Kai Fung (Kelvin) Kan

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Positions and Education

University of California, Los Angeles **USA**

- Hedrick Assistant Adjunct Professor, Department of Mathematics 2024 - Present
  - Mentor: Prof. Stanley Osher

Emory University **USA**

- Postdoctoral Fellow, Department of Mathematics 2023 - 2024
  - Mentor: Prof. Lars Ruthotto
- Ph.D. in Mathematics 2018 - 2023
  - Advisors: Prof. Lars Ruthotto and Prof. James Nagy
- M.S. in Computer Science 2018 - 2023

Chinese University of Hong Kong **Hong Kong**

- M.Phil. in Mathematics 2016 - 2018
  - Advisor: Prof. Raymond Honfu Chan
- B.Sc. in Mathematics 2012 - 2016

Professional Experience

Postdoctoral Researcher

- Department of Mathematics, UCLA, USA July 2024 - Present
  - Led projects and carried out the majority of theoretical derivations, coding (PyTorch) and writing
  - Analyzed training stability, and proposed a new model with proven robustness guarantees
  - Improved performance and robustness of LLM and vision Transformer baselines
  - Produced two first-authored manuscripts, including one accepted at NeurIPS
- Department of Mathematics, Emory University, USA July 2023 - June 2024
  - Developed a modified Newton-Krylov method for log-sum-exp minimization
  - Implemented the method in MATLAB and proved its convergence

Applied Scientist Intern

- Amazon Web Services, USA May - Aug. 2022
  - Received full-time return offer
  - Designed a regime switching state-space model for time series analysis
  - Derived formulas for efficient inference and learning using particle filtering
  - Implemented the model in PyTorch
- Amazon Web Services, Germany June - Dec. 2021
  - Designed probabilistic forecasting/generative models using quantile functions
  - Contributed code to GluonTS (open-source Python package by Amazon) in PyTorch and MXNet
  - Derived analytical forms of training objectives, enabling faster and more accurate training
  - Proved non-quantile-crossing guarantees for multivariate models, ensuring practical reliability
  - Outperformed state-of-the-art models on key benchmarks
  - Results published in two AISTATS papers, including an oral presentation as first author

Research Assistant

- Department of Mathematics, Emory University, USA — Aug. 2018 - June 2023
  - Designed an inexact Newton method for large-scale optimization with proven convergence
  - Implemented a hybrid regularization scheme to avoid double descent for random feature models
  - Coded all methods in MATLAB
- Department of Computer Science, Wake Forest University, USA — June - July 2017
  - Designed and implemented a spectral-spatial hyperspectral image classification method in MATLAB

Research Interests

Machine Learning, Transformers, Generative Modeling, Time Series, Optimization, Inverse Problems

Publications & Preprints

[1] Y. Park, K. Kan, T. Flynn, Y. Huang, S. Yoo, S. Osher, and X. Luo, "Dynamical Implicit Neural Representations". (submitted to CVPR 2026)

[2] K. Kan, X. Li, B. Zhang, T. Sahai, S. Osher, K. Kumar and M. Katsoulakis "Stability of Transformers under Layer Normalization", *arXiv preprint* arXiv: 2510.09904.

[3] X. Li, K. Kan, D. Verma, K. Kumar, S. Osher, and J. Drgoňa "Zero-Shot Transferable Solution Method for Parametric Optimal Control Problems", *arXiv preprint* arXiv: 2509.18404. (accepted by American Control Conference 2025)

[4] K. Kan, X. Li, B. Zhang, T. Sahai, S. Osher, and M. Katsoulakis "Optimal Control for Transformer Architectures: Enhancing Generalization, Robustness and Efficiency", *arXiv preprint* arXiv: 2505.13499. (accepted by NeurIPS 2025). GitHub

[5] K. Kan, X. Li, and S. Osher "OT-Transformer: A Continuous-time Transformer Architecture with Optimal Transport Regularization", *arXiv preprint* arXiv: 2307.04871, (2025).

[6] K. Kan, J. Nagy, and L. Ruthotto "LSEMINK: A Modified Newton-Krylov Method for Log-Sum-Exp Minimization", *Electronic Transactions on Numerical Analysis*, 60 (2024), 618-635. GitHub

[7] K. Kan, F. Aubet, T. Januschowski, Y. Park, K. Benidis, L. Ruthotto, and J. Gasthaus, "Multivariate Quantile Function Forecaster", *International Conference on Artificial Intelligence and Statistics* (AISTATS 2022), 10603-10621. (Oral presentation, 44/1685=2.6% of submissions). GitHub

[8] Y. Park, D. Robinson, F. Aubet, K. Kan, J. Gasthaus, and Y. Wang, "Learning Quantile Functions without Quantile Crossing for Distribution-free Time Series Forecasting", *International Conference on Artificial Intelligence and Statistics* (AISTATS 2022), 8127-8150. GitHub

[9] K. Kan, J. Nagy, and L. Ruthotto, "Avoiding the double descent phenomenon of random feature models using hybrid regularization", *arXiv preprint* arXiv: 2012.06667, (2020). GitHub

[10] K. Kan, S. Wu Fung, and L. Ruthotto, "PNKH-B: a projected Newton-Krylov method for large-scale bound-constrained optimization", *SIAM Journal on Scientific Computing*, 43 (5), S704-S726. GitHub

[11] R. Chan, K. Kan, M. Nikolova, and R. Plemmons, "A two-stage method for spectral-spatial classification of hyperspectral images", *Journal of Mathematical Imaging and Vision*, 62 (2020), 790-807.

[12] R. Chan, K. Kan, and A. Ma, "Computation of implementation shortfall for algorithmic trading by sequence alignment", *The Journal of Financial Data Science*, 1 (2019), 88-97.

[13] R. Chan, K. Kan, and A. Ma, "An integer programming based strategy for Asian-style futures arbitrage over the settlement period", *Algorithmic Finance*, 7 (2018), 31-42.

[14] R. Chan, K. Kan, and A. Ma, "An upper bound for ex-post Sharpe ratio with application in performance measurement", *The Journal of Performance Measurement*, 22 (2017), 7-19.

Reviewing Experience

AAAI ('24, '25), AISTATS ('26), ICLR ('24, '25, '26), ICML ('23, '24, '25), NeurIPS ('22, '23, '24, '25)

Awards

Peter O'Donnell Jr. Postdoctoral Fellowship, UT Austin (Declined)	2024
Emory Graduate Student Research Award	2023
Postgraduate Fellowship, Emory	2018 - 2023
Chung Chi College Academic Creativity Award	2015
The Scholarship for Diligent and Thrifty Students	2012