Lavan A. Sumanan

Wearable Sensors Researcher

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Education

B.A.Sc., Biomedical Engineering **University of Waterloo** Sep 2021 - Apr 2026 (Expected)

- Relevant Courses: Tactile Sensors, Multi-Sensor Data Fusion, Biomedical Signal Processing, Neural Rehabiliation Engineering, Sports Engineering, Optimization, Statistics

Research Interests

Rehabiliation devices, smart textiles, self-powered sensing, wearability & ergonomics, soft robotics, sports engineering

Publications and Posters

Publications

N. Levinski, **L. A. Sumanan**, D. Tong, J. Kowalski, C. Sjaarda, C. L. Ren (2026). A Pneumatic McKibben Muscle-Based Limb Volume Phantom Model for Wearable Strain Sensor Validation. (Submitted) c66d84f9-4f2b-4f40-8d2f-8624d9e87e17.

N. Levinski, D. Tong, **L. A. Sumanan**, J. Kowalski, C. Sjaarda, R.Z. Gao, C. L. Ren (2026). Soft, Highly Stretchable Capacitive Strain Sensors for Continuous In-Home Volumetric Monitoring of Breast Cancer Related Lymphedema. (Submitted) BIOSBE-D-26-00541.

Posters

L. A. Sumanan, C. Sjaarda, J. Kowalski, J. Michaud, C. L. Ren (2026). Wearable Capacitive Pressure Sensor Design. 48th International Conference of the IEEE Engineering in Medicine and Biology Society. (Submitted) 3431.

D. Tong, **L. A. Sumanan**, N. Levinski, C. L. Ren (2026). Highly Stretchable Capacitive Strain Gauges for Continuous Volumetric Monitoring of Limb Swelling. 48th International Conference of the IEEE Engineering in Medicine and Biology Society. (Submitted) 3505.

J. Bose, S. Ahmed, **L. A. Sumanan**, Z. Syed, A. Yu 1, J. Tung, C. Mele (2026). Shell-Based Design Framework for the Development of a Lower-Limb Exoskeleton Anthropomorphic Test Device. *48th International Conference of the IEEE Engineering in Medicine and Biology Society*. (Submitted) 3897.

Honours and Awards

Canadian Posture & Seating Centre Project Award ($100)	2025
NSERC Undergraduate Student Research Award ($6000)	2025
Engineer of the Future Trust Award ($200)	2025
University of Waterloo President's Research Award ($1500)	2023
University of Waterloo Faculty of Engineering Entrance Scholarship ($4000)	2021
University of Waterloo President's Scholarship of Distinction ($2000)	2021

Experience

Wearable Sensors Research Assistant **Waterloo Microfluidics Lab** May 2025 - Present

- *Supervised by Dr. Carolyn L. Ren.* Conducting experimental research on low-cost materials and fabrication approaches for capacitive wearable pressure and strain sensors applied to health monitoring and human-robot interaction
- Contributed to data analysis, figure preparation, and methodological development for a successfully defended Master's thesis on wearable capacitive strain sensing for lymphedema-related limb volume measurement
- Developed a comprehensive test framework, including automation and analysis tools, to enable rapid and systematic sensor characterization

System Validation Intern **onsemi** Jan 2025 - April 2025

- Developed test applications for a digital signal processor using embedded C and chip-specific assembly language to validate core functional blocks
- Utilized electrical test instrumentation (digital logic analyzers, digital multimeters, source measurement units) to support systematic hardware characterization and debugging

Undergraduate Researcher **University of Waterloo** May 2023 - Aug 2023

- Reviewed 30+ papers to identify peak torque and velocity of lower limb joints for musculoskeletal torque model
- Identified joint x-y coordinates from motion capture data to use as training data for ML model using **OpenCV**

Web Applications Developer **Intellijoint Surgical** Jan 2023 - Apr 2023

- Implemented role-based access control and concurrent access on an ISO 13485-certified medical web app for orthopedic surgeons to plan hip surgery using React, TypeScript, Java Spring, PostgreSQL, Jira, and Git/GitHub
- Applied test-driven development by a) preparing test cases during feature planning and b) writing 50+ unit and integration tests to ensure robust, secure, and well-documented software that complies with quality standards

SKILLS

Research: Test Equipment (DMM, SMU, Tensile Test), MATLAB, Figure Generation, Simulation (COMSOL)

Development: SOLIDWORKS, Python, C++, STM32, PCB/FPCB, FPGA

Fabrication: 3D Printing (FDM/SLA/DIW), Laser Cutting, Screen Printing, Heat Pressing, Textiles

PROJECTS

FallDetect (Smart Cane) Jan 2024

- Developed custom force sensor by characterizing voltage divider circuit under various loadings and resistors with a Velostat piezoresistor to detect force within 50-250 N range expected for elderly population
- Fused multi-modal data from tilt sensor, IMU, and force sensor by applying window averaging on IMU data and a custom state machine to detect fall states while ignoring safe states
- Developed complementary web app pairing smart cane to a phone via Bluetooth, enabling real-time fall detection and emergency alerting of loved ones when an elderly person is detected to have fallen

PumpkinGPT Oct 2023

- Engineered sentient pumpkin to detect children stealing candy, scold them with live conversation, and dispense candy at SAP event using PIR, USB mic, speaker, servo, and Raspberry Pi programmed in Python
- Utilized multiprocessing to run 4 threads for event handling, audio processing, and API calls to GPT and Google Cloud

LEADERSHIP AND VOLUNTEER WORK

Founder **Peer-Led Volleyball Coaching Organization** May 2025 - Present

- Awarded $500 in seed funding through Velocity's Cornerstone program to establish a peer-led coaching initiative
- Mentored 12 experienced undergraduate volleyball players in applying motor learning principles (as taught in BME 540) to peer coaching and skill development
- Organized six low-cost instructional clinics and one mentorship-focused tournament with 100+ attendees over all events to increase access to evidence-informed volleyball coaching for beginner players at the University of Waterloo

BME Undergraduate Mentor **University of Waterloo** Sep 2023 - Present

- Mentored first-year biomedical engineering students on academic and professional development, introducing frameworks such as iterative design, challenge point theory, and the W-curve model of cultural adjustment to support their transition to undergraduate study
- Conducted résumé reviews and mock interviews, and facilitated connections to relevant academic and research opportunities (e.g., exoskeleton research groups) to support mentees' career development

Subteam Lead **Waterloop Student Design Team** May 2022 - Dec 2022

- Led project planning and mentored junior team members, coordinating deliverables and timelines within a multidisciplinary student design team

Engineering Orientation Leader **University of Waterloo** May 2022 - Sep 2025

- Led and coordinated teams of 100+ first-year students and 5+ peer leaders annually, supporting orientation programming for the Faculty of Engineering