BINGBING HU

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PROFILE

Theoretical Computer Science Ph.D. student with a B.A. in Mathematics, developing algorithms and data structures with rigorous performance guarantees. Research spans dynamic algorithms, approximation algorithms, string and graph problems, fine-grained complexity, as well as theoretical and empirical work on transformer quantization.

EDUCATION

University of California, San Diego — La Jolla, CA
Ph.D. in Computer Science and Engineering; Expected graduation 2029–2030 — *Sep. 2024 – Present*

Rice University — Houston, TX
Bachelor of Arts in Mathematics; GPA: 3.94/4.00 — *Aug. 2020 – May 2024*

EXPERIENCE

Max Planck Institute for Informatics — Saarbrücken, Germany
Research Intern — *May 2023 – Aug. 2023*
- Conducted research in learning-augmented algorithms for graph connectivity.

Rice University — Houston, TX
Undergraduate Research Assistant — *May 2022 – Aug. 2022*
- Optimized SeqScreen-Nano, a real-time bioinformatics pipeline for assigning taxonomic and pathogenic labels to long DNA sequences; reduced RAM usage and developed a Python module for assigning taxonomic labels from protein-reference alignments, using a combination of majority voting and a greedy weighted set-cover algorithm.

SELECTED RESEARCH

Tree Edit Distance Algorithms — Preprint
- Developed new near-linear-time approximation, sublinear-time, and dynamic algorithms for tree edit distance, a fundamental problem for comparing tree-structured data.
- Proved approximation guarantees and analyzed time–accuracy tradeoffs for large inputs.

Quantization for LLM Transformers — Ongoing
- Investigating vector-quantization schemes for transformers that approximately preserve post-softmax attention weights, with the goal of reducing memory use and computation.
- Designing and implementing Python/PyTorch experiments to compare quantization methods using attention-weight distortion, downstream model accuracy, runtime, and memory usage.

Graph Connectivity under Predicted Failures — ESA 2024
- Designed a dynamic data structure that quickly answers connectivity queries on graphs with predicted vertex failures.
- Proved the conditional optimality of its preprocessing and query times under standard fine-grained complexity conjectures.

Dynamic Problems and Fine-Grained Lower Bounds — ITCS 2026; ESA 2025
- Established conditional lower bounds for dynamic tree edit distance and related similarity measures.
- Studied non-Boolean variants of the online matrix–vector multiplication problem and established hardness results with implications for a broad range of dynamic problems.

SELECTED PUBLICATIONS

- **Bingbing Hu**, T. Kociumaka, J. Nogler, and B. Saha. "Tree Edit Distance: Near-Linear-Time Approximate, Sublinear, and Dynamic." *Preprint*.
- **Bingbing Hu**, J. Nogler, and B. Saha. "Hardness of Dynamic Tree Edit Distance and Friends." *ITCS 2026*.
- **Bingbing Hu** and A. Polak. "Non-Boolean OMv: One More Reason to Believe Lower Bounds for Dynamic Problems." *ESA 2025*.
- **Bingbing Hu**, E. Kosinas, and A. Polak. "Connectivity Oracles for Predictable Vertex Failures." *ESA 2024*.

TECHNICAL BACKGROUND

Programming: Python; prior experience with C/C++ and Java
Tools and frameworks: PyTorch, Git, LaTeX
Research expertise: Algorithm design and analysis, string and graph algorithms, data structures, dynamic and approximation algorithms, fine-grained complexity, transformer quantization and empirical evaluation
Relevant coursework: Probability Theory, Statistics, Linear Algebra, Advanced Algorithms, Real Analysis, Combinatorics