlet) and MCMC sampling (MCLMC, LAPS)

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

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 a Hill-function-modulated CTMC
· Delivered a 9-page report and 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

University of Florida REU May 2025 - Aug. 2025
Advised by Prof. Sandip Ray *Gainesville, FL*

· Explored network-level bit-flipping attack and defense on 5G Connected and Automated Vehicles (CAV)
· Proposed a keystream-based shuffling that drastically lowers attack success rate; internal poster presentation
· Accepted to *MASS25* for workshop presentation; extended work published at *VTC26-Spring*

Berkeley AI Research - C.H.E.N. Lab Jul. 2024 - Feb. 2025
Advised by Prof. Irene Chen *Berkeley, CA*

· Designed a zero-shot LLM pseudo-label pipeline to improve semi-supervised learning accuracy
· Investigated LLM agents for image labeling such as CLIP and VIT, and 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 commercial medical imaging models
· Collaborated with four M.D. professionals for medical and statistical analysis; accepted to *Intell.-Based Medicine*

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

ACADEMIC LEADERSHIP

Undergraduate TCS Reading Group Feb. 2026 - Aug. 2026
Organizer/Leader *Berkeley, CA*

· Organized a student-led TCS reading group of 5 people, studied randomized algorithms and applied probability
· Topics: Karger's MinCut, MaxCut algorithms, t-spanners, FPRAS, KVV Ranking, Dinic's algorithm, XOR basis

CS70 Course Staff Jan. 2026 - Aug. 2026
Undergraduate TA *Berkeley, CA*

· 24 hours of leading discussions, creating content, and supervising tests 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)