CHRIS PRASANNA

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SUMMARY

Detail-oriented mechatronics engineer passionate about advancing control applications through high-quality research and creative problem solving. Hands-on experience developing real-time robotic control systems and highly proficient in modern control methods, rapid prototyping, embedded systems, programming, and data science.

TECHNICAL SKILLS

Controls, Mechatronics & Robotics
Real-Time Adaptive Control, Optimal Predictive Control, Embedded Computing, BLDC Motor Control, Electromechanical System Modeling, Modern Control, Feedforward Control, DSP, Serial Interfaces

Hardware
Microcontrollers, 3D Printing, Embedded System Design & Fabrication, Machining (CNC, Mill, Lathe), DAQ, PID Servo Controllers, Sensors, Shielding, Soldering, Digital & Analog Circuit Prototyping

Programming & Software Tools
Python, LabVIEW, C/C++, Pytorch, Arduino, MATLAB, CAD (SOLIDWORKS), Optuna, Simulink, HMI/GUI Development, LaTeX, Pandas, Git, LM Flash Programmer, HTML, CSS, Abaqus, PuTTY

Product Design & Development
Rapid Prototyping, DFMA, DFMEA, Reliability Test Design & Analysis, GD&T, Component Selection, Materials Testing, Lagrangian Mechanics, Protocol Development, Supplier/Vendor Coordination

Data Science
Deep Learning, Machine Learning, Reinforcement Learning, Time Series Analysis & Forecasting, Optimization, System Identification, Algorithm Implementation, Computer Vision, Video Tracking, Evolutionary Algorithms, Black Box Optimization & Sampling, PCA, Feature Manipulation, Data Analysis

PROFESSIONAL EXPERIENCE

Graduate Research Assistant — U.S. Department of Veteran Affairs, Seattle, WA
Center for Limb Loss & Mobility — 7/2019 – Present

- Invented a time-invariant and adaptive control strategy for a robotic ankle-foot prosthesis which significantly improved amputee walking symmetry
- Designed an extensive and reliable real-time LabVIEW program responsible for mechatronic system control, sensor fusion, filtering, wireless network communication, coordinate system transformations, data logging, and visualization
- Developed deep neural network models to accurately predict human-robot system dynamics for future prosthesis control methods
- Built a compact embedded system that enclosed multiple sensor interfaces, custom circuit boards, shielding, and BLDC servo controllers within a 3D-printed case
- Successfully learned and implemented advanced control techniques such as iterative learning, robot model inversion, spectral methods, PCA, and real-time mechanical phase variables in order to achieve the best controller performance
- Executed bench tests, conducted human subject experiments, implemented a data-driven learning pipeline, and performed statistical analyses to evaluate the mechanical device and control method

Research & Test Engineer — U.S. Department of Veteran Affairs, Seattle, WA

Center for Limb Loss & Mobility 2/2018 – 6/2019

- Conducted research that aimed to reduce limb loss and developed novel techniques using computer vision and image processing techniques in order to better evaluate lower limb bone motion
- Led and collaborated on mechanical design projects for unique laboratory equipment needs, including but not limited to, a ligament potting jig for Instron testing, high-speed camera gantries, and an environmental chamber that simulates in-vivo conditions for biological material testing
- Created a closed-loop feedback controller for the mechanical testing chamber using an Arduino, LabVIEW, thermal sensors, and heat lamps in order to reach and maintain a desired temperature. This system effectively reduced steady state percent error to 3.5%
- Implemented automated digital signal processing and quality control pipelines to the X-ray video analysis protocol which significantly reduced errors and the amount of necessary manual data processing time
- Mentored 4 undergraduate students through design process troubleshooting, project management challenges, and device testing protocols in addition to being available as a creative problem solver

Research & Development Engineering Co-Op Intern Brooks, Seattle, WA
Human Performance Lab Team 6/2016 – 1/2017

- Executed multiple successful engineering projects related to product design and testing while preparing cross-divisional presentations and documentation for the company
- Developed MATLAB programs that reduced the time needed to complete the product testing and analysis pipeline by 66%
- Reported biomechanical and mechanical testing results to a multidisciplinary and cross-functional team for future product development strategies
- Consistently processed experimental data and completed product testing protocols days ahead of schedule
- Quickly learned to operate equipment and software programs such as instrumented treadmills, Instron testing machines, 3D motion capture system software, and Tableau Software

Project Engineering Intern City of Lynnwood, Lynnwood, WA
Street, Stormwater, and Traffic Engineering Divisions 6/2017 – 9/2017

- Formulated, executed, and completed a city project plan 2 months ahead of schedule
- Demonstrated motivation and a willingness to learn by seeking out additional traffic engineering projects outside my assigned department and independently learning software such as Python and ArcGIS
- Exceled working both independently and in team environments on multiple projects simultaneously across different departments

PROJECTS & COMMUNITY ENGAGEMENT

Tetris-Playing AI University of Washington, Seattle, WA
Graduate Programming Project 9/2020 – 12/2020

- Created a Tetris-playing AI agent in Python that cleared over 88,000 lines on average before getting a game over. To compare, the Guinness Record for lines cleared by a human player is 4,988
- Implemented two reinforcement learning methods (genetic algorithm and cross-entropy method) to train the Tetris-playing AI learner
- Constructed algorithms, programmed training scripts, and simulated Tetris games using Python
- Identified and tested multiple sets of state features and heuristics to include in the training algorithm's parameterized optimization function
- Devised an additional Tetris player AI that learned and optimized based on both the current piece as well as the next piece ahead. This AI was able to play a single game for 4 days straight without a game over

Cerebral Palsy Rehabilitation Product Design Cal Poly, San Luis Obispo, CA
Undergraduate Senior Capstone Design Project 1/2017 – 12/2017

- Collaborated with three other young engineers to design and build an underwater stationary cycle. This device is used by the United Cerebral Palsy's clients to practice their motor skills and improve their airflow
- Performed detailed simulations and analysis using MATLAB to validate the product's design
- Constructed a detailed design report which includes a description of the design process, discussion of our research, engineering analysis, and a final design justification
- Built the product using machining processes such as CNC milling, drilling, welding, and finishing
- Communicated with sponsors and vendors to ensure that the design specifications met the client's needs
- Thrived in a rapid development environment with short timelines, multiple tasks, and a limited budget

Mechanical Engineering Department Tutor Cal Poly, San Luis Obispo, CA
Cal Poly, Mechanical Engineering Department 9/2015 – 12/2017

- Mentored and assisted 5-10 undergraduate students per day through their various challenges related to academics, curriculum planning, and collegiate life
- Effectively articulated difficult concepts related to statics, dynamics, mechanics, and thermodynamics
- Demonstrated strong interpersonal, time management, leadership, and communication skills

Electric Off-Road Trike Design Project Cal Poly, San Luis Obispo, CA
Undergraduate Design Project 1/2016 – 4/2016

- Collaborated with a team of six to design an all-wheel drive, electric off-road tricycle for paraplegic users
- Primarily responsible for designing the rear axle, drivetrain, chain, and sprocket assemblies as well as selecting suitable mechanical components from online vendors
- Designed complex parts and large assemblies for the tricycle's frame, electrical components, and powertrain system using SOLIDWORKS
- Implemented factor of safety and effective gear ratio calculators in MS Excel for rapid design iteration
- Produced a concept definition and design report which includes a description of the development process, discussion of performance, results achieved, and a final design description and justification

Special Olympics Design Project San Luis Obispo, CA
Special Olympics Southern California 4/2017 – 6/2017

- Fabricated a durable and wheelchair-accessible award stand for a local Special Olympics organization
- Conducted DFMA to reduce production time and constructed final design drawings using GD&T standards
- Corresponded with a small engineering team and the client in order to ensure a successful product launch

EDUCATION

University of Washington Seattle, WA
Master of Science in Mechanical Engineering Expected December 2021

- **Thesis:** Personalized Adaptive Control and Data-Driven Modeling for Robotic Ankle-Foot Prostheses to Improve Amputee Walking Symmetry
- **Curriculum Concentration:** Mechatronics, Controls, and Robotics
- **GPA:** 3.9/4.0

California Polytechnic State University (Cal Poly) San Luis Obispo, CA
Bachelor of Science in Mechanical Engineering 2013-2017

- **Capstone:** Cerebral Palsy Rehabilitation Product Design & Fabrication
- **GPA:** 3.5/4.0

HONORS & AWARDS

Best Podium Presentation Award, Northwest Biomechanics Symposium — Summer 2018

Community Leadership Award, Embedded Systems Course — Summer 2020

Dean's List, California Polytechnic State University — Fall 2013-Winter 2017

CONFERENCE PRESENTATIONS

Christopher Prasanna, Jonathan Realmuto, Krista Cyr, and Glenn Klute. Towards an Adaptive Neural Network-Based Predictive Control Strategy for Individuals with Transtibial Amputation Carrying Loads. VA Center for Limb Loss & Mobility Young Investigators Symposium, 2020 (*Podium Talk*)

Christopher Prasanna, Matthew Kindig, Kalle Chastain, Levi Davis, Eric Thorhauer, Joseph Iaquinto, and William Ledoux. Validation of Biplane Fluoroscopy System Tracking Using Bone Phantoms. International Society of Biomechanics Conference, 2019 (*Poster*)

Christopher Prasanna, Eric Thorhauer, Matthew Kindig, Joseph Iaquinto, and William Ledoux. First Metatarsophalangeal Joint Kinematics Measured Using Biplane Fluoroscopy. Northwest Biomechanics Symposium, 2018 (*Podium Talk*)

Christopher Prasanna, Eric Thorhauer, Matthew Kindig, Joseph Iaquinto, and William Ledoux. Bone Tracking Using a Biplane Fluoroscopy System: Approaches, Challenges, and Potential Solutions. VA Center for Limb Loss & Mobility Young Investigators Symposium, 2018 (*Podium Talk*)

JOURNAL ARTICLES IN PREPARATION

Prasanna C, Anderson A, Realmuto J, Rombokas E, Klute G. Design and Preliminary Evaluation of an Adaptive Symmetry Controller with Iterative Learning for Robotic Ankle-Foot Prostheses.

Prasanna C, Realmuto J, Anderson A, Klute G. Investigation of Biomechanical Effects for Individuals with Transtibial Amputation during Locomotion while using an Adaptive Symmetry Learning Robotic Prosthesis.

Prasanna C, Rombokas E, Klute G. Deep Neural Networks for Forward Prediction of Human-Robotic Prosthesis System Dynamics.

Berardo-Cates A, **Prasanna C**, Kindig M, Stender C, Ledoux W, Iaquinto J. Quasi-Linear Viscoelastic Characterization of Small Foot and Ankle Ligaments. (In preparation for Journal of Biomechanics)

Chastain K, Kindig M, **Prasanna C**, and Ledeoux W. Construction of Bone Phantoms for Biplane Fluoroscopy Validation. (In preparation for Journal of Biomechanical Engineering)

ADVANCED COURSEWORK

Modern Optimal Adaptive Control & Reinforcement Learning | Data-Driven Modeling & Control
Feedforward Control | Numerical Methods & Computing | Embedded Systems | Linear Systems
Advanced Dynamics & Vibrations | Classical Automatic Control | Biomechanics | Mechanical Design