

Nairen Cao

LLM Evaluation | Clustering | Scalable Algorithms

caonairen@sufe.edu.cn | nairenc.github.io | Google Scholar

Computer science Ph.D. and Associate Professor specializing in cost-aware LLM evaluation, clustering theory, and scalable graph algorithms; experience in experiment design, implementation, and student supervision.

Selected Research Experience

Cost-Aware LLM Evaluation2026

- Designed and implemented experiments for cost-aware LLM evaluation using Bayesian bandits; supervised students in running the experiments and comparing adaptive evaluation policies.
- Evaluated a Gittins-index policy combining posterior uncertainty, adaptive sampling, and a stopping rule; offline index precomputation supports efficient online decisions under unequal evaluation costs.
- On GSM8K, PIQA, and MMLU response matrices, the reported experiments often achieved near-zero simple regret at stopping with **about 1–10% of the exhaustive evaluation budget**; comparisons included Bayesian optimization and frequentist bandit baselines.

Recognition: ICML 2026 DEMO Workshop Spotlight; publication details on page 2.

Scalable Correlation Clustering2024–2026

- Main contributor to theory across **six papers** on correlation clustering: cluster linear programs, min-max and simultaneous-norm objectives, parallel algorithms, and dynamic updates.
- Joint results include a $(3 + \epsilon)$ min-max approximation in nearly linear time in positive edges and a $(1.485 + \epsilon)$ total-disagreement approximation with nearly linear dependence on vertices for fixed ϵ ; developed approaches for scalable computation.

Parallel and Distributed Graph Algorithms2019–2024

- Co-authored eight conference and journal publications on algorithms for exact and approximate shortest paths, directed hopsets, reachability, and I/O-efficient topological sorting, including graphs with negative edge weights.
- Joint exact shortest-path work achieved almost linear work and approximately square-root parallel depth for non-negative integer weights; negative-weight shortest-path research received a **2022 Outstanding Paper Award**.

Education

Ph.D., Computer Science, Georgetown University2016–2022

Advisors: Jeremy T. Fineman and Ophir Frieder

M.S., Software Engineering, Peking University2013–2016

B.Eng., Software Engineering, Sun Yat-sen University2009–2013

Professional Experience

Associate Professor, Shanghai University of Finance and EconomicsCurrent

Institute for Theoretical Computer Science, School of Computing and Artificial Intelligence

Faculty Fellow, NYU Tandon School of EngineeringSep. 2024 – Jun. 16, 2026

Postdoctoral Researcher, Boston CollegeSep. 2022 – Aug. 2024

Expertise and Recognition

Methods: Bayesian bandits, sequential decision-making, approximation algorithms, combinatorial optimization, graph clustering, parallel and distributed algorithms.

Outstanding Paper Awards: ACM Symposium on Parallelism in Algorithms and Architectures (SPAA 2023 and SPAA 2022).

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Selected Publications

Selected work in LLM evaluation, clustering, and scalable algorithms. Full list: nairenc.github.io/publication.html.

1. **Efficient Cost-Aware LLM Evaluation via Bayesian Bandit Gittins Indices**
Qian Xie, Yueli He, **Nairen Cao**
International Conference on Machine Learning (ICML 2026) Workshop on Decision-Making from Offline Datasets to Online Adaptation: Black-Box Optimization to Reinforcement Learning (DEMO), **Spotlight**
2. **Static to Dynamic Correlation Clustering**
Nairen Cao, Vincent Cohen-Addad, Euiwoong Lee, Shi Li, David Rasmussen Lolck, Alanthan Newman, Mikkel Thorup, Lukas Vogl, Shuyi Yan, Hanwen Zhang
International Colloquium on Automata, Languages, and Programming (ICALP 2026)
3. **Solving the Correlation Cluster LP in Sublinear Time**
Nairen Cao, Vincent Cohen-Addad, Euiwoong Lee, Shi Li, David Rasmussen Lolck, Alanthan Newman, Mikkel Thorup, Lukas Vogl, Shuyi Yan, Hanwen Zhang
ACM Symposium on Theory of Computing (STOC 2025)
4. **Min-Max Correlation Clustering via Neighborhood Similarity**
Nairen Cao, Steven Roche, Hsin-Hao Su
European Symposium on Algorithms (ESA 2025)
5. **Simultaneously Approximating All Norms for Massively Parallel Correlation Clustering**
Nairen Cao, Shi Li, Jia Ye
International Colloquium on Automata, Languages, and Programming (ICALP 2025)
6. **Understanding the Cluster LP for Correlation Clustering**
Nairen Cao, Vincent Cohen-Addad, Euiwoong Lee, Shi Li, Alanthan Newman, Lukas Vogl
ACM Symposium on Theory of Computing (STOC 2024)
7. **Breaking 3-Factor Approximation for Correlation Clustering in Polylogarithmic Rounds**
Nairen Cao, Shang-En Huang, Hsin-Hao Su
ACM-SIAM Symposium on Discrete Algorithms (SODA 2024)
8. **Parallel and Distributed Exact Single-Source Shortest Paths with Negative Edge Weights**
Vikrant Ashvinkumar, Aaron Bernstein, **Nairen Cao**, Christoph Grunau, Bernhard Haeupler, Yonggang Jiang, Danupon Nanongkai, Hsin-Hao Su
European Symposium on Algorithms (ESA 2024)
9. **Nearly Optimal Parallel Algorithms for Longest Increasing Subsequence**
Nairen Cao, Shang-En Huang, Hsin-Hao Su
ACM Symposium on Parallelism in Algorithms and Architectures (SPAA 2023), **Outstanding Paper Award**
10. **Parallel Exact Shortest Paths in Almost Linear Work and Square Root Depth**
Nairen Cao, Jeremy T. Fineman
ACM-SIAM Symposium on Discrete Algorithms (SODA 2023)
11. **Parallel Shortest Paths with Negative Edge Weights**
Nairen Cao, Jeremy T. Fineman, Katina Russell
ACM Symposium on Parallelism in Algorithms and Architectures (SPAA 2022), **Outstanding Paper Award**
12. **Efficient Construction of Directed Hopsets and Parallel Approximate Shortest Paths**
Nairen Cao, Jeremy T. Fineman, Katina Russell
ACM Symposium on Theory of Computing (STOC 2020)