

# Shibo Zhang

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## Research Interests

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

## Education

<b>Ph.D.</b> , Computer Science, Northwestern University	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

**HP Labs**, Research Engineer, Palo Alto, CA Oct - , 2021

**Samsung Research America**, Research Intern, Mountain View, CA Jan - Sep, 2021

Proposed a novel on-device Multi-Centroid Classification (MCC) algorithm for time-series classification using sensor fusion on earbuds, work published and being patented.

**OPPO US Research Center**, Machine Learning Intern, Palo Alto, CA Jul - Sep, 2019

Improved hand pose estimation by developing a physical model based optimization method.

**DJI Technology**, Intern, Shenzhen Jul - Aug, 2015

Developed control system for an automated vision-based ball-collecting quadrotor. [\[photo\]](#)

## 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

## 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 landslideing 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.

## **Selected Publication**

Please refer to [Google Scholar](#) (299 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  
**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] A Novel Multi-Center Template-Matching Algorithm and Its Application for Cough Detection (accepted)  
**Shibo Zhang**, Ebrahim Nemati, Tousif Ahmed, Md Mahbubur Rahman, Jilong Kuang, Alex Gao  
*43rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, 2021
- [2] CoughBuddy: Multi-modal Cough Event Detection Using Earbuds Platform  
Ebrahim Nemati, **Shibo Zhang**, Tousif Ahmed, Md Mahbubur Rahman, Jilong Kuang, Alex Gao  
*The 17th IEEE-EMBS International Conference On Wearable And Implantable Body Sensor Networks (BSN)*, 2021
- [3] 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)*, 2020
- [4] 🏆 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)*, 2020
- [5] Multiscale Directional Fusion for Depth Map Super Resolution with Denoising  
Dan Xu, Xiaopeng Fan, **Shibo Zhang**, Yang Wang, Debin Zhao, Wen Gao  
*IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2019
- [6] Visualization of Multi-Objective Switched Reluctance Machine Optimization at Multiple Operating Conditions with t-SNE  
Shen Zhang, **Shibo Zhang**, Sufei. Li, Liang. Du, Thomas G. Habetler  
*2019 IEEE Energy Conversion Congress and Exposition (ECCE)*, 2019
- [7] 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  
*IEEE/ACM International Conference on Connected Health: Applications, Systems and Engineering Technologies (CHASE)*, 2018
- [8] 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
- [9] 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
- [10] 🏆 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
- [11] Machine Learning Algorithms Applied to Detect Feeding Gestures  
**Shibo Zhang**, Rawan Alharbi, William Stogin, Kevin Moran, Angela F. Pfammatter, Bonnie Spring, Nabil Alshurafa  
*The Obesity Society* (2016). 2016
- [12] An Iterative Dimensionality-Scaling System for Real-Time Health Monitoring Applications  
Haik Kalantarian, Majid Sarrafzadeh, **Shibo Zhang**, Nabil Alshurafa  
*2016 IEEE International Conference on Healthcare Informatics (ICHI)*, 2016
- [13] Auto-commissioning and Adaptive Tuning of Servo Control Parameters in an Electro-hydraulic System based on Physical Plant Model  
Xiaomeng Cheng, **Shibo Zhang**, Yilun Chen, Haicong Zhang  
*2014 IEEE 15th Workshop on Control and Modeling for Power Electronics (COMPEL)*, 2014

## Teaching

### Teaching Assistant

- EECS 397/497 Wireless and Mobile Health (mHealth) 2017, 2018
- Designed programming homeworks, graded, assisted in course projects
  - Held office hours

## Students Mentored

Chixiang Wang (now Dartmouth PhD student)	Nov 20 - Feb 21
Qiuyang Xu (now NU undergraduate)	Jun - Sep, 2020
Fanfei Meng (now NU PhD student)	Jan - Jun, 2019
Ziwei Dong (now Emory PhD student)	Jun - Sep, 2018

## Skills

**Programming:** Python (pytorch, tensorflow, sklearn, tslearn, numba), Matlab, C/C++, R

**Tools:** AWS, Git, Docker

## References

Available upon request.