

# Mehrdad Hesar

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PhD Candidate at University of Washington

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CSE Department

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## OBJECTIVE

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Job in hardware engineering, machine learning systems or low-power embedded systems

## EDUCATION

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**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

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**Networks and Mobile Systems Lab**, Seattle, WA

**Research Assistant**

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

*2015-Present*

**OctoML**, Seattle, WA

**Research Intern**

Deep learning optimization on low-power hardware platforms using TVM compiler stack.

*March 2020-Present*

**Sound Life Sciences**, Seattle, WA

**System Engineer Consultant**

Designing smart-speakers with ultrasound capabilities for medical research.

*Jan-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

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- **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 ( $> 20 kHz$ )
- 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

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- Low-power system design, RF backscatter communication and PCB design
- Experienced in IoT wireless communication protocols such as LoRa
- **Hardware Platforms:** Xilinx FPGAs, Altera DE series, Igloo Nano FPGA, MSP430 series, Arduino, Atmega, 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).

## SELECTED PUBLICATIONS

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- **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

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- 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

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- **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

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- 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

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- **Program Committee** ACM S3 Workshop, in conjunction with MobiCom 2019.
- **External Reviewer** of MobiCom, 2019.
- **Reviewer** of IEEE Transactions on Wireless Communications.
- **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

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- 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.