Nadim Ghaddar

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Research Interests

Information Theory, Coding Theory, Wireless Communication, Signal Processing

Employment

April 2025 – Present
Postdoctoral Research Fellow, *Department of Electrical and Computer Engineering, University of British Columbia*, Vancouver, BC, Canada.
Host: Prof. Lele Wang

October 2023 – March 2025
Postdoctoral Research Fellow, *Department of Electrical and Computer Engineering, University of Toronto*, Toronto, ON, Canada.
Host: Prof. Wei Yu

Education

2016 – 2022
Ph.D. in Electrical Engineering (Communication Theory and Systems), *University of California San Diego (UCSD)*, San Diego, CA, USA.
Thesis: Channel Coding Techniques for Communication over Networks and over Channels with Memory
Advisor: Prof. Young-Han Kim, Co-advisor: Prof. Laurence B. Milstein

2014 – 2016
M.Sc. in Communication Systems, *École Polytechnique Fédérale de Lausanne (EPFL)*, Lausanne, Switzerland.
Thesis: Connectionist Temporal Classification for Robust Speech Recognition Applications
Advisors: Prof. Hervé Bourlard (EPFL) and Dr. Wilhelm Hagg (SONY Europe, Germany)

2010 – 2014
B.E. in Computer and Communication Engineering, *American University of Beirut (AUB)*, Beirut, Lebanon.
Minor in Mathematics. Graduated with Distinction.

Publications

* denotes equal contribution

Submitted / Preprints

(S1) Z. Wang, <u>N. Ghaddar</u>, B. Zhu and L. Wang, "Noisy Computing of the Threshold Function", 2024. [Online]. Available: `https://arxiv.org/abs/2403.07227`

(S2) <u>N. Ghaddar</u> and W. Yu, "Active Uplink Sensing Beamformer Design via Bayesian Cramér-Rao Bound Dual Optimization", accepted for publication in the *Proceedings of the IEEE International Conference on Communications (ICC)*, Montreal, Canada, June 2025.

(S3) <u>N. Ghaddar</u>, L. Wang and W. Yu, "Angle-of-Arrival Estimation in Large-Scale MIMO Systems Using Channel Codes", accepted for publication in the *Proceedings of the IEEE International Symposium on Information Theory (ISIT)*, Ann Arbor, MI, USA, June 2025.

Journal Papers

(J1) <u>N. Ghaddar</u> and L. Wang, "Low-Complexity Coding Techniques for Cloud Radio Access Networks", in *IEEE Journal on Selected Areas in Information Theory*, vol. 5, pp. 572-584, 2024.

(J2) Z. Wang, <u>N. Ghaddar</u>, B. Zhu and L. Wang, "Noisy Sorting Capacity", in *IEEE Transactions on Information Theory*, vol. 70, no. 9, pp. 6121-6138, 2024.

(J3) B. Zhu*, Z. Wang*, <u>N. Ghaddar</u>*, J. Jiao and L. Wang, "Noisy Computing of the OR and MAX Functions", in *IEEE Journal on Selected Areas in Information Theory*, vol. 5, pp. 302-313, 2024.

(J4) <u>N. Ghaddar</u>, S. Ganguly, L. Wang and Y.-H. Kim, "A Lego-Brick Approach to Coding for Network Communication," in *IEEE Transactions on Information Theory*, vol. 70, no. 2, pp. 865-903, Feb. 2024.

(J5) <u>N. Ghaddar</u>, Y.-H. Kim, L. B. Milstein, L. Ma and B. K. Yi, "Joint channel estimation and coding over channels with memory using polar codes," in *IEEE Transactions on Communications*, vol. 69, no. 10, pp. 6575-6589, Oct. 2021.

Conference Papers

(C1) Z. Wang, <u>N. Ghaddar</u>, B. Zhu and L. Wang, "Variable-Length Insertion-Based Noisy Sorting," in *2023 IEEE International Symposium on Information Theory (ISIT)*, pp. 1782–1787, 2023.

(C2) B. Zhu, Z. Wang, <u>N. Ghaddar</u>, J. Jiao and L. Wang, "On the Optimal Bounds for Noisy Computing," in *2023 IEEE International Symposium on Information Theory (ISIT)*, pp. 1788–1793, 2023.

(C3) Z. Wang, <u>N. Ghaddar</u>, and L. Wang, "Noisy sorting capacity," in *2022 IEEE International Symposium on Information Theory (ISIT)*, pp. 2541–2546, 2022.

(C4) <u>N. Ghaddar</u>, S. Ganguly, L. Wang and Y.-H. Kim, "A Lego-brick approach to lossy source coding," in *2022 17th Canadian Workshop on Information Theory (CWIT)*, pp. 45–50, 2022.

(C5) <u>N. Ghaddar</u>, S. Ganguly, L. Wang and Y.-H. Kim, "A Lego-brick approach to coding for asymmetric channels and channels with state," in *2021 IEEE International Symposium on Information Theory (ISIT)*, pp. 1367–1372, 2021.

(C6) <u>N. Ghaddar</u>, H. Saber, H.-P. Lin, J. H. Bae and J. Lee, "Simplified decoding of polar codes by identifying Reed-Muller constituent codes," in *2020 IEEE Global Communications Conference (GLOBECOM)*, pp. 1–6, 2020.

(C7) <u>N. Ghaddar</u>, Y.-H. Kim, L. B. Milstein, L. Ma and B. K. Yi, "Joint channel estimation and error correction for finite-state markov channels using polar codes," in *2018 IEEE Global Communications Conference (GLOBECOM)*, pp. 1–6, 2018.

(C8) A. Bhatt*, <u>N. Ghaddar</u>*, and L. Wang, "Polar coding for multiple descriptions using monotone chain rules," in *2017 55th Annual Allerton Conference on Communication, Control, and Computing (Allerton)*, pp. 565-571, Oct 2017.

Patents

(P1) <u>N. Ghaddar</u>, H. Saber, H.-P. Lin, J. H. Bae, and J. Lee, "System and method for identifying and decoding Reed-Muller codes in polar codes," U.S. Patent 11271596, Mar. 8, 2022.

Internships

Summer 2021   **Intern**, *Qualcomm Inc.*, Bridgewater, NJ, USA.
Worked on deep learning methods for decoding linear codes.

Summer 2019	**Intern**, *Samsung Semiconductor Inc.*, San Diego, CA, USA. Worked on the design of a simplified successive cancellation list decoder of polar codes.
Feb. 2016 – Sept. 2016	**Intern**, *SONY Europe*, Stuttgart, Germany. Worked on the design of noise-robust speech recognition systems using connectionist temporal classification (CTC)
Summer 2015	**Intern**, *OnYourMap*, Solution provider for location-based services, Préverenges, Switzerland. Worked on the design and implementation of an RF fingerprinting scheme that uses WiFi for indoor positioning on Android platforms.
Summer 2013	**Intern**, *TELUS*, Wireless and Internet service provider, Edmonton, Canada. Worked on the development of three applications on TELUS IPTV using Microsoft Mediaroom.

Teaching Experience

- **Course Instructor:**

Fall 2024	*Matrix Algebra and Optimization*, University of Toronto

- **Teaching Assistant:**

Fall 2022	*Topics in Coding Theory*, UCSD
Winter 2020	*Introduction to Data Processing and Information Theory*, UCSD
Fall 2018	*Linear Algebra and Applications*, UCSD
Spring 2018	*Random Processes*, UCSD
Fall 2013	*Introduction to Programming*, AUB

Invited Talks

(T1) "Noisy Computing of the Threshold Function", Remarkable 2025 Event at Vector Institute, Toronto, Canada, March 2025.

(T2) "Noisy Computing of the OR and MAX Functions", Banff International Research Station (BIRS) for Mathematical Innovation and Discovery, Banff, Canada, March 2024.

(T3) "A Lego-Brick Approach to Lossy Source Coding", Information Theory and Applications Workshop (ITA), Graduation-Day talk, UCSD, May 2022.

(T4) "Noisy Sorting Capacity", 56th Annual Conference on Information Sciences and Systems (CISS), Princeton University, March 2022.

Reviewing Activities

IEEE Transactions on Information Theory, IEEE Transactions on Communications, IEEE Journal on Selected Areas in Information Theory, IEEE Transactions on Wireless Communications, IEEE Transactions on Vehicular Technology, IEEE Transactions on Cognitive Communications and Networking, APSIPA Transactions on Signal and Information Processing, IEEE International Symposium on Information Theory (ISIT), IEEE Information Theory Workshop (ITW), International Symposium on Topics in Coding (ISTC), ACM-SIAM Symposium on Discrete Algorithms (SODA), IEEE Communications Letters, Digital Signal Processing.

Relevant Projects

Fall 2015 – 2016	**Semester Project**, *EPFL*, under supervision of Prof. Emre Telatar and PhD candidate Mr. Mani Bastani Parizi. On the pairwise correlation between the synthetic bit-channels from the polar transformation and the tightness of the union bound on the block error probability of polar codes.

Spring 2015	**Semester Project**, *EPFL*, under supervision of Prof. Rüdiger Urbanke and PhD candidate Mr. Marco Mondelli.
	Extremes of information combining for channels with constant Bhattacharyya parameters.
Sept. 2013 – June 2014	**Final Year Project**, *AUB*, under supervision of Prof. Ayman Kayssi.
	Design and implementation of a GPS signal generator/spoofer using USRP 2920, a radio programmable platform from National Instruments.
Fall 2013 – 2014	**Course Project – Internet Engineering**, *AUB*.
	Paper on performance analysis of an interworking architecture between current Internet and Name-Oriented Networks.
Fall 2013 – 2014	**Course Project – Wireless Communications**, *AUB*.
	Design of a system level simulator for dimensioning LTE systems under fading conditions.

Honors and Awards

Fall 2016	Recipient of ECE Departmental Fellowship, UCSD
Fall 2016	Recipient of IC Faculty Fellowship, EPFL
2010-2014	Recipient of a 4-year Merit scholarship, AUB

Computer Skills

Languages	Advanced user of Matlab, Python, C and C++ programming, Very good in Java and Android programming, Good skills in SQL, Basic user of assembly and VHDL
Platforms	Advanced user of Microsoft OS, OS using linux kernel and Microsoft Office
Machine Learning Tools	Tensorflow, PyTorch, Lasagne, Kaldi Speech Recognition Toolkit

Affiliations

2016 – Present	Member of IEEE Communication Society and IEEE Information Theory Society
2017 – 2018	Member of the ECE Graduate Student Council (ECE-GSC) at UCSD
2017 – 2018	Session co-chair at the Information Theory and Application (ITA) Workshop at UCSD