

Jan C. L. Lau

Doctoral Student in Biomechanics and Human-Centred Robotics

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RESEARCH FOCUS

- Doctoral: Analysis of stability and robustness of karate motions to develop new criterion related to system modelling of humanoid robots and/or robotic lower-limb exoskeletons
- Master's: Towards improving human-exoskeleton interaction in the geriatric population with a novel tutorial and optimal control

EDUCATION

PhD in Systems Design Engineering

University of Waterloo, May 2023 to Present

Specialization in Biomedical Engineering

Waterloo, Canada

MASc in Systems Design Engineering

University of Waterloo, 2023

Specialization in Biomedical Engineering

Waterloo, Canada

BASc in Biomedical Engineering

University of Waterloo, 2020

Waterloo, Canada

AWARDS

Provost's Doctoral Entrance Award for Women

University of Waterloo, 2023

NSERC Undergraduate Student Research Award

University of Waterloo, 2017

RESEARCH EXPERIENCES

Doctoral Student Researcher

HCRMI Lab, University of Waterloo: May 2023 to Present

Waterloo, Canada

- Conducting literature review on existing stability criteria, human stability, and biomechanics of martial arts
- Designing motion capture experiments involving the Theia motion capture system (marker-less)

MASc Researcher

HCRMI Lab, University of Waterloo: Sep. 2020 to Apr. 2023

Waterloo, Canada

- Generated a new sit-to-stand trajectory with optimal control as a method to modify an existing lower-limb exoskeleton towards geriatric users
- Developed a novel protocol intended to improve exoskeleton usage familiarity and conducted a preliminary study with able-bodied, first-time users (study was limited by COVID-19 restrictions)
- Connected with psychologists and researchers from Germany on improving geriatric mobility in the interdisciplinary consortium HeiAge
- Analyzed, processed, and collected human motion capture data using the Vicon Nexus System (marked)

Undergraduate Research Assistantship Student

Waterloo, Canada

Engineering Bionics Lab, University of Waterloo: Jan. 2018 to Apr. 2018

- Calculated identification rate from experimental data to evaluate biometrics algorithm
- Conducted literature research on behavioral biometrics
- Analyzed EMG data from signal processing MATLAB code to identify noise

Research Assistant

Waterloo, Canada

Engineering Bionics Lab, University of Waterloo: Jan. 2017 to Apr. 2017

- Designed and 3D-printed a modular exoskeleton prototype to help people with Parkinson's Disease initiate gait
- Applied anthropometric data, engineering design methods, and mechanics calculations to exoskeleton design
- Performed Finite Element Analysis on Fusion 360 to determine stress profile

STARTUP EXPERIENCE / CAPSTONE PROJECT

Co-Founder

Toronto, Canada

Cadera Inc.: Sep. 2018 to Jul. 2021

- Co-developed a physical simulator to train physicians to better detect and diagnose developmental dysplasia of the hip (DDH) in infants
- Awarded CAD60k and completed the Accelerator Centre Jumpstart program in 2021
- Conducted literature research on infant hip anatomy and DDH
- Designed and 3D-printed mechanical components for prototypes
- Developed business plan and managed budget

WORK EXPERIENCES

Assistant Pricing Analyst

Stuttgart, Germany

Global Pricing, Philips Healthcare: Jan. 2019 to Aug. 2019

- Designed a competition tool for pricing intelligence on Qlik Sense
- Applied mathematical model to observe product sales trend as a foundation for determining price elasticity, customer segment identification, and product sales forecast
- Developed code to optimize product portfolio using the Extract-Transform-Load process

Marketing Communications Assistant

Hong Kong

Marketing & Communication Department, IDS Medical Systems (HK) Co. Ltd.: Sep. 2017 to Dec. 2017

- Supported sales team in crafting medical devices product catalogue for Hong Kong market
- Collaborated with seven Asia offices to launch artefacts and internal programs to promote the company branding
- Trained Hong Kong sales team to operate promotional materials for marketing events

EXTRACURRICULAR LEADERSHIP EXPERIENCES

Marketing and Social Media Executive

Waterloo, Canada

Karate & Jujitsu Club, University of Waterloo: May 2022 to Present

- Managing and creating social media content on Facebook and Instagram
- Communicating with target audience on social platforms and increased total followings by 51% year-over-year
- Orchestrating club fair and open house arrangements to promote karate (goju-ryu) and Japanese jujitsu (shindo-ryu) in the UWaterloo community
- Coordinated logistics with the Chief Instructor and Club Manager for an Ontario Inter-University tournament

Orientation Leader

Waterloo, Canada

Engineering Orientation Week, University of Waterloo: Sep. 2016 to Sep. 2019

- Co-managed 8 front-line leaders and over 100 first-year students
- Ensured smooth logistic flow from one event to another
- Prepared engineering activities and team-building events with other student volunteers

Team Lead

Waterloo, Canada

Biomechatronics Club, University of Waterloo: Jan. 2018 to Dec. 2018

- Delegated tasks amongst sub-team leaders to ensure sub-teams work towards their goal
- Gained a profit of over CAD550 in six hours through fundraising event
- Organized workshops to teach team members technical skills
- Facilitated a sub-team on deciding project scope with the Priority Criteria Matrix and Best-of-Class Chart

Chapter Lead

Waterloo, Canada

eNable Waterloo, University of Waterloo: Sep. 2016 to Aug. 2017

- 3D-printed prosthetic hands to help children to perform daily tasks as part of the “Enabling The Future” initiative
- Promoted to Chapter Lead within 3 months due to outstanding leadership skills and teamwork
- Delegated tasks amongst team members to obtain optimal work efficiency
- Experimented with Fusion 360 to customize prosthetic hands for children depending on their needs

PUBLICATION

Jan C. L. Lau and Katja Mombaur. “Preliminary Study on a Novel Protocol for Improving Familiarity with a Lower-Limb Robotic Exoskeleton in Able-Bodied, First-Time Users.” *Front. Robot. AI* 8:785251, January 2022. doi: [10.3389/frobt.2021.785251](https://doi.org/10.3389/frobt.2021.785251)

CONFERENCE PRESENTATIONS

Jan C. L. Lau and Katja Mombaur. “Towards crutch-less exoskeleton-assisted geriatric sit-to-stand motions – an experimental and optimization-based study.” *Accepted to the International Society of Biomechanics-Japanese Society of Biomechanics Conference (ISB-JSB 2023)*. Fukuoka, Japan. August 2023.

Jan C. L. Lau and Katja Mombaur. “Motion analysis and motion synthesis on crutch-less sit-to-stand for geriatric users with an exoskeleton using optimal control.” *Accepted to the TGCS Symposium on Computer Simulation in Biomechanics (ISB TGCS 2023)*. Kyoto, Japan. July 2023.

Jan C. L. Lau and Katja Mombaur. “How can we make exoskeletons less intimidating for geriatric users?”. *Poster presented at the Internationales Wissenschaftsforum Heidelberg Hengstberger Symposium on Aging and Technology*. Heidelberg, Germany. May 2022.

Jan C. L. Lau and Katja Mombaur. “Protocol for improving familiarity with a lower-limb robotic exoskeleton in able-bodied, first-time users.” *Poster presented at the ISB 2021 Conference*. Virtual. July 2021.

SKILLS AND INTERESTS

- Programming skills: Python, MATLAB, C++, R
- Language skills: Cantonese (native proficiency), Mandarin (native proficiency), German (A2 proficiency), Spanish (elementary proficiency)
- Athletic interests: Karate (brown belt in goju-ryu) and Muay Thai
- Artistic interest: Drawing cartoons and comics