Canan Cebeci

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Website | LinkedIn | Google Scholar

SUMMARY

Ph.D. candidate in Electrical and Computer Engineering at UC Santa Barbara specializing in signal processing and machine learning for next-generation communication systems. Focused on developing scalable signal processing architectures and uncovering fundamental principles to inform system design, with multiple peer-reviewed publications.

EDUCATION

University of California, Santa Barbara, CA, USA Sep. 2021 – Dec. 2026 (Expected)
Ph.D. Candidate, Electrical and Computer Engineering
Advisor: Prof. Upamanyu Madhow | M.S. degree awarded June 2024

Koç University, Istanbul, Turkey Sep. 2015 – Jun. 2021
B.Sc., Electrical and Electronics Engineering — *Summa cum laude*
B.A., Philosophy — *Class rank: 2nd*

Ankara Fen Lisesi (Science High School), Ankara, Turkey Sep. 2011 – Jun. 2015

SKILLS & SELECTED COURSEWORK

Signal Processing & Wireless Systems: Massive multiuser MIMO, digital/hybrid beamforming, OFDM, MIMO-OFDM, channel modeling/estimation, capacity analysis, beamspace detection, ADC quantization effects, performance-complexity tradeoff analysis, 5G NR PHY concepts

Machine Learning: Deep learning (CNN, RNN, Transformer), classical ML (SVM)

Programming: MATLAB (Simulink), Python (NumPy, PyTorch, TensorFlow, Pandas, Scikit-learn), C, C++, CUDA, Git

Tools & Platforms: NVIDIA Sionna (Ray Tracing, Digital Twins), GitHub Copilot, Linux, HPC clusters

Theory: Digital signal processing, multirate DSP, digital communication theory, information theory, time series analysis, stochastic processes, estimation theory, error-correcting coding, linear algebra, matrix theory

Selected Coursework

UCSB: Digital Communication Theory, Optimal Estimation & Filtering, Error-Correcting Coding, Digital Image Processing, Multi-rate Digital Signal Processing, Wireless Communication & Networking, Machine Learning from a Signal Processing Perspective, Matrix Analysis & Computation

Koç University (EEE): Digital Signal Processing, Feedback Control Systems Laboratory, Numerical Modelling & Simulation, Linear System Theory, Wireless Communications

Koç University (Philosophy): Ontology, Logic, Epistemology, Philosophy of Mind, Mind & Reality in the Ancient World, Philosophy of Curiosity, Metaphysics of Science

RESEARCH EXPERIENCE

Graduate Student Researcher & SRC Research Scholar
Sep. 2022 – Present

Wireless Communication and Sensornets Laboratory (WCSL), UC Santa Barbara

Positioning with Cellular MIMO Using Wireless Digital Twins *(ongoing)*

- Developing AI/ML-based algorithms for positioning and tracking, evaluating performance under varying SNR, bandwidth, and array configurations
- Using synthetic channel data generated with NVIDIA Sionna to design and evaluate algorithms for realistic urban environments

Geometric Foundations of Reduced-Dimension Beamspace Detection for Massive MU-MIMO

- Developed theoretical frameworks for low-complexity signal processing algorithms, showing how beamspace dimensionality reduction can enable scalable modem architectures
- Derived lower bounds on expected signal-to-interference-plus-noise ratio (SINR) that will inform system design
- Demonstrated the framework on measured and simulated 28 GHz channels with wideband MIMO-OFDM, benchmarking against information-theoretic limits
- *Submitted for publication*

Wideband Hybrid Beamforming for sub-THz Communication with Large Arrays

- Investigated wideband hybrid beamforming at sub-THz (100+ GHz) focusing on receive-side design and beam squint mitigation
- Derived capacity limits for various RF beamforming architectures under 20% fractional bandwidth using analytical and simulation models
- *Invited paper at the 59th Asilomar Conference on Signals, Systems and Computers, 2025*

Information-Theoretic Guidance for Scaling mmWave MU-MIMO

- Derived spectral-efficiency benchmarks from measured channels and compared ideal capacity with low-complexity beamspace detection
- Quantified performance-complexity trade-offs for scalable mmWave systems

Tiled Beamspace Processing for Scaling mmWave Massive MU-MIMO

- Designed LMMSE-based adaptive multiuser detection for tiled beamspace architectures, leveraging channel sparsity to reduce computational complexity
- Achieved lower BER compared to conventional LMMSE methods while reducing training overhead; demonstrated scalability under power and interconnect constraints

Fourier Analysis of Digital Beamforming with Severely Quantized mmWave Arrays

- Analyzed nonlinear distortion in receivers with 1-bit ADCs, targeting low-power front-end architectures
- Proposed a training sequence design to recover angle-of-arrival under severe hardware constraints

Robust and Interpretable Deep Learning Inspired by Communication Theory Concepts *(ongoing)*

- Implemented weight-shaping regularization in VGG16 to increase sparsity and reduce dynamic range for enhancing robustness
- Exploring extensions to other CNNs and transformers

INDUSTRY EXPERIENCE

Intern — ASELSAN (Military Defense Industries) Jun. – Aug. 2020

Department of Power and Control Systems Electronics Design, Ankara, Turkey

- Programmed microcontrollers for submarine equipment tasks using C

Intern — NETAS (Telecom & Networking) Jun. – Aug. 2018

Innovation Department, Istanbul, Turkey

- Developed and tested TCP/IP networking modules in C on Linux
- Performed packet analysis on Wireshark and troubleshoot network connectivity and protocol-level issues

TEACHING EXPERIENCE

Teaching Assistant, UC Santa Barbara

Advanced Topics in Wireless Systems	Winter 2026
Digital Communication Fundamentals	Fall 2025
Probability and Statistics	Spring 2022
Discrete-Time Signal Analysis and Processing	Winter 2022

PUBLICATIONS

Journal (Under Review)

[1] C. Cebeci, O. D. Noroozi, U. Madhow, *"Beamspace Dimensionality Reduction for Massive MU-MIMO: Geometric Insights and Information-Theoretic Limits,"* submitted for publication, 2025. arXiv:2512.06234.

Conference Papers

[2] A. Haddad, O. D. Noroozi, C. Cebeci, M. J. W. Rodwell, U. Madhow, *"Scaling Wideband Hybrid Beamforming for sub-THz Communication,"* 59th Asilomar Conference on Signals, Systems and Computers, 2025 (Invited). arXiv:2512.06532.

[3] C. Cebeci, O. D. Noroozi, U. Madhow, *"Scaling mmWave MU-MIMO: Information-Theoretic Guidance Using Real-World Data,"* 58th Asilomar Conference on Signals, Systems and Computers, pp. 1620–1624, 2024.

[4] J. Han, C. Cebeci, W. Tang, Z. Zhang, U. Madhow, *"Tiled Beamspace Processing for Scaling mmWave Massive MU-MIMO,"* 2024 IEEE 100th Vehicular Technology Conference (VTC2024-Fall), pp. 1–6, 2024.

[5] C. Cebeci, U. Madhow, *"A Fourier Analysis of Digital Beamforming with Severely Quantized mmWave Arrays,"* 57th Asilomar Conference on Signals, Systems and Computers, pp. 433–437, 2023.

AWARDS & HONORS

Semiconductor Research Corporation (SRC) Research Scholar	2022 – Present
Government Scholar — Top 100 in national university entrance exam	2015 – 2021
Semahat – Nusret Arsel High Honor Scholar — Top-ranked students, Koç family award	2015 – 2021
Vehbi Koç Scholar (4 semesters) — Awarded to top-performing students	2016 – 2021
Dean's Honor Roll (2 semesters) — Awarded for academic excellence	2016 – 2021
Ranked 89th out of 1.5 million examinees in the national university entrance exam	2015

LEADERSHIP & SERVICE

Professional Committee Chair — Womxn in Science & Engineering (WiSE), UCSB Sep. 2023 – Jun. 2024