Siyi Yang

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Education

Mar. 2018 – Dec. 2021 **University of California, Los Angeles**, *Ph.D.*, Los Angeles, United States
Advisor: Lara Dolecek, Laboratory for Robust Information Systems
Thesis: Application-Driven Coding Techniques: From Cloud Storage to Quantum Communications

Sep. 2016 – Mar. 2018 **University of California, Los Angeles**, *M.S.*, Los Angeles, United States
Advisor: Lara Dolecek, Laboratory for Robust Information Systems
Thesis: Theoretical Bounds and Constructions of Codes in the Generalized Cayley Metric

Aug. 2012 – July. 2016 **Tsinghua University**, *B.S.*, Beijing, China
Advisor: Yuan Shen
Thesis: Theoretical Analysis on Information Coupling in Network Navigation

Experience

Vocational

Dec. 2021 – present **Duke University**, Postdoctoral Associate
Supervisor: Robert Calderbank
Research interests: quantum LDPC codes and fault-tolerant quantum computing

- Proposed an algebraic framework for spatially-coupled (SC) QLDPC codes, which possess the locality required for efficient implementation and decoding in quantum computing.
- Developed an optimization framework that efficiently enumerates and minimizes the number of cycles in a representative class of SC-QLDPC codes, specifically SC-hypergraph product codes, identified as the intersection of SC codes and lifted product codes.
- Demonstrated that low-memory SC codes can achieve both high threshold and high rate under BP decoding on depolarization channels.

Jun. 2020 – Sep. 2020 **Intel Corporation**, System on Chip Design Engineer
Manager: Ravi Motwani, **Mentor**: Santhosh Kumar
Project: optimization of non-binary LDPC codes for 3D-Xpoint and 3D-NAND memories

- Performed error profile analysis on non-binary LDPC codes used in 3D XPoint and 3D NAND memory technologies.
- Developed an algorithm that efficiently enumerates all absorbing sets of size 7 or smaller in quasi-cyclic non-binary LDPC codes for 3D XPoint and 3D NAND memories.
- Received recognition from my mentor with an Intel Spontaneous Award for independent work.

Publications

Manuscripts

Siyi Yang, Robert Calderbank, *Spatially-Coupled QLDPC Codes*, under review at Quantum Journal, available on https://arxiv.org/abs/2305.00137.

Siyi Yang, Murat Can Sarihan, Kai-Chi Chang, Shyam Venkatasubramanian, Chee Wei Wong and Lara Dolecek, *Efficient non-binary spatially-coupled error correction codes for high-dimensional quantum communication channels.*

Siyi Yang, Ahmed Hareedy, Robert Calderbank, and Lara Dolecek, *Hierarchical Hybrid Error Correction for Time-Sensitive Devices at the Edge*, available on https://arxiv.org/abs/2103.11046.

Journal Publications

Siyi Yang, Ahmed Hareedy, Robert Calderbank, and Lara Dolecek, *Breaking the Computational Bottleneck: Probabilistic Optimization of High-Memory Spatially-Coupled Codes*, IEEE Transactions on Information Theory, vol. 69, no. 2, pp. 886-909, Feb. 2023.

Siyi Yang, Ahmed Hareedy, Robert Calderbank, and Lara Dolecek, *Hierarchical coding for cloud storage: topology-adaptivity, scalability, and flexibility*, IEEE Transactions on Information Theory, vol. 68, no. 6, pp. 3657-3680, Jun. 2022.

Siyi Yang, Clayton Schoeny, and Lara Dolecek, *Theoretical Bounds and Constructions of Codes in the Generalized Cayley Metric*, IEEE Transactions on Information Theory, vol. 65, no. 8, pp. 4746-4763, Aug. 2019.

Shaoyuan Chen, Shan Zhong, **Siyi Yang**, and Xiaodong Wang, *A Multiantenna RFID Reader With Blind Adaptive Beamforming*, IEEE Internet of Things Journal, vol. 3, no. 6, pp. 986-996, Dec. 2016.

Conference Publications

Siyi Yang, Ahmed Hareedy, Shyam Venkatasubramanian, Robert Calderbank, and Lara Dolecek, *GRADE-AO: Towards Near-Optimal Spatially-Coupled Codes With High Memories*, in Proc. IEEE ISIT, Melbourne, Victoria, Australia, Jul. 2021, pp. 587-592.

Siyi Yang, Ahmed Hareedy, Robert Calderbank, and Lara Dolecek, *Topology-aware cooperative data protection in blockchain-based decentralized storage networks*, in Proc. IEEE ISIT, Los Angeles, CA, USA, Jun. 2020, pp. 622-627, **Runner-up for Memorable Paper Award at NVMW 2021**.

Siyi Yang, Ahmed Hareedy, Robert Calderbank, and Lara Dolecek, *Hierarchical coding to enable scalability and flexibility in heterogeneous cloud storage*, in Proc. IEEE GLOBECOM, Waikoloa, HI, USA, Dec. 2019, pp. 1-6.

Siyi Yang, Murat Can Sarihan, Kai-Chi Chang, Chee Wei Wong, and Lara Dolecek, *Efficient Information Reconciliation for Energy-Time Entanglement Quantum Key Distribution*, in Proc. IEEE Asilomar, Pacific Grove, CA, USA, Nov. 2019.

Siyi Yang, Clayton Schoeny, and Lara Dolecek, *Order-Optimal Permutation Codes in the Generalized Cayley Metric*, in Proc. IEEE ITW, Kaohsiung, Taiwan, Nov. 2017, **Runner up for Memorable Paper Award at NVMW 2018**.

Presentations

Feb. 2024 *Spatially-Coupled QLDPC Codes*, Information Theory and Applications Workshop (ITA 2024).

Jan. 2024 *Spatially-Coupled QLDPC Codes*, Joint Mathematics Meetings (JMM 2024).

Sep. 2023 *Spatially-Coupled QLDPC Codes*, Algebraic Coding and Cryptography Seminar Series (ACCESS).

Jul. 2021 *GRADE-AO: Towards Near-Optimal Spatially-Coupled Codes With High Memories*, IEEE Symposium on Information Theory (ISIT).

Mar. 2021 *Topology-aware cooperative data protection in blockchain-based decentralized storage networks*, oral presentation (runner up for memorable paper award) in the 11th Annual Non-Volatile Memories Workshop (NVMW).

Jun. 2020 *Topology-aware cooperative data protection in blockchain-based decentralized storage networks*, IEEE Symposium on Information Theory (ISIT).

Dec. 2019 *Hierarchical Coding to Enable Scalability and Flexibility in Heterogeneous Cloud Storage*, IEEE Global Communications Conference (GLOBECOM).

Nov. 2019 *Efficient Information Reconciliation for Energy-Time Entanglement Quantum Key Distribution*, poster presentation in the 53nd Asilomar Conference on Signals, Systems and Computers.

Mar. 2019 *Multi-level Access and Information Leakage in Scalable Cloud Storage*, oral presentation in the 10th Annual Non-Volatile Memories Workshop (NVMW).

Mar. 2018 *Order-Optimal Permutation Codes in the Generalized Cayley Metric*, oral presentation (runner up for memorable paper award) in the 9th Annual Non-Volatile Memories Workshop (NVMW).

Nov. 2017 *Order-Optimal Permutation Codes in the Generalized Cayley Metric*, oral presentation in Information Theory Workshop (ITW).

Honors and Awards

Awards

2021 UCLA Dissertation Year Fellowship

2016-2017 Departmental Fellowship, Electrical Engineering, UCLA

2012 Silver Medal in the 27th Chinese Mathematical Olympiad, Xi'an, China

2011 2nd place in the 10th Chinese Girls' Mathematical Olympiad, Shenzhen, China

2010 1st place in the 9th Chinese Girls' Mathematical Olympiad, Hebei, China

Runner-up Recognitions

2021 Runner-up for Memorable Paper Award at NVMW 2021

2020 Qualcomm Innovation Fellowship Finalist

2018 Runner-up for Memorable Paper Award at NVMW 2018

Professional Services

Reviewer for IEEE Transactions on Information Theory, IEEE Transactions on Communications, Quantum Journal, Quantum Information and Computation

Reviewer for ISITA, ITW, ISIT, Globecom

Teaching

Instructor

Fall 2023 ECE 590, Duke University, joint teaching with Prof. Robert Calderbank, Graph-Based Codes: from Classical to Quantum

Teaching Assistant

Summer 2021 ENG 116, UCLA, Statistics for Management Decisions

Fall 2019 ECE 131A, UCLA, Probability and Statistics

Summer 2019 ENG 116, UCLA, Statistics for Management Decisions

Fall 2018 ECE 131A, UCLA, Probability and Statistics

Winter 2018 ECE 205A, UCLA, Matrix Analysis for Scientists and Engineers

Outreach

Summer 2019 Los Angeles Computing Circle (LACC), Instructor of Graph Theory and Social Network Section

Summer 2018 Los Angeles Computing Circle (LACC), Instructor of Graph Theory and Social Network Section

Skills

C++ **Advanced**, *used in research projects for software development and simulations on computing clusters for LDPC/QLDPC constructions and decoders*

MATLAB **Advanced**, *utilized in research projects for generating simulation plots and performing error profile analysis of LDPC decoders*

Python **Proficient**, *self-learned; used for implementing LDPC decoders and density evolution for teaching purposes*