

Murat Ozatay

Department of Electrical Engineering, Princeton University
41 Olden Street, Engineering Quadrangle, Princeton, NJ 08544, USA
mozatay@princeton.edu • www.muratozatay.com

EDUCATION

Princeton University, Princeton, NJ

- **Ph.D. Candidate** in Electrical Engineering 09/2015 – Present
 - Adviser: Prof. Naveen Verma
- **M.A. in Electrical Engineering** 09/2015 – 09/2017
 - CGPA: **3.97** / 4.00

Middle East Technical University, Ankara, Turkey

- **B.Sc. in Electrical and Electronics Engineering** 08/2010 – 06/2015
 - Graduated as the **highest-ranking-student** in the university.
 - CGPA: **4.00** / 4.00

RESEARCH & TEACHING EXPERIENCE

Princeton University, Princeton, NJ

- **Graduate Student Research Assistant, Electrical Engineering** 02/2016 – Present
 - Supervisor: Prof. Naveen Verma
 - Focus: Machine learning, artificial intelligence, Internet-of-Things, design of VLSI systems.
- **Teaching Assistant, Electrical Engineering**
 - ELE 206 / COS 306 – Contemporary Logic Design 09/2018 – 01/2019
 - ELE 302 – Building Real Systems 02/2018 – 06/2018
 - ELE/COS 462/562 – Design of Very Large-Scale Integrated (VLSI) Systems 09/2016 – 01/2017

PUBLICATIONS

- [1] H. Jia, **M. Ozatay**, Y. Tang, H. Valavi, R. Pathak, J. Lee, and N. Verma, “Scalable and Programmable Neural-network Inference Accelerator based on In-Memory Computing,” to appear in *IEEE Journal of Solid-State Circuits (JSSC)*.
- [2] H. Jia, **M. Ozatay***, Y. Tang*, H. Valavi*, R. Pathak*, J. Lee, and N. Verma, “A Programmable Neural-network Inference Accelerator based on Scalable In-Memory Computing,” *IEEE International Solid-State Circuits Conf. (ISSCC)*, Feb. 2021.
- [3] N. Verma, H. Jia, H. Valavi, Y. Tang, **M. Ozatay**, L. Chen, B. Zhang, and P. Deaville, “In-Memory Computing: Advances and prospects,” *IEEE Solid-State Circuits Mag.*, vol. 11, no. 3, pp. 43-55, Summer 2019.
- [4] **M. Ozatay** and N. Verma, “Exploiting Emerging Sensing Technologies Towards Structure in Data for Enhancing Perception in Human-centric Applications,” *IEEE Internet Things J.*, vol. 6, no. 2, pp. 3411-3422, April 2019.
- [5] Y. Mehlman, P. Kumar, **M. Ozatay**, S. Wagner, J. C. Sturm, and N. Verma, “Large-Area electronics HF RFID Reader-array for Object-detecting Smart Surfaces,” *IEEE Solid-State Circuits Lett.*, vol. 1, no. 8, pp. 182-185, Aug. 2018.
- [6] **M. Ozatay**, L. Aygun, H. Jia, P. Kumar, Y. Mehlman, C. Wu, S. Wagner, J. C. Sturm, and N. Verma, “AI Meets Large-Scale Sensing: using Large-Area Electronics (LAE) to enable intelligent spaces,” *IEEE Custom Integrated Circuits Conf. (CICC)*, San Diego, CA, Apr. 2018. (invited)

*Equally Credited Authors (ECAs).

PRESENTATIONS

- [1] **M. Ozatay**, H. Jia, L. Aygun, S. Wagner, J. C. Sturm, and N. Verma, “Sound Identification Using Physically-Expansive Sensing System,” *17th Annual Flexible Electronics Conference (2018FLEX)*, Monterey, CA, Feb. 2018. (**Third Place Student Poster Award**)

RESEARCH PROJECTS

- **Task-driven Wireless Sensing based on Reconfigurable Antennas** 2019 – Present
 - Created a deep neural network (DNN) based reconfigurable antenna control system for spatially-selective wireless communication.
- **Application Mapping for Scalable In-Memory Computing (IMC)** 2018 – Present
 - Created a neural network (NN) mapping flow from network design to hardware which involves resource allocation, placement, and routing. Verified the functionality at each stage using behavioral model.

- Performed energy and throughput characterization of IMC-based architecture compared to digital architecture.
- Implemented the network RTL of the IMC-based architecture and verified its functionality.
- **Large-scale Sensing and AI Technologies for Smart Interactive Environments** 2017 – 2019
 - Synthesized two datasets for human-activity detection from 3D modeling and rendering software, emulating vision sensing as well as physically-integrated (PI) sensing.
 - Trained linear support vector machine (SVM) using PI sensing data and deep convolutional neural network (CNN) using vision data. Demonstrated improved data efficiency of learning using PI sensing compared to vision sensing.
 - Analyzed the relative value of each PI sensor within perception tasks using Fisher score metric and showed significant diversity in relative value across sensors and consistency in relative value across different human-activity-detection deployments.
 - Integrated vision sensing with PI sensing by combining PI features with vision features in CNN and demonstrated gains in data efficiency, relative to baseline vision sensing, in accordance with the relative ranking of PI sensors.
 - Implemented feature-space mapping for PI-sensing features across deployments for transfer learning and demonstrated the ability to rapidly learn such mapping.
- **Environmental Sound Identification Using Physically-Expansive Sensing System** 2016 – 2017
 - Implemented environmental sound classification system using sound source direction in addition to common audio features.
 - Obtained 12% increase in mean classification accuracy with the addition of sound source direction using SVMs.
 - Analyzed transfer learning by training Adaptive SVMs to improve classification performance.
 - Trained genetic programming model to reduce feature extraction energy by bypassing audio feature extraction block.

AWARDS & SCHOLARSHIPS

- **Ph.D. Fellowship in Natural Sciences and Engineering, Princeton University** 2015
- **Nominated as a Fulbright Ph.D. Grant Principal Finalist, The Turkish Fulbright Commission** 2015
- **Valedictorian, Middle East Technical University** 2015
For being the highest-ranking-student in the university.
- **Best Engineering Design Award, IEEE METU** 2015
For outstanding graduation project (selected by the audience).
- **Engineering Achievement Award, Middle East Technical University** 2015
For outstanding graduation project (selected by the jury).
- **Assoc. Prof. Bulent Kerim Altay Award (8 times), Middle East Technical University** 2011 – 2015
For ranking first in the class.
- **High Honor Student (8 times), Middle East Technical University** 2011 – 2015

INDUSTRY POSITIONS

- ASELSAN, Ankara, Turkey**
- **Co-op Engineer, Digital and Embedded Systems Department** 04/2015 – 06/2015
Transportation, Security, Energy, and Automation Systems
 - **Intern, Electronic Design Department** 06/2014 – 07/2014
Defense Systems Technologies
- Baymina Energy, Ankara, Turkey**
- **Intern, Instrumentation and Control Systems** 09/2013
- Turkish Aerospace Industries, Inc. (TAI), Ankara, Turkey**
- **Intern, Electronics Hardware Laboratory** 06/2013 – 07/2013
Space Systems

PROFESSIONAL AFFILIATIONS & ACTIVITIES

- **IEEE Computer Society, Member** 2018 – Present
- **IEEE Signal Processing Society, Member** 2018 – Present
- **IEEE Internet of Things Journal, Reviewer** 2018 – Present
- **IEEE Solid-State Circuits Society, Member** 2017 – Present
- **IEEE, Student Member** 2016 – Present

SKILLS

- **Programming:** MATLAB, Python, C, C++, Verilog, Ruby.
- **Applications:** Cadence Virtuoso, LTspice, Xilinx ISE/EDK, NI Multisim, PSoC Creator, Electronics Workbench, Kubotek KeyCreator, SketchUp, HP VEE, HEW, Microsoft Office, MPLAB IDE.
- **Libraries/APIs:** scikit-learn, Keras, TensorFlow, MATLAB Statistics and Machine Learning Toolbox.
- **Languages:** English (advanced), Turkish (native).

**CAMPUS
ACTIVITIES**

Graduate Turkish Student Association, Princeton University

- Treasurer (2018 – 2021), President (2017 – 2018), Vice President (2016 – 2017)

**COURSE
PROJECTS**

- **Environmental Sound Classification Leveraging Transfer Learning** Fall 2016
 - ELE 477 – Kernel-Based Machine Learning Term Project, Princeton University.
- **Classification of C. elegans Behavior from Neural Activity** Spring 2016
 - COS 424 – Fundamentals of Machine Learning Term Project, Princeton University.
- **Sound Sensing System Implementing an Online Machine Learning Classifier** Spring 2016
 - ELE 464 – Embedded Computing Term Project, Princeton University.
- **16-bit Reconfigurable Adder Design and Analysis From Energy, Delay, and Area Point of View** Fall 2015
 - ELE 462 – Design of Very Large-Scale Integrated (VLSI) Systems Term Project, Princeton University.
- **Fault Models for Transistor-Level Monolithic 3D Integrated Circuits** Fall 2015
 - ELE 461 – Design with Nanotechnologies Term Project, Princeton University.
- **Comparison of Hardware Branch Predictors on PARCv2** Fall 2015
 - ELE/COS 475 – Computer Architecture, Princeton University.
- **A robot which can play carom bole style billiards** Fall 2014 – Spring 2015
 - Graduation project, Middle East Technical University.
- **Adjustable Voltage Regulator in a 180 nm CMOS Technology** Spring 2015
 - EE 414 – Introduction to Analog Integrated Circuits Term Project, Middle East Technical University.
 - Schematic and Layout Level Implementation.
- **Simple Microcontroller and 8-bit ALU** Fall 2014
 - EE 413 – Introduction to VLSI Design Term Project, Middle East Technical University.
 - Schematic and Layout Level Implementation.
- **2-Level Guitar Hero Game on FPGA with Verilog** Spring 2014
 - EE 314 – Digital Electronics Laboratory Term Project, Middle East Technical University.
- **An AM Receiver with Tunable Frequency** Fall 2013
 - EE 313 – Analog Electronics Laboratory Term Project, Middle East Technical University.
- **A Wireless Charger** Spring 2013
 - EE 214 – Electronic Circuits Laboratory Term Project, Middle East Technical University.
- **A Preliminary Wireless Communication System** Fall 2012
 - EE 213 – Electrical Circuits Laboratory Term Project, Middle East Technical University.

REFERENCES

Available upon request.

[CV compiled on 2021-10-13]