

# Shibo Zhang

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With a research focus on *machine learning*, *deep learning* and *human activity recognition*, I have

- Rich experience in end-to-end ML workflows (data collection -> data preparation -> modeling) and applying machine learning and deep learning techniques to real-world IoT sensor data and physiological signals;
- Several best paper/poster awards in top ubiquitous computing venues;
- Proven abilities of problem defining, technological innovation, model implementation, and presentation;
- Industrial experience of resolving real-world problems with technological advancements and delivering research outcome to engineering team;
- Successfully lead small-sized team to deliver machine learning projects by overseeing the technical challenges, resolving key issues creatively, and de-risking adoption of innovations.

I am expected to graduate in the *summer of 2021*.

## Research Interests

Human Activity Recognition, Time Series Analysis, Machine Learning, Deep Learning, Physiological Sensing

## Education

<b>Ph.D.</b> , Computer Science, Northwestern University (Advisor: Nabil Alshurafa)	2017 - 2021
<b>M.S.</b> , Computer Science, Northwestern University	2015 - 2017
<b>B.S., M.S.</b> , Electrical Engineering, Harbin Institute of Technology	2008 - 2014

## Employment

<b>Samsung Research America</b> , Research Intern, Mountain View, CA	Jan - Jun, 2021
<ul style="list-style-type: none"><li>◦ Proposed a novel on-device Multi-Centroid Classification (MCC) algorithm for time-series classification using sensor fusion on earbuds, work being transferred to engineering team;</li><li>◦ Patenting proposed MCC algorithm as a leading author.</li><li>◦ Submitted work to EMBC 2021 <a href="#">[link]</a> and ICML workshop.</li></ul>	
<b>OPPO Research Institute</b> , Machine Learning Intern, Palo Alto, CA	Jul - Sep, 2019
Improved hand pose estimation by developing a physical model based optimization method.	
<b>DJI Technology</b> , Intern, Shenzhen	Jul - Aug, 2015
Developed control system for an automated vision-based ball-collecting quadrotor. <a href="#">[photo]</a>	

## Awards and Honors

### Paper Awards

Best Poster Award, UbiComp (2%)	2020
Best Presentation Runner-up Award, UbiComp (1.3%)	2020
Distinguished Paper Award, UbiComp/IMWUT (3.7%)	2019
Best Paper Award, ACM BodyNets (2.4%)	2016
Outstanding Undergraduate Thesis Award (3%)	2012

### Scholarships and Others

Student Travel Scholarship, NSF/Northwestern	2017, 2018
Best Intern Award, Eaton Corporate Research & Technology	2012, 2013
Eaton Innovation Scholarship, HIT	2012, 2013
Freescale Cup Autonomous Race Car Challenge, Regional Second Prize	2011
First-Class Scholarship, HIT	2008, 2009

## Selected Projects

### Deep Generative On-body Sensor Synthesis and Augmentation from Videos

- Proposed a deep generative cross-modal model to synthesize on-body sensor data from videos. Experiments being conducted on public sensor-based activity recognition datasets illustrate the validity of the synthetic data.
- Published in Ubicomp doctoral colloquium.

### VibroScale: Turning Your Smartphone into a Weighing Scale [\[Project Website\]](#) [\[Video\]](#)

- Proposed and realized a novel method that utilizes built-in vibration motor and accelerometer to turn an everyday smartphone into a weighing scale.
- Won the best poster award in Ubicomp 2020 (by landsliding 3X votes over runner-up).

### Sensor Fusion for Complex Activity Detection [\[SyncWISE Website\]](#)

- Applied deep learning based multi-sensor (IMUs, respiration sensor, and GPS) fusion algorithms to detect daily activities including smoking and eating gestures in long-term wild settings.
- Proposed and implemented a time synchronization method to resolve the clock-sync issue between wearable-camera and on-body accelerometer.
- Collaborated with scholars from Northwestern Medicine, Georgia Tech, University of Memphis, and OSU.
- Published SyncWISE in Ubicomp as a co-first author and open-sourced the code and dataset [\[link\]](#).

### An Eating Detection Approach using a Multi-sensor Necklace [\[Project Website\]](#) [\[Video\]](#)

- Proposed a multi-sensor necklace based two-stage eating detection approach. Applied a periodic peak detection algorithm in large volume of time series data, followed by gradient boosting algorithm to detect eating activity in free living setting. A density-based clustering method is then used towards eating episode recognition.
- Published in Ubicomp as the 1st author in 2020 (full paper) and 2018 (demo) and won the Best Presentation Runner-up Award.
- Open-sourced the code and dataset [\[link\]](#).


### Machine Learning based Feeding Gesture Detection Using a Smartwatch

- To detect overeating passively, a motif-based machine learning framework was designed to detect and accurately count the number of feeding gestures during an eating episode to characterize each eating episode.
- Published in ACM BodyNets as the 1st author and won the Best Paper Award.

## Publications

Please go to [Google Scholar](#) (231 citations) for a complete publication list.

### Journal Papers

- [1] SyncWISE: Window Induced Shift Estimation for Synchronization of Video and Accelerometry from Wearable Sensors  
Yun C. Zhang\*, **Shibo Zhang\***, Miao Liu, Elyse Daly, Samuel Battalio, Santosh Kumar, Bonnie Spring, James M. Rehg, Nabil Alshurafa (\* equal contribution)  
*Proc. ACM Interact. Mob. Wearable Ubiquitous Technol. (IMWUT/UbiComp)* 4.3 (Sept. 2020). 2020
- [2]  NeckSense: A Multi-Sensor Necklace for Detecting Eating Activities in Free-Living Conditions  
May 2021

**Shibo Zhang**, Yuqi Zhao, Dzung Tri Nguyen, Runsheng Xu, Sougata Sen, Josiah Hester, Nabil Alshurafa  
*Proc. ACM Interact. Mob. Wearable Ubiquitous Technol. (IMWUT/UbiComp)* 4.2 (June 2020). 2020

- [3] Deep Learning Algorithms for Bearing Fault Diagnostics—A Comprehensive Review  
Shen Zhang, **Shibo Zhang**, Bingnan Wang, Thomas. G. Habetler  
*IEEE Access* 8 (2020) pp. 29857–29881. 2020
- [4] 🏆 micro-Stress EMA: A Passive Sensing Framework for Detecting In-the-wild Stress in Pregnant Mothers  
Zachary D. King, Judith Moskowitz, Begum Egilmez, **Shibo Zhang**, Lida Zhang, Michael Bass, John Rogers, Roozbeh Ghaffari, Laurie Wakschlag, Nabil Alshurafa  
*Proc. ACM Interact. Mob. Wearable Ubiquitous Technol. (IMWUT/UbiComp)* 3.3 (Sept. 2019). ACM, 2019
- [5] I Sense Overeating: Motif-based Machine Learning Framework to Detect Overeating Using Wrist-worn Sensing  
**Shibo Zhang**, William Stogin, Nabil Alshurafa  
*Information Fusion* 41 (2018) pp. 37–47. 2018

## Conference Papers

- [1] Deep Generative Cross-modal On-body Accelerometer Data Synthesis from Videos (Doctoral Colloquium)  
**Shibo Zhang**, Nabil Alshurafa  
*Adjunct Proceedings of the 2020 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2020 ACM International Symposium on Wearable Computers (UbiComp/ISWC '20 Adjunct), September 12–16, 2020, Virtual Event, Mexico, 2020*
- [2] 🏆 VibroScale: Turning Your Smartphone into a Weighing Scale  
**Shibo Zhang**, Qiuyang Xu, Sougata Sen, Nabil Alshurafa  
*Adjunct Proceedings of the 2020 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2020 ACM International Symposium on Wearable Computers (UbiComp/ISWC '20 Adjunct), September 12–16, 2020, Virtual Event, Mexico, 2020*
- [3] Multiscale Directional Fusion for Depth Map Super Resolution with Denoising  
Dan Xu, Xiaopeng Fan, **Shibo Zhang**, Yang Wang, Debin Zhao, Wen Gao  
*2019 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2019
- [4] Estimating Caloric Intake in Bedridden Hospital Patients with Audio and Neck-worn Sensors  
**Shibo Zhang**, Dzung Nguyen, Gan Zhang, Runsheng Xu, Nikolaos Maglaveras, Nabil Alshurafa  
*2018 IEEE/ACM International Conference on Connected Health: Applications, Systems and Engineering Technologies (CHASE)*, 2018
- [5] HABits Necklace: A Neck-worn Sensor That Captures Eating Related Behavior and More  
**Shibo Zhang**, Dzung Nguyen, Zachary King, Jishnu Pradeep, Nabil Alshurafa  
*Proceedings of the 2018 ACM International Joint Conference and 2018 International Symposium on Pervasive and Ubiquitous Computing and Wearable Computers (UbiComp)*, 2018
- [6] When Generalized Eating Detection Machine Learning Models Fail in the Field?  
**Shibo Zhang**, Rawan Alharbi, Matthew Nicholson, Nabil Alshurafa  
*Proceedings of the 2017 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2017 ACM International Symposium on Wearable Computers (UbiComp Workshops)*, 2017
- [7] 🏆 Food Watch: Detecting and Characterizing Eating Episodes Through Feeding Gestures  
**Shibo Zhang**, Rawan Alharbi, William Stogin, Mohamad Pourhomayun, Bonnie Spring, Nabil Alshurafa  
*Proceedings of the 11th EAI International Conference on Body Area Networks (BodyNets)*, 2016

## Skills

### Programming Language

Python (pytorch, tensorflow, keras, sklearn, tslearn, numpy, scipy, numba), Matlab, C/C++, R  
bash, html, CSS, JavaScript

### Tools

AWS, Git, Docker

## References (Available upon request.)