Ken Christofferson

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Education

University of Toronto Computer Science	*Ph.D. 2025**
Tsinghua University Data Science and Information Technology	*MSE-DSIT 2021*
University of Washington Technology Innovation	*M.S. 2021*
American University International Studies, Economics (Minor)	*B.A. 2007*

Publications and Projects

EarSteth: Phonocardiogram Reconstruction Using Earbuds **Primary Author*
In Submission - MobiSys 2023
Using a convolutional neural network and digital signal processing techniques, this project reconstructs phonocardiograms (heart sounds) from audio recorded using a commercial ANC-enabled earbud's feedback microphone. A user study comparing reconstructed and real heart sounds showed that they were perceptually similar. A quantitative analysis showed that the timing of cardiac cycle events (e.g., S1 and S2 sounds) were accurately placed. This project is supervised by Professor Shwetak Patel and Professor Alex Mariakakis.

Ultrasonic Silent Letter Recognition for Speachless Text Entry using Earbuds
Submission Planned
Moving the mouth and jaw create small changes in the morphology of the ear canal which prior work has shown can be used for user identification and command clasificaiton (e.g., "Volume up"). This project uses an ultrasonic FMCW (Frequency Modulated Continuous Wave) chirp to detect changes in ear canal deformation and classify the mouthed letters for hands-free silent text input.

Sleep Sound Event Detection Using ANC-Enabled Earbuds **Primary Author*
Published - HCCS Workshop at PERCOM 2022
Under the supervision of Professors Yuntao Wang and Alex Mariakakis, this research developed a lightweight convolutional audio classification algorithm capable of distinguishing between health-related sounds made by sleeping humans. Audio data was recorded using both the inner and outer microphones present in ANC-enabled earbuds.

An AI Driven, Mechanistically Grounded Geospatial Liquefaction Model for Rapid Response and Scenario Planning
Published - Soil Dynamics and Earthquake Engineering 2022
This work develops liquifaction risk prediction models using geospacial (e.g., distance to water) and earthquake features (e.g., shear wave velocity). While liquefaction is a phenomenon best predicted by mechanics, subsurface traits lack theoretical links to above-ground parameters, but correlate in complex, interconnected ways.

SCIO RDTReader
Project - GIX Launch Project 2020
This project designed and implemented an end-to-end rapid diagnostic test workflow and computer vision aided interpretation application for Android.

Induced Acoustic Resonance for Noninvasive Bone Fracture Detection Using Digital Signal Processing and Machine Learning **Primary Author*
Published - IEEE GHTC 2020

This project developed an embedded system capable of noninvasive bone fracture detection. Data was collected from human limb facsimiles created from animal bones and gelatin (simulated flesh). Successfully classified all simulated test limbs (limbs not included in algorithm training) and classified more than 93% of one-second audio segments correctly.

FaceSpace - Face Touching Detection for the Apple Watch
Project - BuiltForCovid19 Hackathon Featured Project
FaceSpace is an Apple Watch application which uses an onboard IMU to predict when users' hands are moving to touch their face.

Work Experience

Computational Health and Interaction Lab, University of Toronto - Toronto, ON ***Sept 2021 -***
Graduate Research Assistant

Centre for eHealth Innovation, University Hostpital Network - Toronto, ON ***Sept 2021 -***
Doctoral Trainee

Smartsheet Inc. - Seattle, WA ***Nov 2015 - Aug 2019***
Lead Technical Solutions Implementation Manager *Dec 2018 - Aug 2019*
Lead Solutions Consultant *Feb 2018 - Dec 2018*
Solutions Consultant *Nov 2015 - Dec 2018*

Corporate Executive Board - Washington, DC ***Mar 2014 - Jun 2015***
Research Analyst

The Language Co. - Puerto Montt, Chile ***June 2013 - Dec 2013***
Regional Manager

Credit Builders Alliance - Washington, DC ***May 2011 - Aug 2012***
Program Associate

Internships
PATH for Global Health - 2021
The United States Senate - 2009
The German Marshall Fund of the United States - 2008

Skills and Proficiencies

Python, Tensorflow, Keras, PyTorch, JAX Android Development, Git, Flutter, ML/DL, Audio Processing, Physiological Sensing, Activity Recognition, Acoustic Sensing, Audio, Computational Image Processsing, Research Design, Rapid Prototyping, Human-Centered Design, Project Management, Fluent in Spanish

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Professional Memberships - IEEE