Xinlei Yu

Xinlei's Website(click here)   Los Angeles, California, United States   xinleiyu@usc.edu

Research Interest

My research focuses on bridging human and computing systems through interdisciplinary research to create interactive devices. Specifically, I'm interested in building a general haptic device that not only works responsively with extended reality but also as a stand-alone device.

Education

University of Southern California, Los Angeles, CA, United States   January 2022-Present
Master of Science in Computer Engineering   Graduation: December 2023
Current GPA:3.52/4.0

Iowa State University, Ames, IA, United States   January 2018-December 2021
Bachelor of Science in Computer Engineering with Cum Laude
GPA: 3.61/4.0

On-Going Work

Wearable Electro-tactile Stimulation Device
- I'm working on a haptic project to understand human perception and emotional responses to electro-tactile stimulation. The goal is to create a responsive, lightweight wearable device offering personalized electro-tactile feedback, designed to integrate seamlessly with virtual reality environments.

Presentations

Electro-tactile Stimulation as a Modality for Sensation Illusion on the Arm, Irvine, CA, United States.
Southern California Robotics Symposium, Oral Presentation, September 2023 (SCR '23).

Tummy Time Toy, Los Angeles, CA, United States
NSF DARE conference, Demo at Lab Tour, March 2023 (DARE '23).

Research Experience

USC HaRVI Lab with Prof. Heather Culbertson   May 2023-Present
Worked on a *electro-tactile stimulation device* project as the co-leading researcher and presented preliminary results at the Southern California Symposium 2023 (SCR'23).
- **Oral Presentation at SCR'23** Presented preliminary results on the effect of the perception of Electro-tactile feedback on the forearm about factors such as location, frequency, and skin moisture based on previous studies at SCR'23.
- **Reinforcement learning-based calibration for electro-tactile stimulation** Designed a calibration method using a multi-armed bandit algorithm to discover the human perception of the electro-tactile stimulation and find the optimal signal parameters for rendering pleasant electro-tactile stimulation. Hardware setups includes a Sensory S826 PCI board, custom-built amplifiers, and a TENS pad array sleeve. Software setups consists ROS for effective backend-frontend communication, an user interface frontend, and a C++ backend for hardware interfacing.
- Conducted user studies for multiple projects.
- Written a poster presented at the World Haptics Conference 2023.

USC Brain-Body Dynamics Lab with Prof. Francisco Valero-Cuevas   August 2022-April 2023
Worked on *Tummy Time Toy: Infant Motor Learning Assistant Toy* project.
- **Tummy Time Toy** Developed a computer vision-assisted infant toy designed to promote prone motor skills by rewarding head lifts with stimuli and to improve muscle control and tummy time duration. The Tummy Time Toy is undergoing the US patent review process.
- Implemented a computer vision algorithm to track infant head motion with OpenCV-Python, and constructed a full-stack web application using HTML, CSS, JavaScript, and Python Flask for remote research monitoring, data collection, and toy control. Developed a portable, microcomputer-controlled base for the tummy time toy, incorporating relay circuits and a custom 3D-printed housing.
- **Demo at DARE 23'** Demonstrated the Tummy Time Toy at NSF DARE conference 2023 as part of lab tour.

Teaching Experience	**CprE 308 Operating System**	August 2021-December 2021

CprE 308 Operating System August 2021-December 2021

Undergraduate Teaching Assistant with Prof. Mai Zheng

- Teaching assistant for the CprE308 Operating System: Principle and Practice.
- Conducted weekly lab sessions with 25 students, graded homework and lab assignments, and hosted weekly office hours.

Grad Research Course Projects

EE 675 Data Analysis and Control Techniques for Neurotechnology Design

with Prof. Maryam Shanechi   Fall 2023 (ongoing)

- **Course paper: EEG-based emotion recognition** The main research question is whether the use of the Kalman filter and smoothing can enhance the accuracy of EEG brainwave in recognizing emotional states, especially considering prior work has demonstrated high accuracy. The project utilized dataset provided from BCMI@SJTU and Kaggle.

EE 554 Cyber-Physical Systems, with Prof. Paul Bogdan   Fall 2022

- **Course Paper: Shortest Path Problems** Authored a course paper evaluating Dijkstra's, Bellman-Ford, and Floyd-Warshall algorithms for the shortest path problem. Utilized LLVM for graph generation and Gephi for visualization and property analysis. Identified that increasing input nodes significantly enlarges graph size while maintaining stable clustering and modularity coefficients.

Other Experience

ISU Dependable Networking and Computing Lab   September 2020-December 2020

Undergraduate Researcher   Prof. Hongwei Zhang

- Participated the ARA project proposal for an NSF research grant on rural broadband, reaching the finalist stage.

Technical Skills

Programming Languages:	Python, Java, C++/C, VHDL, Verilog, C#
Tools and Frameworks:	OpenCV, PyTorch, ROS, GitHub, Google Cloud Platform
Web Development:	HTML, CSS, JavaScript, React, Flask, NodeJS, Angular, Express
Software:	MATLAB, VS Code, Unity, ModelSim, Quartus
Hardware:	Embedded system, Circuit design, Signal processing, Analog electronics

Awards

2018 Gold Merited Scholarship, Office of Admission, Iowa State University – $32,000

Dean's Lists

Community Involvement

IEEE-HKN@ISU, *Student Member*

References

Dr. Heather Culbertson

Assistant Professor of Computer Science at USC, **Email:** hculbert@usc.edu

Dr. Francisco Valero-Cuevas

Professor of Biomedical Engineering at USC, **Email:** valero@usc.edu

Dr. Stacey Dusing

Associate Professor of in Pediatric Physical Therapy at USC, **Email:** stacey.dusing@pt.usc.edu