Linfang Wang

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University of California, Los Angeles

EDUCATION

Ph.D. student in Electronic and Computer Engineering, **UCLA**, GPA: 3.914/4 Present
M.S. in Communication Engineering, **Harbin Institute of Technology,** GPA**:** 3.89/4 Sept. 2018
B.S. in Communication Engineering, **Harbin Institute of Technology**, GPA:3.86/4 Sept. 2016

SKILLS

Language Skills: C++, MATLAB, Python and Bash language.

Professional Skills: information theory, communication theory and coding theory (low-density parity-check code, trellis code), deep neural network learning.

INTERNSHIP EXPERIENCE

Student Intern at Samsung
Director: Rekha Pitchumani June.2020-Sept.2020

- Used C++ to simulate Frame Error Rate of Reconstruction-Computation-Quantization (RCQ) decoder with layered decoding for high-rate LDPC code.
- Modified RCQ decoder and propose Layered-RCQ (L-RCQ) decoder with better throughput.
- Filed a patent on L-RCQ decoder.
- Submitted a paper on L-RCQ decoder to IEEE transactions on communication.

Student Intern at SK Hynix
Director: Fan Zhang June.2019-Sept.2019

- Used Matlab to build Minsum-Information-Optimum Decoder, a finite alphabet size LDPC decoder.
- Used C++ to simulate Frame Error Rate Minsum-Information-Optimum Decoder under Binary Symmetric Channel and compare it with Belief Propagation and MinSum Decoder.

RESEARCH&PROJECT EXPERIENCE

Efficient Transmission System Design for short block-length
Advisor: Richard Wesel Dec.2019-Present

- Used Dynamic Blahut-Arimoto (DAB) to identify the optimal distribution for a discrete input under power- or amplitude-constrained additive white noise channel.
- Proposed a transmission system that applies probabilistic amplitude shaping (PAS) to a cyclic redundancy check (CRC) aided trellis-coded modulation (TCM) to achieve the short-block-length random coding union (RCU) bound.

Neural Network Aided LDPC Decoder
Advisor: Richard Wesel Dec.2020-Present

- Used C++ to build neural network to train the weights of neural normalized MinSum (N-NMS) decoder for LDPC code with long block length.

- Developed different weight sharing schemes for N-NMS decoder.
- Worked with FPGA team of UCLA Communication System Laboratory (CSL) to build a decoder prototype.

Low Bit-with, High throughput RCQ LDPC Decoder
Advisor: Richard Wesel Sept.2018-Sept.2021

- Used density evolution and mutual-information-maximized quantization technique to build Reconstruction-Computation-Quantization (RCQ) decoder for LDPC code.
- Used C++ to simulate Frame Error Rate of RCQ Decoder under Additive White Gaussian Noise Channel and compare it with other types of decoders.
- Worked with FPGA team of UCLA Communication System Laboratory (CSL) to build a decoder prototype.

Low Bit-with, High throughput Information-Optimum LDPC Decoder
Advisor: Richard Wesel Sept.2018-Sept.2019

- Used MATLAB to build a finite alphabet size LDPC decoder, which is called *Information Optimum Decoder*, for regular LDPC code and irregular LDPC code.
- Used MATLAB to estimate the thresholds of LDPC code using discrete density evolution.
- Used MATLAB and C++ to realize a machine-learning-based quantization algorithm.
- Used C++ to simulate Frame Error Rate of Information Optimum Decoder under Additive White Gaussian Noise Channel and compare it with Belief Propagation and MinSum Decoder.

ZTE Project on 5G Communication System
Advisor: Min Jia July.2017

- Used MATLAB to simulate frame error rate curve of uncoded Sparse Code Multiple Access (SCMA) under Additive White Gaussian Noise Channel.
- Used MATLAB to simulate throughput curves of various MAC protocols suitable for satellite-ground links and inter-satellite links.

PUBLICATIONS

1. **L. Wang**, C. Terrill, M. Stark, Z. Li, S. Chen, C. Hulse, C. Kuo, R. Wesel, G. Bauch, R. Pitchumani, "Reconstruction-Computation-Quantization (RCQ): A Paradigm for Low Bit Width LDPC Decoding," in IEEE Transactions on Communications, doi: 10.1109/TCOMM.2022.3149913.
2. J. Nguyen, **L. Wang**, C. Hulse, S. Dani, A. Antonini, T. Chauvin , D. Dariush, R. Wesel, Neural Normalized Min-Sum Message-Passing vs. Viterbi Decoding for the CCSDS Line Product Code." IEEE 2022 International Conference on Communications (ICC), Seoul, South Korea, May 16−20, 2022.
3. **L. Wang**, S. Dan, F. Areces, and R. D. Wesel. "Achieving Short-Blocklength RCU bound via CRC List Decoding of TCM with Probabilistic Shaping." IEEE International Conference on Communications (ICC), Seoul, South Korea, May 16−20, 2022.
4. **L. Wang**, S. Chen, J. Nguyen, D. Dariush, and R. Wesel, "Neural-Network-Optimized Degree-Specific Weights for LDPC MinSum Decoding", 2021 IEEE 11th International Symposium on Topics in Coding (ISTC), pp. 1-5, Aug.30 − Sept. 3, virtual conference, 2021.
5. Terrill, C., **L. Wang**, S. Chen, C. Hulse, C. Kuo, R. Wesel, and D. Divsalar, "FPGA Implementations of Layered MinSum LDPC Decoders Using RCQ Message Passing", 2021 IEEE Global Communications Conference (GLOBECOM), pp 1-6, Madrid,

Spain, Dec. 7-11, 2021.

6. J. Nguyen, E. Liang, **L. Wang**, T. Drullinger, T. Chauvin, and R. D. Wesel, "Comparison of Integrated and Independent RF/FSO Transceivers on a Fading Optical Channel", 2020 Asilomar Conference on Signals, Systems, and Computers, pp. 699-701, Pacific Grove, CA, USA, Nov. 1-5, 2020.
7. D. Xiao, L. **Wang**, D. Song, and R. D. Wesel, "Finite-Support Capacity-Approaching Distributions for AWGN Channels", 2020 IEEE Information Theory Workshop (ITW), pp. 1-5, virtual conference, April 11-15, 2021.
8. **L. Wang**, R. D. Wesel, M. Stark, and G. Bauch, "A Reconstruction-Computation-Quantization (RCQ) Approach to Node Operations in LDPC Decoding", 2020 IEEE Global Communications Conference (GLOBECOM), pp. 1-6，Taipei, TaiwanDec. 8−10, 2020.
9. M. Stark, **L. Wang**, G. Bauch, and R. D. Wesel, (2020). "Decoding Rate-Compatible 5G-LDPC Codes with Coarse Quantization Using the Information Bottleneck Method", IEEE Open Journal of the Communications Society, vol. 1, pp. 646-660, 2020.
10. H. Yang, **L. Wang**, V. Lau, and R. D. Wesel, "An Efficient Algorithm for Designing Optimal CRCs for Tail-Biting Convolutional Codes", 2020 IEEE International Symposium on Information Theory (ISIT), pp. 292-297, Los Angeles, USA, Jun. 22-26, 2020.
11. M. Stark, **L. Wang**, G. Bauch, and R. D. Wesel, "Information bottleneck decoding of rate-compatible 5G-LDPC codes", 2020 IEEE International Conference on Communications (ICC), pp. 1-6, virtual conference, June 7-11, 2020.
12. M. Jia, **L. Wang**, Q. Guo, X. Gu, and W. Xiang, "A Low Complexity Detection Algorithm for Fixed Up-Link SCMA System in Mission Critical Scenario", IEEE Internet of Things Journal, vol. 5, no. 5, pp. 3289-3297, Oct. 2018, doi: 10.1109/JIOT.2017.2696028.
13. M. Jia, S. Zhu, **L. Wang**, Q. Guo, H. Wang, and Z. Liu, "Routing algorithm with virtual topology toward to huge numbers of LEO mobile satellite network based on SDN", Mobile Networks and Applications, 23(2), pp. 285-300, 2018.
14. M. Jia, **L. Wang**, Z. Yin, Q. Guo, and X. Gu, "A Novel Spread Slotted ALOHA Based on Cognitive radio for Satellite Communications System", EURASIP Journal on Wireless Communications and Networking, J. Wireless Com. Network 2016, 232 (2016).

Conference Presentations

- Oral presentation (virtual), "*A Reconstruction-Computation-Quantization (RCQ) Approach to Node Operations in LDPC Decoding*", IEEE Globecom, Dec. 8−10, 2020, Taipei, Taiwan.
- Poster presentation (virtual), "*Neural-Network-Optimized Degree-Specific Weights for LDPC MinSum Decoding*", IEEE 11th International Symposium on Topics in Coding (ISTC), Aug.30 − Sept. 3, 2020, virtual conference.
- (planned) Oral presentation (virtual), "*Achieving Short-Blocklength RCU bound via CRC List Decoding of TCM with Probabilistic Shaping*", IEEE International Conference on Communications (ICC), May 16−20, 2022, Seoul, South Korea.

Public Service

- Reviewer for 2021 International Symposium on Information Theory (ISIT).
- Reviewer for Physical Communication.
- Reviewer for IEEE Cognitive Communications and Networking (TCCN).

Teaching

- Teaching assistant, 2020 Fall ECE 131A, Probability and Statistics.
- Teaching assistant, 2021 Fall ECE 131A, Probability and Statistics.

HONORS& AWARDS

- Won **Second Scholarship** of Harbin Institute of Technology in March 2012.
- Won **First Scholarship** of Harbin Institute of Technology five separate times: September 2012; March 2013; September 2013; March 2014; September 2014.
- Won **First Graduate Scholarship** of Harbin Institute of Technology in September 2016 and September 2017.
- Won **National Scholarship** of Harbin Institute of Technology in October 2017.