

Junsung Hwang

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Research Interests

Learning-augmented combinatorial optimization and spectral graph design, with a focus on maximizing algebraic connectivity (λ_2) under realistic constraints. I use convex optimization (SDP/SOCP, proximal/ADMM) and reinforcement learning to obtain theory-driven performance and stability guarantees and to build scalable, reproducible HPC workflows.

Education & Selected Coursework

Stony Brook University (SBU), Stony Brook, NY

Expected May 2026; 3-year acceleration

B.S. in Computer Science and Applied Mathematics & Statistics; Minor: Mathematics

- **GPA:** 3.89/4.00
- **Honors:** Four-Year Merit Scholarship; **Dean's List (all completed semesters)**
- **Selected Advanced Coursework** († graduate-level, * in progress):
 - **Optimization & HPC:** Linear Programming†*; Principles in Parallel Computing†; Numerical Analysis
 - **Mathematics Core:** Applied Real Analysis; Applied Complex Analysis; Probability & Statistics
 - **CS Theory:** Analysis of Algorithms; Theory of Computation; Computational Geometry*

Publications & Preprints (Legend: † equal contribution; * corresponding author)

- Hongbo Lu, **Junsung Hwang**†, Bernard Tenreiro†, Nabila Jaman Tripti, Darren Hamilton, Yuefan Deng*. *A New Broadcast Model for Several Network Topologies*. **The Journal of Supercomputing**
Status: under review (submitted May 2025); arXiv:2510.18058 (Oct 2025) [arXiv] [Code]
- **Junsung Hwang**. *Spectral Optimal Graph Construction via Reinforcement Learning*.
Status: in preparation; arXiv 2025 (planned) [Code]

Research Experience

Spectral Optimal Graph Construction via Reinforcement Learning (sole author; advisor: Ji Liu)

Dept. of Electrical & Computer Engineering, SBU

Jan 2025 – Present

Status: in preparation; arXiv 2025

- Designed a skeleton + residual policy with monotone λ_2 guardrails under cost/diameter constraints.
- Built an HPC pipeline to construct and iteratively augment high- λ_2 graphs for arbitrary (n, m), with automated constraint enforcement.
- Orchestrated large-scale batched search and checkpointed evaluation via Slurm job arrays in containerized environments.
- Improved λ_2 by 1–2% over strong baselines (e.g., SDP relaxation, ER, small-world) on graphs up to 1,024 nodes.

A New Broadcast Model for Several Network Topologies (co-author; advisor: Yuefan Deng)

Dept. of Applied Mathematics & Statistics, SBU

Aug 2024 – May 2025

Status: under review (submitted May 2025); arXiv:2510.18058 (Oct 2025)

- Designed and implemented the forward-potential selector and core scheduling/evaluation modules.
- Led experimentation (complexity analysis and ablations).
- Spearheaded controlled benchmarking on SeaWulf, demonstrating 20–47% speedups vs Greedy, Binary-Tree, and SRDA across diverse topologies.
- Drove reproducibility with an automated benchmarking pipeline (Slurm job arrays; Docker/Conda; GitHub Actions).

GraphEvo: Evolutionary Design of k-regular Graphs (independent research and open source)

Dept. of Computer Science, SBU

Aug 2024 – Dec 2024

- Implemented the first Master Regulatory Gene (MRG) crossover in C++/Python, improving λ_2 on Graph Golf benchmarks.
- Scaled evolutionary search to k-regular graphs with thousands of nodes using OpenMP and an MPI-based island model.
- Released a reproducible CLI and Python API with Docker/Conda and CI/CD (GitHub Actions).
[Code] [PyPI]

Contraction-based RL Topology Co-Design (CTGNN controller, solo project)

Dept. of Electrical & Computer Engineering, SBU

May 2025 – Present

- Proved invariance of the contraction metric $P(\beta_0)$ under admissible graph edits and derived a rank-2 Laplacian update theory.
- Built a contraction-based CTGNN controller with RL-driven topology co-design grounded in these invariants.
- Benchmarks and manuscript in preparation; technical note available.
[Technical Note]

Teaching Experience

Teaching Assistant

Dept. of Applied Mathematics & Statistics

Jan 2024 – Dec 2024

- **AMS 310 (Probability & Statistics, Fall 2024):** Organized review sessions; authored solution keys; graded assessments.
- **AMS 261 (Multivariable Calculus, Spring 2024):** Led weekly recitations and office hours; provided 1:1 and small-group tutoring; authored solution keys; graded assessments.

Skills

- **Programming:** C, C++, Python, Java
- **HPC & Systems:** MPI, OpenMP, Slurm (job arrays & profiling), Linux, Bash
- **Optimization & ML:** CVXPY (LP, SDP, SOCP), MOSEK; PyTorch, TensorFlow
- **Numerical packages and algorithms:** scikit-learn, NumPy, SciPy, SymPy, Lanczos, LOBPCG
- **Reproducibility & DevOps:** Docker, Conda; Git, GitHub Actions (CI/CD)
- **Documentation:** LaTeX

Outreach & Service

Volunteer, Refugee Outreach (Bayside, NY)

Sep 2023 – Jan 2024

- Led monthly English conversation classes; developed beginner curricula for refugee children and adults.
- Organized seasonal holiday events for 100+ participants; coordinated volunteers and logistics.