Ben Boguslavsky

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EDUCATION

University of Waterloo — Sep. 2022 – May 2027
*BASc Candidate for Mechatronics Engineering, **GPA: 3.95/4.00*** — *Waterloo, ON*
- Awards: President's Scholarship of Distinction, President's Research Award
- Certifications: TCPS2, Accelerated Computing in CUDA in C/C++ (NVIDIA), CSWA, French Immersion

EXPERIENCE

Machine Vision Engineer Co-op — May 2025 – Present
Taymer International Inc. — *Markham, ON*
- Created a C++/OpenCV cable defect detection module in an MFC application using ONNX-based models, with custom filtering, NMS, and Picks-Per-Inch computation to eliminate the need for manual cable measurements and inspection
- Accelerated inference of YOLO PyTorch models by 30% using ONNX Runtime with CUDA & TensorRT execution providers, building a C++ pipeline with pre/post-processing to cut deployment time from 5 min to 53 sec and eliminate engine tuning
- Secured $75K in government funding by leading a research project benchmarking dynamic vs. static input object detection models, analyzing metrics across PyTorch, ONNX, and TensorRT to optimize inference speed and deployment scalability
- Integrated Teensy 4.0 with C++ into a $50K AI cable inspection system for real-time PWM lighting control and 24-channel I/O expansion, reading camera-generated PWM signals and interfacing with MFC software via serial communication

Robotics Undergraduate Research Assistant — May. 2024 – Present
Active and Interactive Robotics Lab - University of Waterloo — *Waterloo, ON*
- Created a collision avoidance system for a KUKA robotic arm using 2D pose detection from Ultralytics YOLO processed in OpenCV and RealSense depth data to track human position, sending spatial info in Java to the Sunrise controller over UTP
- Designed and implemented a human-robot interaction experiment to study emotional and physiological responses to collaborative robot behavior, programming trajectory deviations on the Sawyer robot using Python and ROS
- Captured GSR data with Shimmer3 GSR+, analyzed results using pandas, and visualized intended vs. actual robot motion in real-time via a custom Pygame interface, enhancing user experience in human-robot interaction trials

Product Development Engineer Co-op — Sep 2024 – Dec 2024
Virtek Vision International — *Waterloo, ON*
- Built C# scripts and WinForms apps using .NET, REST APIs, and Swagger Codegen with RabbitMQ functionality to demonstrate API integration, enabling clients to create personalized software solutions and reduce support inquiries by 25%
- Migrated mobile app to a Nginx-hosted webserver with a Windows installer using Wix Toolset, enabling multi-device projector access and improving workflow efficiency across large-scale manufacturing environments

Junior Developer in Test Co-op — Jan 2024 – Apr 2024
AGF Management Limited — *Toronto, ON*
- Built Selenium Webdriver tests with JUnit 5, SQL, and Page Object Model design pattern, doubling overall test coverage
- Optimized test scenarios through SCRUM collaboration with technical experts, reducing testing cycle time by 20%

Software Quality Analyst Co-op — May 2023 – Aug 2023
Infrastructures for Information (i4i) — *Toronto, ON*
- Created tool to transfer and format data from Excel to Word using Python and XSL, saving employees 2 hours of daily work
- Conducted functional, regression and usability testing, participating in defect triage meetings to reduce post-release defects

PROJECTS

Hole/Sticker Detector @ Toyota Innovation Challenge ⚲ | *Python, Keras, OpenCV, Jupyter*
- Developed a CNN using OpenCV and Keras to classify hole and sticker features on extrusions with 98% accuracy

Two-Axis Machine Control ⚲ | *C, STM32, UART, ADC, PlatformIO*
- Programmed a 2-axis STM32 motor control system with ADC-based speed input, limit switch interrupts, and L6470 drivers

Virtual Reality Clothes Shopping @ Hack The North ⚲ | *C#, Unity, Shopify API, META Quest*
- Won Best Use of Shopify API & Ubisoft Game Challenge by creating a VR app to try on clothes from online stores

Home Security Camera ⚲ | *C++, ESP32CAM, IR/Ultrasonic Sensors, Servo Motor, 3D Printing*
- Built an ESP32-CAM system with live streaming, servo panning, IR-based password access, and ultrasonic proximity detection

TECHNICAL SKILLS

Programming Languages: C++/C#/C, Python, Java, MATLAB, VHDL
Tools & Frameworks: Git, SVN, ROS, Linux, OpenCV, CUDA, TensorRT, Numpy, pandas, Jupyter/Google Colab, Roboflow, Selenium WebDriver, Junit 5, Microsoft & Atlassian Suite
**Electrical, Embedded & Control Systems**: STM32, FPGA, I2C, SPI, UART, Oscilloscope, Soldering, PLC
Miscellaneous: SolidWorks, AutoCAD, Fusion360

Undergraduate Robotics Research Project 2   HTTPS://GITHUB.COM/BENBOGUSLAVSKY18/KUKAURA

- Created a collision avoidance system for a **KUKA** robotic arm using 2D pose detection from **Ultralytics YOLO (python)** processed in **OpenCV** and **RealSense depth** camera to track human position, sending spatial info in **Java** to the KUKA controller over **UTP**
- Designed a **3D-printable end-effector** attachment in **SolidWorks** to connect with a human model leg, enabling ankle support and knee repositioning for ACL surgery simulation
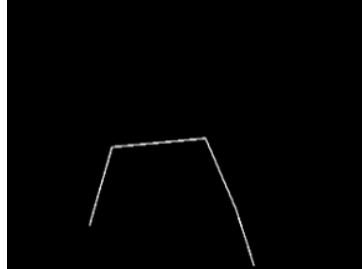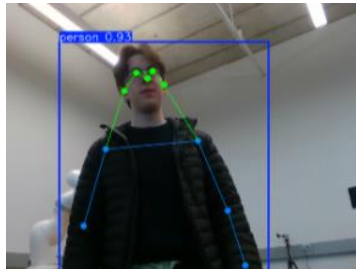
Undergraduate Robotics Research Project 1   HTTPS://GITHUB.COM/BENBOGUSLAVSKY18/SAWYER_RESEARCH_IMPLEMENTATION

- Designed and implemented a human-robot interaction experiment to study participant responses to autonomous versus manual arm control and motion accuracy, focusing on perceptions of trust, safety, and intent in robotic behavior
- Leveraged **ROS** and **Python** on Sawyer robot arm to coordinate spline arm movements along randomized and pre-defined paths, with intentional error in motion to study participant's reaction.
- Captured **GSR data** with Shimmer3 GSR+, analyzed results using **pandas**
- Developed a real-time visualization for trial participants using **Pygame**, dynamically displaying the arm's motion and path for enhanced experimental monitoring and participant interaction
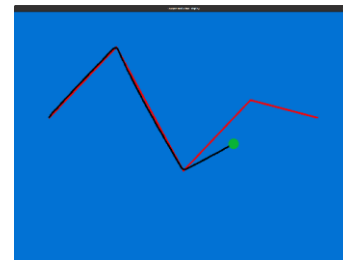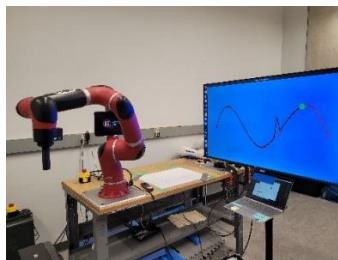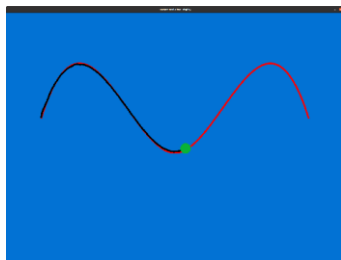
Toyota Innovation Challenge – Hole/Sticker Detector   HTTPS://GITHUB.COM/BENBOGUSLAVSKY18/TOYOTACHALLENGE-STICKERS

- Worked in teams to develop an AI program to detect/differentiate between holes and stickers on extrusions with **98% accuracy**
- Employed **Jupyter** Notebooks as a primary tool for developing and training a **CNN**, utilizing **Python**, **Keras** and **OpenCV**
- Engaged in peer-to-peer learning and knowledge sharing, actively seeking feedback from teammates and incorporating suggestions in brainstorming sessions

## Hack The North 2024 – VR Clothes Shopping

- Designed and developed a **VR** application simulating online clothes shopping, utilizing **C#** and **Unity**
- Integrated **Shopify API** to create a dynamic and interactive shopping environment, enabling users to see online store items and try them on
- **Shopify API Challenge Winner** (Best use of API) and **3rd place in the Ubisoft Game Dev Challenge**

Home Security Camera

- Implemented **ESP32Cam (C++)** locally hosted web server for real-time video
- Incorporated and programmed sensing components such as **ultrasonic sensor, servo motor** and **IR remote sensor** for functionality including controlled camera panning, password authentication, and person detection
- Designed and modelled lightweight, 3D-printable camera shell and desk clamp using **SolidWorks** and **Fusion360**
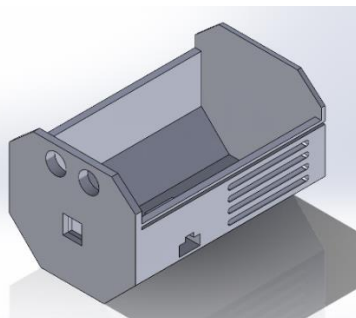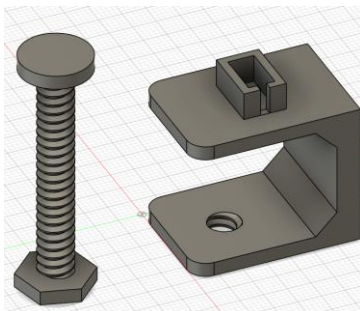

Two-Axis Machine Control

- Programmed real-time control for a two-axis machine using an **STM32** microcontroller in **C**, enabling dynamic speed modulation via **analog** potentiometers and bidirectional motor control
- Implemented **interrupt-driven limit switch handling,** modular **ADC** channel reading, and **UART**-based debugging for robust system feedback and safety
- Applied embedded systems and microprocessors principles from coursework including **ISRs**, timers, GPIO (open-drain/push-pull), and structured interfacing with external motor drivers (**L6470**)

Tennis Training Robot

- Programmed and built prototype tennis training robot that positions itself in various positions on a tennis court and launches tennis balls in random directions
- Constructed mechanical components such as **geared flywheels**, **intake system** and **internal conveyors** using Lego EV3 Robotics Kit
- Implemented **automated runtime functionality** and initial **mode selection** user interface using **RobotC**
- Developed a **color detection mechanism**, enhancing system safety and preventing insertion of unauthorized hazardous objects
- Led and collaborated within an Agile environment, participating in sprint planning/reviews while completing deliverables on time
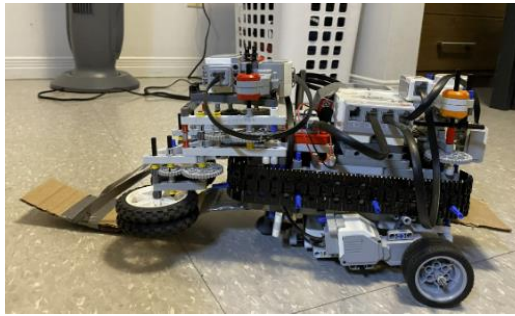
Website Credential Storage

- A **Maven**-based locally hosted website developed with **Java** to store username and password credentials, implementing **REST APIs** and **Spring Boot 2**
- Applied OOP principles from university course topics


Digital Measurement Device

- Designed, modelled and **3D printed** parts for a precision measurement device created using statistical methods using an **Arduino** with a **rotary potentiometer**, successfully achieving measurement **accuracy within one millimeter**
- Conducted **data acquisition**, **calibration** and **uncertainty analysis** to maximize measurement precision and consistency
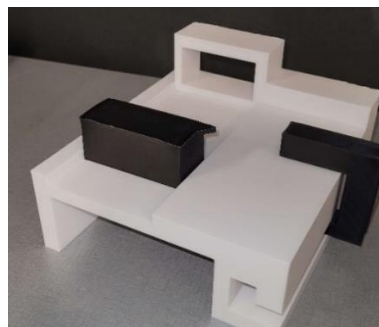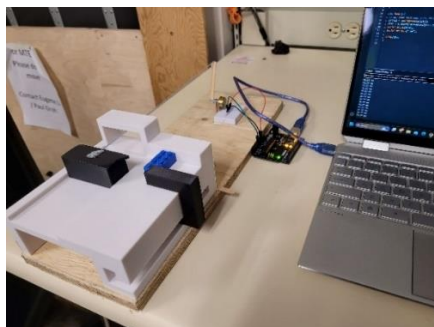
Electric Motorcycle Design Team – UW Electrium Design Team

- Participated in the design, CAD (**SolidWorks**) and **machining** of Electric Motorcycle
- Researched, documented and conducted analysis of several important processes, such as **FEA** and fairing manufacturing for improvement of future design iterations
- Conducted **FMEA**, identifying potential failure modes to maximize safety and robustness of motorcycle components
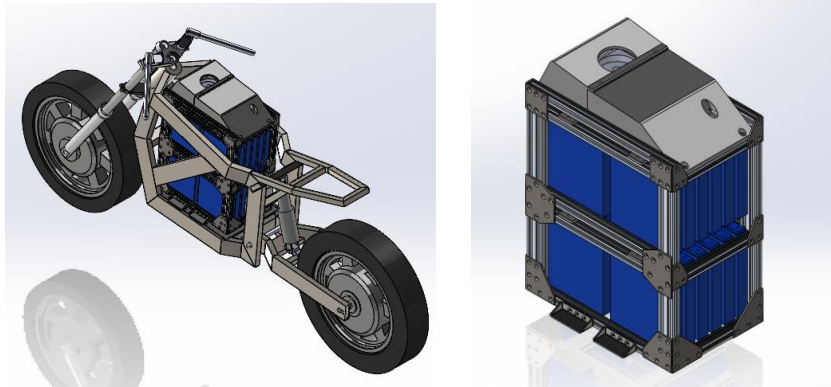
Robot Arm Torque Calculator Algorithm

- Created a program using **C++** which inputs lengths of part of a 3 DOF robot arm and outputs the optimal angles and resulting torque required to hold the manipulator at a specific static position
- Leveraged physics concepts to eliminate repetitive calculations, successfully identifying some of the lowest achievable torque values in the class.

```
**********INPUT**********
Enter 3 lengths.
L1:0.9
L2:1.2
L3:1.0
---------CASE 1---------
Angle Q1 = 2.68332 RADIANS
Angle Q2 = 0.49294 RADIANS
Angle Q3 = PI/3 RADIANS
Total Moment For Case One: -20.8815
```

```
---------CASE 2---------
Angle Q1 = 4.02931 RADIANS
Angle Q2 = 1.51404 RADIANS
Angle Q3 = 0 RADIANS
One of the arms goes below x-axis, try again.
```

```
---------CASE 3---------
Angle Q1 = -0.964888 RADIANS
Angle Q2 = -3.69693 RADIANS
Angle Q3 = PI/4 RADIANS
One of the arms goes below x-axis, try again.


TOTAL TORQUE: 20.8815
```