Alexandra Gallyas-Sanhueza

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Research Interests

● signal processing ● wireless communication systems ● algorithms ● statistics and optimization ●

I am a Ph.D. candidate at Cornell University, expecting to graduate in December 2023. I work on baseband algorithms for beyond 5G multi-antenna wireless communication systems. More broadly, I am interested in applying statistical signal processing techniques to model signals that are corrupted by noise and hardware impairments, and exploiting such models in order to design computationally-efficient algorithms that estimate the signals of interest.

Education

2018 – Present: **Ph.D. student, Electrical and Computer Engineering**. *Cornell University*. Ithaca, NY.
Baseband algorithms for terahertz communication systems. Advisor: Prof. Christoph Studer.
2018 – 2021: **Master of Science, Electrical and Computer Engineering**. *Cornell University*. Ithaca, NY.
2009 – 2015: **Electrical Engineering**. *Pontificia Universidad Católica de Chile*. Santiago, Chile.
$5^{1}/_{2}$ years program. Maximum Distinction. GPA: A+. Ranking: 39 among 607 students (Top 6.5%).

Fellowships, Honors, and Awards

2023: Postdoctoral Recruitment Initiative in Sciences and Medicine (PRISM), Stanford University.
2022-2023: NextGen Professors Program, Cornell University.
2019: U.S. Winner, Qualcomm Innovation Fellowship [8].
2019: Travel Grant, IEEE International Workshop on Signal Processing Advances for Wireless Communications [9].
2015: Maximum Distinction in Electrical Engineering, Pontificia Universidad Católica de Chile.
2015: Top 10% in the Bachelor's Degree Exam, Pontificia Universidad Católica de Chile.
2013-2014: Undergraduate Research Scholarship, Pontificia Universidad Católica de Chile [10].

Work Experience

May 2022 – Aug 2022: **Hybrid Cloud Hardware Engineer Intern**. *IBM Research*. Yorktown Heights, NY.
May 2021 – Aug 2021: **Advanced Algorithms Research Intern**. *Analog Devices*. Boston, MA.
Feb 2017 – Aug 2018: **Visiting scientist**. *Wilson Synchrotron Laboratory, Cornell University*. Ithaca, NY.
Designed mixed-signals and digital printed circuit boards, and programmed FPGA for particle accelerator instrumentation. Maintained and repaired the beam position monitoring system at the Cornell Electron Storage Ring.
Jun 2016 – Oct 2016: **Printed circuit board design**. *Freelance Part-Time Job for CorSolutions LLC*. Ithaca, NY.
Designed and assembled a printed circuit board for sensing and controlling fluid delivery.

Undergraduate Research

Oct 2015 – Dec 2015: **ATLAS upgrade**. *Pontificia Universidad Católica de Chile*. Santiago, Chile.
Tested readout electronics for scintillation muon detectors to be used in ATLAS, the biggest detector of the Large Hadron Collider (LHC). Designed and assembled an interfacing printed circuit board. Trained lab staff in FPGA programming.
Mar 2015 – May 2015: **ATLAS upgrade**. *Universidad Técnica Federico Santa María*. Valparaíso, Chile.
Wired and calibrated an array of 120 muon detectors. Soldered PCBs. Programmed an FPGA to process the detector's data.
Aug 2013 – June 2015: **Analog ASIC design [10]**. *Pontificia Universidad Católica de Chile*. Santiago, Chile.
Implemented a voltage reference and a temperature sensor in an analog application specific integrated circuit (ASIC). Supported the team with Synopsys analog design tools. Characterized transistors using a semiconductor parameter analyzer.
Jan 2014 – Mar 2014: **International research internship program**. *Cornell University*. Ithaca, NY.
Designed a transimpedance amplifier for an optical receiver, with $3\,\mathrm{GHz}$ bandwidth, $5\,\mathrm{k\Omega}$ gain, $15\,\mathrm{mW}$ power consumption.

Teaching Assistantships (School of Engineering, Pontificia Universidad Católica de Chile)

Spring 2014: **Electrical Measurements Laboratory**. Introductory course to laboratory methods and use of equipment.

Fall 2012: **Electromagnetic Theory**. At the level of "Fundamentals of Engineering Electromagnetics" by Cheng (1998).

Fall 2012: **Signals and Systems**. At the level of "Signals and Systems" by Oppenheim et al. (1998).

Spring 2012: **Electricity and Magnetism**. At the level of "Physics" by Halliday & Resnick (2001).

Programming Languages

MATLAB, LaTeX, Python, Verilog.

Languages

English: Fluent.   **Spanish**: Native.   **German**: Basic.

Volunteering

Spring 2022: **COVID-19 vaccine outreach**. *Vaccination conversations with scientist (VaCS) program*. Cornell University, Ithaca, NY. Phone banking to answer questions about COVID-19 vaccines, and to tackle misinformation.

2019: **Bits over the air**. *CATALYST academy program*. Cornell University, Ithaca, NY. Assisted students from under-represented groups in building a wireless communication system, with the purpose of exposing them to a hands-on experience in engineering.

2019: **Electrical engineering workshop**. *Expanding Your Horizons (EYH) program*. Cornell University, Ithaca, NY. Helped 7th to 9th grade girls during an interactive workshop, to encourage them into mathematics and science majors.

2010: **High school physics teacher**. *Belén UC educational program*. Pontificia Universidad Católica de Chile, Santiago, Chile. Prepared low income students to be competitive in the national university admission system (PSU) in physics.

Mar 2010: **Post earthquake and tsunami response**. *TECHO*. Pichilemu, Chile. Helped building an emergency cabin.

Reviewer of Journal Papers

2022: IEEE Transactions on Very Large Scale Integration Systems, IEEE Transactions on Circuits and Systems II, IEEE Communication Letters.

2021: IEEE Transactions on Very Large Scale Integration Systems, IEEE Communication Letters.

2020: IEEE Transactions on Wireless Communications, Springer Journal of Signal Processing Systems, IEEE Open Journal of Circuits and Systems.

Reviewer of Conference Papers

2022: IEEE International Conference on Communications (ICC), IEEE Vehicular Technology Conference (VTC-Spring), IEEE International Workshop on Signal Processing Advances for Wireless Communications (SPAWC), IEEE International Symposium on Circuits and Systems (ISCAS).

2021: IEEE International Workshop on Signal Processing Systems (SiPS).

2020: IEEE International Workshop on Signal Processing Systems (SiPS), IEEE International Workshop on Signal Processing Advances for Wireless Communications (SPAWC).

Publications

[1] A. Gallyas-Sanhueza and C. Studer, "Low-complexity blind parameter estimation in wireless systems with noisy sparse signals," *IEEE Transactions on Wireless Communications*, Feb. 2023.

[2] Y. Dai, M. E. Rasekh, S. H. Mirfarshbafan, H. Liew, A. Gallyas-Sanhueza, J. Dunn, U. Madhow, C. Studer, and B. Nikolić, "An adaptable and scalable generator of distributed massive MIMO baseband processing systems," *Springer Journal of Signal Processing Systems*, May 2022.

[3] Y. Dai, H. Liew, M. E. Rasekh, S. H. Mirfarshbafan, A. Gallyas-Sanhueza, J. Dunn, U. Madhow, C. Studer, and B. Nikolić, "A scalable generator for massive MIMO baseband processing systems with beamspace channel estimation," *IEEE International Workshop on Signal Processing Systems (SiPS)*, Oct. 2021.

[4] E. Gönültaş*, S. Taner*, A. Gallyas-Sanhueza, S. H. Mirfarshbafan, and C. Studer, "Hardware-aware beamspace precoding for all-digital mmWave massive MU-MIMO," *IEEE Communications Letters*, Aug. 2021.

[5] A. Gallyas-Sanhueza and C. Studer, "Blind SNR estimation and nonparametric channel denoising in multi-antenna mmWave systems," *IEEE International Conference on Communications (ICC)*, Jun. 2021.

[6] S. H. Mirfarshbafan, A. Gallyas-Sanhueza, R. Ghods, and C. Studer, "Beamspace channel estimation for massive MIMO mmWave systems: Algorithm and VLSI design," *IEEE Transactions on Circuits and Systems I: Regular Papers (TCAS-I)*, Sep. 2020.

[7] A. Gallyas-Sanhueza, S. H. Mirfarshbafan, R. Ghods, and C. Studer, "Sparsity-adaptive beamspace channel estimation for 1-bit mmWave massive MIMO systems," *IEEE International Workshop on Signal Processing Advances in Wireless Communications (SPAWC)*, May 2020.

[8] O. Castañeda, M. Bobbett, A. Gallyas-Sanhueza, and C. Studer, "PPAC: A versatile in-memory accelerator for matrix-vector-product-like operations," *IEEE International Conference on Application-specific Systems, Architectures and Processors (ASAP)*, Jul. 2019.

[9] R. Ghods, A. Gallyas-Sanhueza, S. H. Mirfarshbafan, and C. Studer, "BEACHES: Beamspace channel estimation for multi-antenna mmWave systems and beyond," *IEEE International Workshop on Signal Processing Advances in Wireless Communications (SPAWC)*, Jul. 2019.

[10] C. Alessandri, D. Guzman, A. Abusleme, D. Avila, E. Alvarez, H. Campillo, A. Gallyas-Sanhueza, C. Oberli, and M. Guarini, "Theoretical framework and simulation results for implementing weighted multiple sampling in scientific CCDs," *Scientific Detectors Workshop*, Oct. 2013.

Patents

[11] C. Studer, R. Ghods, S. H. Mirfarshbafan, and A. Gallyas-Sanhueza, "Circuit and method for enabling channel denoising in a wireless communication apparatus," U.S. Patent 10 608 686, Mar. 2020.