510-80 Mill St
Toronto, ON M5A 4T3, Canada
Mobile (437) 858-3791
nadim.ghaddar@utoronto.ca
https://nadimgh.github.io/

Nadim Ghaddar

Research Interests

Information Theory, Coding Theory, Wireless Communication, Signal Processing

Employment

2023 – Present **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.

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.

Publications

* `denotes equal contribution`

Submitted / Preprints

(S1) Z. Wang, N. Ghaddar, B. Zhu and L. Wang, "Noisy Sorting Capacity," submitted to *IEEE Transactions on Information Theory*, 2023. [Online]. Available: `https://arxiv.org/abs/2202.01446`

(S2) B. Zhu*, Z. Wang*, N. Ghaddar*, J. Jiao and L. Wang, "Noisy Computing of the OR and MAX Functions," to be submitted to *IEEE Transactions on Information Theory*, 2023. [Online]. Available: `https://arxiv.org/abs/2309.03986`

Journal Papers

(J1) N. Ghaddar, S. Ganguly, L. Wang and Y.-H. Kim, "A Lego-Brick Approach to Coding for Network Communication," accepted in *IEEE Transactions on Information Theory*, doi: 10.1109/TIT.2023.3323839, Oct. 2023.

(J2) N. Ghaddar, 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, N. Ghaddar, 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, N. Ghaddar, 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, N. Ghaddar, and L. Wang, "Noisy sorting capacity," in *2022 IEEE International Symposium on Information Theory (ISIT)*, pp. 2541–2546, 2022.

(C4) N. Ghaddar, 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) N. Ghaddar, 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) N. Ghaddar, 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) N. Ghaddar, 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*, N. Ghaddar*, 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) N. Ghaddar, 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.

Invited Talks

(T1) "A Lego-Brick Approach to Lossy Source Coding", Information Theory and Applications Workshop (ITA), Graduation-Day talk, UCSD, May 2022.

(T2) "Noisy Sorting Capacity", 56th Annual Conference on Information Sciences and Systems (CISS), Princeton University, March 2022.

Teaching Assistantship Experience

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

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