Canan Cebeci

PH.D. STUDENT · ELECTRICAL AND COMPUTER ENGINEERING

University of California, Santa Barbara, California, USA

Email: ccebeci@ucsb.edu

LinkedIn | SRC Research Scholar Profile

4164A Harold Frank Hall
University of California
Santa Barbara, CA 93106-9560

EDUCATION

University of California, Santa Barbara, CA, USA

M.S./Ph.D. Program, Electrical and Computer Engineering **Sep. 2021 – Present**

- Emphasis: Communications, signal processing, scientific computing
- Advisor: Prof. Upamanyu Madhow
- M.S. degree awarded in June 2024
- CGPA: 3.95/4.0
- Expected graduation date: June 2026

Koç University, Istanbul, TURKEY

B.Sc., Electrical and Electronics Engineering **Sep. 2015 – June 2021**

- Full Scholarship: Scholarship meets the 100% of the tuition fee
- CGPA: 3.87/4.0 | Graduated with summa cum laude

B.A., Philosophy **Sep. 2017 – June 2021**

- Full Scholarship
- Graduated with a 2nd place class ranking

Ankara Science High School, Ankara, TURKEY **Sep. 2011 – June 2015**

- Graduated with 96.37/100

RESEARCH INTERESTS

Millimeter Wave (mmWave) / MIMO Communication Systems
Information Theory
Machine Learning

SELECTED COURSES

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: Undergraduate level: Digital Signal Processing, Feedback Control Systems Laboratory.
Graduate level: Numerical Modelling & Simulation, Linear System Theory, Wireless Communications.

Koç University, Philosophy: Undergraduate level: Ontology, Logic, Epistemology, Philosophy of Mind.
Graduate level: Mind & Reality in the Ancient World, Philosophy of Curiosity, Metaphysics of Science.

RESEARCH PROJECTS

Research projects during PhD:

- All-Digital Massive mmWave MIMO with 1-bit ADCs:
  Examined how spatial harmonics are affected by 1-bit analog-to-digital converter (ADC) by utilizing a Fourier analysis approach. The analysis provided guidance on training sequence design to isolate the spatial frequency corresponding to the true angle of arrival.

- Hierarchical Signal Processing for Tiled Massive mmWave Multi-user MIMO:
  Proposed linear minimum mean squared error (LMMSE) adaptive multi-user detection techniques for tiled beamspace architectures, where digital signal processing is performed locally within each tile. Techniques exploit channel spatial sparsity to reduce the computational complexity. BER performances of the proposed techniques beat the conventional multi-user LMMSE detection with a shorter training overhead and lower computational complexity.

- Beamspace Processing for Scaling mmWave Multi-user MIMO:
  Derived information-theoretic benchmarks from measured channels compare ideal capacity with low-complexity beamspace detection, revealing performance and complexity trade-offs for scalable next-generation wireless signal processing. Ongoing research extends this approach to wideband systems with beam-time processing, exploring fundamental limits and design trade-offs.

- Robust and Interpretable Deep Learning, Inspired from Communication Theory Concepts:
  Ongoing efforts focus on reducing dynamic range and increasing sparsity by weight shaping in VGG16 with layers having an additional objective that increases robustness and interpretability, with potential extension to other CNNs and transformers.

PUBLICATIONS

Canan Cebeci*, Oveys Delafrooz* and Upamanyu Madhow, "Scaling mmWave MU-MIMO: Information-Theoretic Guidance using Real-World", 58th Asilomar Conference on Signals, Systems and Computers, 2024.

Jiyoon Han, Canan Cebeci, Wei Tang, Zhengya Zhang and Upamanyu Madhow, "Tiled Beamspace Processing for Scaling mmWave Massive MU-MIMO", 2024 IEEE 100th Vehicular Technology Conference (VTC2024-Fall), Washington, DC, USA, 2024, pp. 1-6.

Canan Cebeci and Upamanyu Madhow, "A Fourier Analysis of Digital Beamforming with Severely Quantized mmWave Arrays", 57th Asilomar Conference on Signals, Systems and Computers, 2023.

WORK EXPERIENCE

Wireless Communication and Sensornets Laboratory (WCSL), UCSB **Sep. 2022 – Present**

Semiconductor Research Corporation (SRC) Research Scholar **Sep. 2022 – Present**

Teaching Assistant, UCSB

- Probability and Statistics – ECE 139 **Spring 2022**
  (offered by Prof. Kenneth Rose)
- Discrete-Time Signal Analysis and Processing – ECE 130B **Winter 2022**
  (offered by Prof. Upamanyu Madhow)

Intern, ASELSAN (Military Defense Industries), Ankara, TURKEY **June – Aug. 2020**
Department of Power and Control Systems Electronics Design, 40 hours/week
Programmed micro controllers for specific tasks for submarine equipment.

Tutor, Koç University, Istanbul, TURKEY
Koç University Office of Learning and Teaching
Held review sessions before exams and office hours to help students and solve example problems.

- ELEC 201 (Signals and Systems) **Spring 2018 – Fall 2019**
- ENGR 200 (Probability and Random Variables for Engineers) **Spring 2019**

Intern, NETAŞ, Istanbul, TURKEY **June – Aug. 2018**
Innovation Department, 40 hours/week
Worked in a software-oriented department for three months on network programming (TCP/IP).

Undergraduate Research Assistant, Koç University, Istanbul, TURKEY **Fall 2017**
Optic Microsystems Laboratory
Provided assistance in creating image data for a machine learning project.

VOLUNTARY WORK EXPERIENCE

Womxn in Science & Engineering (WiSE) at UCSB **Sep. 2023 – June 2024**
Professional committee chair

HONORS & AWARDS

Vehbi Koç Scholar for 4 Semesters	Awarded to top-performing students.	**2016-21**
Dean's Honor Roll for 2 Semesters	Awarded to students for academic excellence.	**2016-21**
Government Scholar	Awarded to the top 100 in the national university entrance exam.	**2015-21**
Semahat - Nusret Arsel High Honor Scholar	Awarded by the Koç family to the top-ranked students.	**2015-21**
Ranked 89th out of 1.5 million examinees in the national university entrance exam.		**2015**

SKILLS

Computer Programming: Proficient in MATLAB, Python. Experience in C, C++, Java.
Platforms & Tools: macOS, Linux, Windows, MATLAB Simulink.