

Yiran Zhao

I envision that mental health interventions can be *mindless* and step in autonomously when people are in distress. I use two approaches to work toward this grand vision:

- 1) How can we design wearable devices that utilize the body itself as *mindless* interventions?
- 2) How can we design closed-loop intervention systems to empower people to manage their mental health symptoms and regain control over their body and mind?

I draw from my interdisciplinary knowledge and mix-method expertise. I rely on my background in neural engineering and cognitive neural science to design interventions grounded in **neurophysiology**. I utilize **rapid prototyping** and **machine learning** skillsets to build wearable devices and sensor systems. I design **quantitative** behavioral studies to evaluate intervention systems. Most importantly, I am conscious of exposing human to autonomous interventions in vulnerable moments; therefore, I utilize **qualitative** methods to understand how humans make decisions and how to design tools that empower patients.

PhD Student

Information Science
Computer and Information
Science
Cornell Tech
New York, NY

WEBSITE

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EDUCATION

- 2019 – Present **Cornell Tech**
Ph.D. Information Science
Advisor: Tanzeem Choudhury, Qian Yang
- 2017 – 2019 **University of Washington**
M.S. Biomedical and Health Informatics
Advisor: Wanda Pratt, Ari Pollack, Shwetak Patel
- 2013 – 2017 **Georgia Institution of Technology**
B.S. Biomedical Engineering; minor of Computer Science
Advisor: Hang Lu, Eric Schumacher

PUBLICATIONS AND CONFERENCES

- P6 CRAFT @ Large: Building Community Through Co-Making
Yiran Zhao, Maria Alinea-Bravo, Niti Parikh
ISAM 2021
- P5 Support Goal-Based Collaboration for Hospitalized Children
Yiran Zhao, Yoojung Kim, Calvin Apodaca, Regina Casanova-Perez, Shefali Haldar, Sonali R. Mishra, Julia C. Dunbar, Ari Pollack, Wanda Pratt
CSCW 2021
- P4 CASPER: Capacitive Serendipitous Power Transfer for Through-Body Charging of Multiple Wearable Devices
Edward Jay Wang, Manuja Sharma, Yiran Zhao, Shwetak Patel
ISWC 2018
- P3 E-archery: Prototype Wearable for Analyzing Archery Release.
Yiran Zhao, Shanu Salunke, Alexander Leavitt, Kevin Curtin, Nghia Huynh, and Clint Zeagler
Ubicomp 2016
Best Paper Wearable Sports Workshop
- P2 Investigating the Intersession Reliability of Dynamic Brain-State Properties
Derek M. Smith, Yiran Zhao, Shella D. Keilholz, and Eric H. Schumacher
Brain Connectivity 2018, 8(5), 255-267.

- P1 Reverse-Correlation Analysis of the Mechanosensation Circuit and Behavior in *C. elegans* Reveals Temporal and Spatial Encoding
Daniel A. Porto, John Giblin, Yiran Zhao, Hang Lu
Nature Scientific Reports 2019, 9(1), 1-14

FELLOWSHIPS

- Sept 2021 **Digital Life Initiative Doctoral Fellow**
Cornell Tech
- May 2021 **Public Interest Tech Impact Doctoral Fellow**
Cornell Tech

AWARDS

- Sept 2016 **Best Paper Award**
ISWC/UbiComp 2016 Wearable Sports Workshop
- Oct 2016 **President Research Award**
Georgia Institute of Technology

RESEARCH

- May 2021 - **CRAFT @ Large: Building Community Through Co-Making**
Current **Qualitative | Rapid Prototyping | Co-Design | Informal Methods of Design**
Advised by Niti Parikh, Deborah Estrin
- Conduct weekly workshops for community members to co-make through informal methods of design; Conducted qualitative interview with recreational and art therapists to understand how therapists design recreational and crafting sessions and assess residents' progression through such sessions
- Present at ISAM 2021*
- Feb 2021 - **BioScholar: Investigating how clinicians use literature as explainable decision support**
Current **Qualitative | Sense-making | Clinical Decision-Making | Human-AI Interaction**
Advised by Qian Yang
- Conducted qualitative interview and think aloud sessions with clinicians and clinical librarians to understand how they search, evaluate and make sense of biomedical literature to facilitate decision making at point-of-care; Synthesized implications for how AI-powered clinical decision support systems can improve explainability
- Submitted to CHI 2022*
- Nov 2020 – **Romotouch: Mitigating stress through affective touch**
Current **Quantitative | Rapid Prototyping | Behavioral Experiment | Mental Health Intervention**
Advised by Tanzeem Choudhury, Pedro Lopes
- Developing wearable actuators to deliver affective touch as a mindless, inherently pleasant stress intervention. Designed and conducting controlled behavioral experiments to evaluate the effect in heart rate variability, subjective stress rating, affects and pleasantness
- Feb 2020 – **Cravigator: Mindless craving intervention through vibrotactile heart rate biofeedback**
Current **Quantitative | Sensor Fusion | Behavioral Experiment | Mental Health Intervention**
Advised by Tanzeem Choudhury, Emanuela Offidani
- Designed and conducting experiment to evaluate the effectiveness of smartwatch-based, stress-lowering vibrotactile heart rate feedback on reducing craving for alcohol and nicotine
 - Developing closed-loop system that detects the usage and craving for e-cigarette and automatically activates stress-lowering intervention to reduce e-cigarette usage.

- Jan 2018 – Oct 2020 **Plan&Talk: Supporting collaborative goal-setting for hospitalized adolescent patients**
Qualitative | Interface Design | Patient Engagement
 Advised by Wanda Pratt and Ari Pollack
- Designed and developed an interface to facilitate collaborative goal-setting for hospitalized children; Conducted design workshops and expert review workshops
 - Lead a technology probe study to characterize the effect of goal-based on patient-caregiver-care provider collaboration for hospitalized adolescents; conducted semi-structured interviews; coded interview data, observation notes and app usage data
- Published in CSCW 2021*
- March 2018 – Sept 2018 **CASPER: Capacitive serendipitous power transfer for through-body charging of multiple wearable devices**
Quantitative | Rapid Prototyping | System Characterization | Wireless Charging
 Advised by Edward Wang, Shwetak Patel
- Developed digital jewelry prototypes for a capacitive through-body charging system; characterized the charging requirements of the electronics for the jewelry and implemented as tattoos with lights and a charging jacket; developed the design guideline for such system
- Published in ISWC 2018*
- Jan 2016 – May 2017 **Reverse-correlation analysis of the mechanosensation circuit and behavior in *C.Elegans* reveals temporal and spatial encoding**
Quantitative | Computer Vision | Neural Engineering
 Advised by Hang Lu
- Designed PDMS microfluidic devices; Applied computer vision and system identification techniques to analyze neural imaging data and model the neural circuit in *C. elegans*
- Published in Nature Scientific Reports 2019*
- Sept 2015 – May 2017 **Investigating the intersession reliability of dynamic brain-state properties**
Quantitative | Machine Learning | Cognitive Neuroscience
 Advised by Derek Smith, Eric Schumacher
- Analyzed functional MRI data of human brain with computer vision and machine learning to identify the activation patterns of brain networks; developed MATLAB-based application for fMRI signal processing and unsupervised learning
- Published in Brain Connectivity 2018*

PROJECTS

- March 2018 – June 2018 **Conceptualization of Personal Values for Patient-Provider Communication for patients with multiple chronic conditions**
Interface Design | Patient Engagement
 Advised by Andrea L Hartzler and James Ralston
- Led the development of a design guideline that helped patients reflect on connections between personal values and self-care strategy, as well as manage self-care for multiple chronic conditions.
- Jan 2017 – May 2017 **AirTech: Home-Use Lung Function Monitoring Device**
Rapid Prototyping | Mobile Development | Sensor Fusion
- Partnered with Micro-C LLC., led the development of a lung function monitoring device and iOS application for pediatric lung disease patients. The system quantified air flow rate using pressure sensors and exhaled gas components using CO₂ sensor, conducted test validity check, and automatically recorded test results to compatible iOS application
- Jan 2016 – Sept 2016 **E-archery: Prototype Wearable for Analyzing Archery Release**
Quantitative | Rapid Prototyping | Sports Training
 Advised by Clint Zeagler, Thad Starner
- Led the development of a wearable glove and Android application system for archery form classification from accelerometer and IMU sensor data; conducted user interview with the university's archery team
- Published in Ubicomp 2016*

PROFESSIONAL

Summer 2018 **Proteus Digital Health LLC.**

Redwood City, CA

Algorithm Engineer Intern

- Led the development of algorithms based on sensors in a wearable pill detection patch (ECG, device temperature, skin conductivity and accelerometer) for user activity classification and device attachment quality classification; implemented such algorithms in iOS and Android application; conducted on-person field study

Sept 2015 – **Invention Studio**

May 2017 Georgia Institute of Technology

Prototyping Instructor

- Instructed, trained and advised students on prototyping with 3D printing, waterjet, laser cutting, electronics and circuits, and various metalwork and woodwork tools

TEACHING

Graduate Ubiquitous Computing
Applied Machine Learning
Data Science in the Wild
Psychological and Social Aspects of Technology
Prototyping Studio of Human-Computer Interaction and Design

K-12 Infectious Disease Modeling and Vaccine Mechanism for COVID-19
Playful Digital Interaction with Traditional Instruments
Self-Tracking and Prediction of Menstrual Pain: Support Adolescents Female to Design
Technology for Themselves

NON-PROFIT

Sept 2013 – **Engineers without Borders Uganda Clean Water Program**

May 2015 Georgia Institute of Technology

Director of Operation

- Implemented a borehole well with a solar pump in Oloo, Uganda; communicated with the village community throughout the design process; trained the community technicians responsible for well and pump maintenance; conducted local health survey; the project allowed the community of approximate 200 people to have access to clean water

PATENT

Application **DEVICE, SYSTEM, AND METHOD FOR CONTEXT-AWARE MEASUREMENT BASED MEDICAL COMPLIANCE**

Aditya Dua, Bill Weeks, Ronny Li, Neraj Bobra, Yiran Zhao

Provisional Application Filed on June 15th, 2018

SKILLS

Data Analytic/ML MATLAB, Python, Keras, OpenCV, TensorFlow, R, PLAS, Mathematica, Netlogo, GPower, AFNI

CAD Solidworks, Autodesk Fusion 360, Sketch Up, Inkscape, Adobe Illustrator

Prototyping PSoC, Arduino, 3D Printing, laser-cut, waterjet, electronics, woodwork, metalwork

Programming Java, C, Python, JS, Flask, ReactJS, Assembly, GBA, Lua, php, Unix Shell, Android, iOS, Latex

Cloud Computing SQL, MongoDB, AWS

Interface Design Sketch, Figma, Balsamiq

Qualitative Study Interviews, think aloud, survey/questionnaires, participatory design, cognitive modeling

Language Mandarin – native; English – fluent; Japanese – moderate; Korean – beginner