Geoffrey Clark

Application for PhD Residency - ML in Robotics, Fall 2021

@ clark.m.geoffrey@gmail.com +1 480-200-8290 geoffrey-m-clark/

Highlighted Skills

Languages: Python, C++, MATLAB, Embeded C, Arduino
Frameworks: Tensorflow, Keras, Robot Operating System (ROS), Microchip Embeded Coder, CANopen, FreeRTOS
Tools: Visual Studio Code, MATLAB/Simulink, Sublime, Pybullet Simulator, LaTex, git, MPLAB
Research: Statistical Machine Learning, Imitation Learning, Deep Learning, Biomechanics, Optimal Control
Engineering: Mechatronics, Control Theory, Board Design, Sensor Implementation, Soldering, Machine Tools
Operating Systems: Linux Ubuntu, Windows

Experience

Human-Robot Collaboration Internship

May 2021 – Aug 2021

Honda Research Institute

- Formulate a neural network architecture that is capable of learning explicit model predictive control (MPC) solutions from example demonstrations of high-dimensional nonlinear systems.
- Implement the MPC scheme in a human-robot collaborative task to optimize the robots motion in order to push a human subject into safer, healthier, or more robust interactions.

Research Associate

Aug 2018 – Ongoing

Interactive Robotics Lab - Arizona State University

- Generate probabilistic models for control of powered prosthetics in human-robot symbiotic walking. ***Papers:*** ICRA '20.
- Integrate optimal control methods with statistical machine learning to learn data-driven models capable of adapting control outputs given predicted probabilistic outputs to elecit specific state responses. ***Papers:*** Corl '20.
- Utilize depth prediction deep neural networks along with a range of human sensor modalities to incorporate environmental information into control for assisted locomotion.
- Publish open source libraries and tutorials to aid in independent use and evaluation of my research. ***Repo:*** IntPrim **git**

Engineering Consultant

May 2019 – Apr 2021

SpringActive inc.

- Develop, prototype, and test control software and mechatronic hardware for novel quasi-passive prosthetic ankle which detects and accommodates changes in stride.
- Lead interaction with university partners to design EMG sensor and conditioning board.

Bioforce

- Engineer hardware and software ecosystem to aid in processing samples for a novel cancer screening solution.

Mechatronics Engineer

Jan 2014 – May 2018

SpringActive inc.

- Designed controls and electronics for the Ruggedized Odyssey Ankle, which is the only prosthetic ankle to demonstrate fully powered walking and running while completely submerged in water, over uneven terrain, and in unconstrained environments. This technology was later sold to Össur. ***Video:*** here
- Influenced major electrical engineering and controls decisions on the development of powered prosthetics and exoskeletons. Directly drove state of the art controls and mechatronics research, which helped to secure multiple licensing agreements and over $8.5 million of government funding including SBIR phase I and II grants.
- Managed the design of multiple sensor packages including inertial, magnetic encoder, capacitive touch, temperature, force, and high fidelity current sensors from conception to implementation.
- Improved data collection process to allow for live streaming and plotting of data through a custom GUI, which reduced tuning time for individuals by 10X.

Electrical Engineering Internship

Jan 2013 – Dec 2013

SpringActive Inc.

- Contributed with development of prosthesis design, control, tuning, and human subject testing.
- Engineered low-level communications drivers in embedded system which improved data rate by 8x and increased computational efficiency by 10x.

Formal Education/Degrees

PhD Electrical Engineering (Dean's Fellow)
Aug 2018 – Expected May 2022

Ira A. Fulton Schools of Engineering - Arizona State University

- Research Topic: Integration of machine learning with optimal control to transform the state of the art in robotic control.
- Focused coursework in: AI/machine learning, linear and nonlinear control systems, neural networks, and optimal filtering.
- Lead communications with perspective students by facilitating lab meetings and student interviews.

Electrical Engineering (Masters)
Aug 2016 – Jul 2018

Ira A. Fulton Schools of Engineering - Arizona State University

- ***Dissertation:*** Learning Interaction Primitives for Biomech. Prediction.
- Worked on novel applications of machine learning toward robotic prosthetics, while developing research skills.
- Implemented a reinforcement learning algorithm on a bi-manual robot to throw basketballs into a hoop.

Engineering-Robotics (BSE)
Aug 2009 – May 2013

Ira A. Fulton Schools of Engineering - Arizona State University

- Focus areas in Electrical and Robotics Engineering to learn the fundamentals of engineering, robotics, and control.

Personal Interests

Piano | Film Photography | Motorcycle Restoration | Dogs | Woodworking

Publications

G. Clark, X. Liu, and H. Ben Amor. *Environment-aware Predictive Modeling Framework for Human-Robot Symbiotic Walking*
Under Review — TBD

G. Clark, and H. Ben Amor. *Learning Ergonomic Control in Human-Robot Symbiotic Walking*
Under Review — TBD

G. Clark, J. Campbell, and H. Ben Amor. *Learning Predictive Models for Ergonomic Control of Prosthetic Devices*
Conference on Robot Learning (CoRL) — Nov 2020

G. Clark, J. Campbell, S.M.R. Sorkhabadi, W. Zhang, and H. Ben Amor. *Predictive Modeling of Periodic Behavior for Human-Robot Symbiotic Walking*
International Conference on Robotics and Automation (ICRA) — May 2020

G. Clark. *Learning Interaction Primitives for Biomechanical Prediction*
Arizona State University, Dissertation Publishing — Jul 2018

INVITED TALKS AND POSTERS

Learning Ergonomic Control for Powered Prosthetic Devices
Powered Leg Prosthesis Workshop at (IROS) — Oct 2020

Learning to Walk with Prosthetics
International Symposium on Artificial Intelligence and Brain Science (AIBS) — Sep 2020

Optimal Control for Robotic Prosthetics with Interaction Primitives
Dynamic Walking — Jun 2020

Predictive Biomechanics for Dynamic Walking
Dynamic Walking — Jun 2019

The Human and Robotic Connection
Space to Thrive Public Panel — Jun 2019

Better teaming through visual cues: how projecting imagery in a workspace can improve human-robot collaboration
International Conference on Robotics and Automation (ICRA) — May 2019

Awards

Deans Fellowship
Awarded by Arizona State University: Ira. A Fulton School of Engineering, ECEE Dean's Office 2018 - 2022

Arizona Graduate Scholar Award
Awarded by Arizona State University: Ira. A Fulton School of Engineering, Program Chair 2016 - 2018

Sparkfun Autonomous Vehicle Challenge
Awarded by Sparkfun Electronics (Video 2012) (Video 2013) 1st place - 2012, 2nd place - 2013

Deans List
Awarded by Arizona State University: Polytechnic School of Engineering, Deans Office 2009 - 2013

National Underwater Robotics Competition: Collegiate division
Awarded by NURC in partnership with NASA and Honeywell 1st place - 2010, 1st place - 2009, 2nd place - 2008

Mentorship & Competitions

Robotics Team Mentor
2020 - Ongoing

Desert WAVE, Women in Autonomous Vehicle Engineering
- Teach courses on Deep Learning and lead Machine Learning integration into the autonomous underwater robots with the Arizona State University women's robotics team.

Robot Design/Fabrication
May 2014 - Jul 2014

Spare Parts Movie (Lionsgate Entertainment)
- Drafted and machined the Cornell remote underwater vehicle (ROV) including fabrication of: working sensor packs, controller, and water-proof housing, for the movie Spare Parts.

Robotics Team Coach
2010 – 2013

Highland High School, Gilbert, AZ
- Mentored high school students competing in the FIRST robotics competition.

Track and Field Coach - Pole Vaulting
2010 – 2013

Highland High School, Gilbert, AZ
- As the head pole vault coach for the track and field team, I designed daily workouts, trained students, ran competitions, and hoped to motivate confidence and self discipline for students.

Peer Mentor
2010 – 2013

Arizona State University
- Work with freshman students in their first year in the Arizona State University, engineering program.

Physics and Engineering Tutor
2010 – 2013

Independent
- Tutor students in introductory physics and engineering coursework.

Engineers in the Classroom
2011 – 2013

Grade School Science Instructor
- Give hands on instruction in science, math, and engineering lessons to students at underprivileged schools.