

Mehrdad Hessar

PhD Candidate at University of Washington

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CSE Department

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OBJECTIVE

Job in on-device machine learning, machine learning systems or low-power embedded systems.

EDUCATION

University of Washington (Seattle, WA)

2017-Winter 2021

PhD student at Paul G. Allen School of Computer Science and Engineering

Supervisor: Prof. Gollakota

Research: Communication system design towards the vision of low-power IoT networks.

University of Washington (Seattle, WA)

2015-2017

M.Sc. in Electrical Engineering (GPA: 3.84/4.0)

Supervisor: Prof. Gollakota

Research: On-body communication, low-power embedded system design.

Amirkabir University of Technology (Tehran)

2011-2015

B.Sc. in Computer Engineering (GPA: 3.86/4)

RESEARCH AND PROFESSIONAL EXPERIENCE

Networks and Mobile Systems Lab, Seattle, WA

Research Assistant

Low-power communication system for IoT devices, ubiquitous computing and connectivity.

2015-Present

Google, Seattle, WA

Research Intern

On-device machine learning in Chrome using TensorFlow on Android platforms.

June-September, 2020

OctoML, Seattle, WA

Research Intern

Deep learning optimization on Azure Sphere platform using TVM compiler stack.

March-June 2020

Sound Life Sciences, Seattle, WA

System Engineer Consultant

Designing smart-speakers with ultrasound capabilities for medical research.

January-March, 2020

Microsoft Research Lab, Redmond, WA

Research Intern

A scalable long-range IoT network in VHF narrowband wireless technology.

June-September, 2018

SELECTED PROJECTS

- **On-Device ML for Browsers**

- TensorFlow support in Chrome browser
- Deep analysis of on-device ML performance in Chrome browser targeting Android devices such as Pixel 4

- **Bringing ML to the Azure Sphere using TVM**

- Bringing TVM compiler stack support to Azure Sphere for the first time
- Improved ML performance on Azure Sphere with auto tuning

- **TinySDR: Low-Power SDR Platform for IoT**

- Designed an SDR platform for IoT networks
- Supports 4 MHz bandwidth, 2.4 GHz and Sub-GHz radio frequencies
- Ultra-low-power sleep mode ($30\mu W$)

- **Custom Smart-Speaker for Medical Research**

Sound Life Sciences

- Custom design for breathing pattern detection
- Uses Matrix Voice and Raspberry pi and capable of emitting ultrasound ($> 20\text{ kHz}$)
- Deployed more than 70 smart-speakers as part of Seattle Flu Study

- **Ultra-long-range IoT Network (IoN)**

Microsoft Research Lab

- IoN is a long-range IoT network which operates in VHF narrowband
- Deployed LoRa base station and LoRa nodes for network comparison with IoN
- We showed IoN has 100 times the area coverage of LoRa

- **NetScatter: Large-Scale Backscatter Networks**

- First wireless backscatter protocol that scales to hundreds of devices
- Deployed a network of 256 devices. NetScatter improves data rate and latency

- **Battery-Free HD Video Streaming**

- Low-power video streaming using hybrid backscatter technique and PWM modulation

- **LoRa Backscatter: Enabling Ubiquitous Connectivity**

- First long-range backscatter communication using Chirp Spread Spectrum coding
- We showed reliable coverage of LoRa Backscatter across a house, an office building and one acre farm

PROFESSIONAL SKILLS

- Low-power system design, RF backscatter communication and PCB design
- Experienced in IoT wireless communication protocols such as LoRa
- **Hardware Platforms:** Altera DE, Xilinx, IGLOO series and Lattice ECP5 FPGAs, MSP430 series, Arduino, Azure Sphere, Atmega, Raspberry pi, NXP BLE SoC, NI DAQs, USRP
- **Hardware Design:** Verilog, VHDL, System Verilog, Modelsim, Cadence ICFB, Altium Designer, OrCAD Capture CIS.
- **Programming:** C/C++, Java, Android, Python, Matlab, Databases.
- **Modeling:** Machine learning, Deep learning, TensorFlow, PyTorch

SELECTED PUBLICATIONS

- **M. Hesar***, A. Najafi*, V. Iyer, S. Gollakota, TinySDR: Low-Power SDR Platform for Over-the-Air Programmable IoT Testbeds, NSDI 2020. [[Paper](#)] [[Website](#)]
- C. Gao, **M. Hesar**, K. Chintalapudi, B. Priyantha, Blind Distributed MU-MIMO for IoT Networking over VHF Narrowband Spectrum, MobiCom 2019. [[Paper](#)] [[Website](#)]
- A. Saffari, **M. Hesar**, S. Naderiparizi, J. R. Smith, Battery-Free Wireless Video Streaming Camera System, *13th Annual International Conference on RFID*, 2019. [[Paper](#)]
- **M. Hesar***, A. Najafi*, S. Gollakota, NetScatter: Enabling Large-Scale Backscatter Networks, NSDI 2019. [[Paper](#)]
- S. Naderiparizi, **M. Hesar**, V. Talla, S. Gollakota, J. R. Smith, Low-Power HD Video Streaming, NSDI 2018. [[Paper](#)] [[Website](#)] [Press: [Techcrunch](#)]
- V. Talla*, **M. Hesar***, B. Kellogg, A. Najafi, J. R. Smith and S. Gollakota, "LoRa Backscatter: Enabling The Vision of Ubiquitous Connectivity, Ubicomp 2017 (**Distinguished Paper Award**). [[Paper](#)] [[Website](#)] [Press: [Economist](#), [IEEE Spectrum](#), [Tech Review](#)]

- **M. Hesar***, V. Iyer*, and S. Gollakota, "Enabling On-Body Transmissions with Commodity Devices", Ubicomp 2016. [[Paper](#)] [[Website](#)] [Press: [WSJ](#), [Atlantic](#), [IEEE Spectrum](#)]

PATENTS

- S. Gollakota, S. Naderiparizi, **M. Hesar**, V. Talla, J. R. Smith, Image and/or video transmission using backscatter devices.
- V. Talla, **M. Hesar**, J. R. Smith, S. Gollakota, A. Najafi, B. Kellogg, Backscatter systems, devices, and techniques utilizing css modulation and/or higher order harmonic cancellation.

OTHER PROJECTS

- **Improving Robustness of Deep Convolutional Networks Using Input Dropout** *Fall 2019*
Explored the role of image redundancy in deep convolutional networks such as ResNet. Experimenting on different CNNs, I showed training with both original and sub-sampled images of CIFAR-10 significantly increases robustness of the model against Gaussian noise for both normal and sub-sampled images.
- **Image Inpainting Using Convolutional Neural Network** *Spring 2017*
Used unsupervised visual feature learning model, using a CNN-based context encoder, to predict missing parts of images from MNIST dataset. The architecture included an encoder to capture the context into a compact feature representation, which was used to produce the missing image content.
- **Neural Networks Regularization** *Winter 2017*
Used regularization techniques for reducing overfitting in neural networks. Specifically, we implemented Knowledge Distillation, Penalizing Output Confidence and Label Smoothing techniques on MNIST and German traffic sign benchmarks (GTSRB) dataset.
- **Android Programming: Acoustic Communication** *Spring 2016*
Designed a half duplex communication system with sonar on Android smartphones. The Android application uses On-Off keying modulation to transmit/receive data between two smartphones in real time.
- **Data Analytics Acceleration: Performance Implications of Cloud FPGAs** *Spring 2018*
Investigated the benefits of static FPGA accelerators for database management systems. The project focus was specifically on accelerators developed by Xilinx for PostgreSQL databases. We implemented accelerators on AWS and analyzed their performance.

TEACHING EXPERIENCE

- TA, **CSE461: Introduction to Computer Communication Networks**, UW, CSE, 2018.
- TA, **Microprocessors**, Amirkabir University of Technology, 2014.
- TA, **Computer Architecture**, Amirkabir University of Technology, 2014.
- TA, **Advanced Programming**, Amirkabir University of Technology, 2013.

PROFESSIONAL SERVICES

- **Program Committee** ACM S3 Workshop, in conjunction with MobiCom 2019.
- **Reviewer:** IEEE Transactions on Wireless Communications, MobiCom.
- **Program Committee** International Conference on Sensor Technologies and Applications, 2018.
- **Program Committee** International Conference on Ambient Computing, Applications, Services and Technologies, AMBIENT, 2017-2018.

AWARDS AND HONORS

- IMWUT Distinguished Paper Award, 2018.
- USENIX Student Grant, NSDI 2018.
- Awarded honorary **Computer Science and Engineering Research Fellowship** from Microsoft at Paul G. Allen School of Computer Science and Engineering, 2017.
- Awarded honorary **Madrona prize** on "The Next Big Leap in Backscatter Communication" from **Madrona Venture Group**, 2016.
- Awarded honorary **direct admission to graduate school** of computer engineering at **Sharif University of Technology** as a reward of high academic records and achievements, 2015.
- **Ranked as Top 0.5%** among more than 300,000 Participants in National Entrance Exam for Undergraduate State Universities, 2011.