Shibo Zhang

⌂ Homepage   ✉ shibozhang2015@u.northwestern.edu   ☏ (+1) 224-999-2864

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, with applicable code/data open-sourced;
- 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

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

Employment

Samsung Research America, Research Intern, Mountain View, CA   Jan - Jun, 2021

○ 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;

○ Patenting proposed MCC algorithm as a leading author.

○ Submitted work to EMBC 2021 [link] and ICML workshop.

OPPO Research Institute, 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

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

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.)