

# Michael Sobrepera

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## Summary

I am a doctoral student and full stack roboticist. I have an array of hard skills across design, hardware, software, and algorithms, complemented by strong data analysis, experimental design, and communication skills, allowing me to enter new project spaces, rapidly gain domain knowledge, and go deep into problems to generate answers and solutions. I am passionate about learning, working on meaningful problems, pushing the boundaries of technology, and mentoring the next generation.

My PhD work has focused on understanding the use of social robotics for upper extremity rehabilitation and computer vision for objective assessment in upper extremity rehabilitation. I have prior experience in computer vision for industrial automation and medical device design and manufacturing.

**I am currently searching for a team working on exciting problems to join for a summer 2021 internship in Seattle.**

## Education

### Doctor of Philosophy in Mechanical Engineering

Aug 2016 – Expected Dec 2021

*University of Pennsylvania*

Advisor: Dr. Michelle Johnson.

Affiliated with the General Robotics, Automation, Sensing, & Perception Laboratory (GRASP Lab).

### Master of Science in Robotics

Aug 2016 – Aug 2019

*University of Pennsylvania*

### Bachelor of Science in Biomedical Engineering

Aug 2012 – Dec 2015

*Georgia Institute of Technology*

Minor in Computer Science

## Skills

### Programming Languages

Python, R, MATLAB, TypeScript, SQL, C++

### Robotics

ROS, HRI, Kinematics, State Estimation, System Integration, Mechatronics

### Mechanical Design

MCAD, Technical Drawing, RTV Molding, 3D Printing, Classical Machining

### Software Infrastructure

PyTorch, Docker, Git, NGINX, NodeJS, Redis, PostgreSQL, React

## Funding

### NIH F31 Predoctoral Fellowship (F31HD102165)

Apr 2020 – Present

### University of Pennsylvania Fontaine Fellowship

Sept 2016 – Apr 2020

## Experience

### PhD Student

Aug 2016 – present

*University of Pennsylvania, Rehabilitation Robotics Laboratory*

Socially Assistive Robot for Upper Extremity Telerehabilitation

- Led hardware design and software integration for the development of an affordable socially assistive robot (Lil'Flo) to aid in telepresence based assessment and treatment of patients with upper extremity motor impairments (<https://youtu.be/DDZe1RhcpWY>).
- Developed and now implementing experiments to determine how patients react to telepresence robots which incorporate social robots and how that affects remote assessment.
- Developing a framework for identifying motor function from video of a patient doing various robot guided activities using both classical computer vision and machine learning techniques.
- Mentored and managed over a dozen students doing research within the project.
- Presented work in papers, posters, and talks.

## Research Technician II

Dec 2015 – Jun 2016

## Undergraduate Research Assistant

Aug 2015 – Dec 2015

Georgia Institute of Technology, IRIM Technology Transition Laboratory

### Edge-Based Tracking for Flexible Manufacturing

- Refined a C++ video based real-time textureless tracker from a research code base to a well documented robust system capable of running at 30+ fps at  $1920 \times 1080$  pixels, to enable manipulation on non-fixed, non-located car parts at a partner automotive facility.
- Supported industrial partner in successful technical demonstrations to management.
- Developed tools for calibrating multiple robot arms to cameras.
- Integrated perception and motion control to track moving targets with a collaborative robot.

## Automation Intern

May 2015 – Aug 2015

Eli Lilly and Company

### Offline Plant Simulations for Automation Development and Testing

- Rapidly learned automation systems being used (Emerson DeltaV and Rockwell).
- Evaluated options for offline software/hardware/operator in the loop plant simulations for process validation, control code development, pre-factory acceptance testing control system checkout, operator training, and process improvement.
- Reported on findings in both a technical paper and oral presentation.

## Machine Shop Supervisor

Aug 2014 – May 2015

Georgia Institute of Technology, TEP Machine Shop

- Guided Master's in Biomedical Innovation and Development students in design and prototyping of medical devices.
- Supported the Cardiovascular Fluid Mechanics Lab and the Tissue Mechanics Lab in development and fabrication of experimental equipment.

## Product Development Engineering Co-Op

Jan 2014 – Jul 2014

Unilife Corporation

### Product Development and Manufacturing for Injectable Drug Delivery Devices

- Tested prototypes for both usability and engineering constraints and iterated on design.
- Developed and prototyped new product concepts based on customer needs.
- Designed, procured, assembled, and programmed automation equipment for syringe component gluing, assembly, and finish operations.
- Worked with vendor to design and procure sterilizable packaging for 1MM annual units of product.

## Publications

### Peer-reviewed Journal Publications

- [1] Michelle J Johnson, **Michael J Sobrepera**, Enri Kina, and Rochelle Mendonca. "Design of an Affordable Socially Assistive Robot for Remote Health and Function Monitoring and Prognostication". In: *International Journal of Prognostics and Health Management (IJPHM)* 10. Special Issue PHM for Human Health and Performance (2019).

### Peer-reviewed Conference Publications

- [1] **Michael J Sobrepera**, Enri Kina, and Michelle J Johnson. "Designing and Evaluating the Face of Lil'Flo: An Affordable Social Rehabilitation Robot". In: *IEEE International Conference on Rehabilitation Robotics*. Toronto, Ontario, Canada, 2019. DOI: [10/ggdd87](https://doi.org/10/ggdd87).

### Preprints

- [1] **Michael J Sobrepera**, Vera G Lee, and Michelle J Johnson. "The Design of Lil'Flo, a Socially Assistive Robot for Upper Extremity Motor Assessment and Rehabilitation in the Community Via Telepresence". In: *medRxiv* (2020). DOI: [10.1101/2020.04.07.20047696](https://doi.org/10.1101/2020.04.07.20047696).

### Extended Conference Abstracts with Poster Presentations

- [1] **Michael J Sobrepera** and Michelle J Johnson. "The design of Lil'Flo, a socially assistive robot for upper extremity motor assessment and rehabilitation via telepresence". In: *Rehabilitation Research 2020: Envisioning a Functional Future*. Digital: National Institutes of Health, Oct. 2020.
- [2] **Michael J Sobrepera** and Michelle J Johnson. "Designing Arms for Lil'Flo, a Socially Assistive Rehabilitation Robot". In: *Biomedical Engineering Society Annual Meeting 2019*. Biomedical Engineering Society Annual Meeting. Philadelphia, PA: Biomedical Engineering Society, Oct. 2019.
- [3] Ralph Tamakloe, **Michael J Sobrepera**, and Michelle J Johnson. "Designing a Game for Upper Extremity Motor Function Assessment Using Anki Cozmo, a Desktop Social Robot". In: *Biomedical Engineering Society Annual Meeting 2019*. Biomedical Engineering Society Annual Meeting. Philadelphia, PA: Biomedical Engineering Society, Oct. 2019.

- [4] **Michael J Sobrepera** and Michelle J Johnson. "The Design of Lil'Flo, an Affordable Socially Assistive Robot for Telepresence Rehabilitation". In: *Proceedings of the 2018 Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) Conference*. RESNA, 2018.
- [5] Enri Kina, **Michael J Sobrepera**, Carla Diana, and Michelle J Johnson. "Creating An Emotive Robotic Face To Inspire Trust In Telepresence And Autonomous Rehabilitation Activities". In: *Proceedings of the 2018 Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) Conference*. RESNA, 2018.

## Awards & Honors

|   |             |
|---|-------------|
| <b>Penn Wharton Entrepreneurship Startup Challenge Innovation Award</b> | May 2020    |
| <b>Rothberg Catalyzer First Place</b>                                   | Nov 2019    |
| <b>Hispanic Scholarship Fund (HSF) Scholar</b>                          | Dec 2016    |
| <b>Georgia Institute of Technology OMED Tower Award</b>                 | 2015        |
| <b>Georgia Institute of Technology Dean's List</b>                      | 2012 – 2014 |
| <b>Auburn University Dean's List</b>                                    | 2011 – 2012 |
| <b>The Auburn National Scholars Presidential Scholarship</b>            | 2011        |

## Ventures

|   |                    |
|---|--------------------|
| <b>MAR Orthotics</b>  | Oct 2019 – Present |
| <i>Co-Founder &amp; President</i>   |                    |
| Novel Orthoses for Pediatric Cerebral Palsy   |                    |
| <ul style="list-style-type: none"> <li>Public face of company, successfully pitched through multiple innovation and business competitions to win competitive awards.</li> <li>Performing customer discovery and validation to refine product market fit.</li> <li>Working on technical design.</li> </ul> |                    |

## Professional Development

|                           |             |
|---------------------------|-------------|
| <b>Neuromatch Academy</b> | Summer 2020 |
|---------------------------|-------------|

## Teaching Experience

### Teaching Assistantships

|   |             |
|---|-------------|
| <b>Lead Teaching Assistant for MEAM 147: Intro to Mechanics Lab</b> | Fall 2018   |
| <b>Teaching Assistant for MEAM 211: Undergraduate Dynamics</b>      | Spring 2018 |
| <b>Teaching Assistant for MEAM 147: Intro to Mechanics Lab</b>      | Fall 2017   |

### Guest Lectures

|   |                |
|---|----------------|
| <b>Robots in Pediatric Rehabilitation</b>                                     | Nov 2018, 2020 |
| Course: Bioengineering 514: Rehab Engineering and Design                      |                |
| <b>Robots in Pediatric Rehabilitation</b>                                     | Apr 2018       |
| Course: Robots in HealthCare: From Science Fiction to Reality                 |                |
| <b>Robot Inspiration: Artificial Intelligence, the Brain, and Programming</b> | Mar 2018       |
| Course: Robots in HealthCare: From Science Fiction to Reality                 |                |

## Talks

|  |          |
|--|----------|
| <b>Global Perspectives on Medicine, Rehabilitation, and Robotics Webinar Series</b>  | Nov 2020 |
| Using Social Robots for Remote Assessment of Children With Disability  |          |
| <b>Penn MEAM Department Seminar</b>  | Jul 2020 |
| The Design of Lil'Flo, a Socially Assistive Robot for Upper Extremity Motor Assessment and Rehabilitation Via Telepresence |          |

## Service

### Community Service

|  |          |
|--|----------|
| <b>UPenn Bioengineering BETA Day Volunteer</b>                   | Jan 2020 |
| <b>Tech Girlz Circuit Workshop Volunteer</b>                     | Jan 2020 |
| <b>Girls Advancing in STEM (GAINS) Lab Tour Lead</b>             | Nov 2019 |
| <b>Philadelphia Robotics Expo Volunteer</b>                      | Oct 2019 |
| <b>Philadelphia Maker Faire Volunteer</b>                        | Oct 2019 |
| <b>Upward Bound Growing out of the Stereotypes Workshop Lead</b> | Dec 2018 |

|  |                           |
|--|---------------------------|
| <b>EL Education Future of Work Conference Interviewee</b>  | Nov 2018                  |
| <b>Participated in RET: Leveraging Our Collective Impact Conference</b>  | Oct 2018                  |
| <b>Philadelphia Robotics Expo Presenter</b>  | Oct 2018                  |
| <b>GRASP NSF Research Experience for Teachers Program</b>  | Summer 2017 & Summer 2018 |
| Mentored three middle school teachers through a six week research experience covering the entire scientific process. Visited their classrooms a total of six times to demonstrate state of the art research and teach lessons. |                           |
| <b>Be a Pennovator Workshop Lead</b>   | Apr 2018                  |
| <b>Penn Science Olympiad Volunteer</b>   | Feb 2017                  |
| <b>Penn First Lego League Judge</b>  | Feb 2017                  |
| <b>Penn-Alexander School Science Fair Judge</b>  | Dec 2016                  |
| <b>University Service</b>  |                           |
| <b>Penn Doctoral Diversity and Inclusion Board Member</b>  | Jun 2020 – Present        |
| <b>GRASP Student Advisory Committee Member</b>   | Jan 2020 – Present        |
| <b>Mechanical Engineering Graduate Association Vice President</b>  | Sept 2017 – Sept 2018     |
| <b>Reviewer</b>  |                           |
| <b>Journal of Rehabilitation and Assistive Technologies Engineering</b>  | 2020                      |
| <b>International Conference on Robotics and Automation</b>   | 2017, 2020                |
| <b>International Conference on Intelligent Robots and Systems</b>  | 2018, 2020                |
| <b>HRI Conference</b>  | 2020–2021                 |
| <b>Conference Volunteer</b>  |                           |
| <b>Northeast Robotics Colloquium</b>   | 2019                      |
| <b>Biomedical Engineering Society Conference</b>   | 2019                      |
| <b>Rehabilitation Engineering and Assistive Technology Society of North America Conference</b>   | 2018                      |

## Selected Press

|   |           |
|---|-----------|
| <b>2020 Startup Challenge Special Part 3: MAR Designs</b><br><a href="https://link.medium.com/34ti0GvN83">https://link.medium.com/34ti0GvN83</a>                            | Apr 2020  |
| <b>Students' Innovative Orthotic Device Wins Rothberg Catalyzer</b><br><a href="https://link.medium.com/34ti0GvN83">https://link.medium.com/34ti0GvN83</a>                  | Oct 2019  |
| <b>Teachers Become Students to Become Better Teachers at GRASP Lab's RET Program</b><br><a href="https://link.medium.com/zIHvqZH25S">https://link.medium.com/zIHvqZH25S</a> | Sept 2018 |

## Mentees

|   |                      |
|---|----------------------|
| <b>Vera Lee</b><br>Penn BioE Undergrad, Robotics Master's       | Sept 2019 – Present  |
| <b>Suveer Garg</b><br>Penn Systems Engineering Master's         | Feb 2020 – Present   |
| <b>Ralph Tamakloe</b><br>Penn BioE Undergrad                    | Jun 2019 – Aug 2019  |
| <b>Dhruv Karthik</b><br>Penn CIS Undergrad                      | Jan 2018 – May 2019  |
| <b>Enri Kina</b><br>Penn MEAM Undergrad                         | May 2017 – May 2019  |
| <b>Danielle Chen</b><br>Penn Integrated Product Design Master's | Jun 2018 – Sept 2018 |
| <b>Andrew Levine</b><br>Penn MEAM Undergrad                     | Jun 2018 – Aug 2018  |
| <b>Jagtar Singh</b><br>Penn MEAM Master's                       | May 2018 – Aug 2018  |
| <b>Shyon Small</b><br>Penn BioE Undergrad                       | May 2018 – Jul 2018  |
| <b>Weiyu Du</b><br>Penn CIS Undergrad                           | May 2018 – Jul 2018  |

**Sabrina Smith**

Imperial College London Biomedical Engineering Undergrad

July 2017 – Sept 2017

**Tim Kulesza**

BSE, Mechanical Engineering & Materials Science

Jun 2017 – Aug 2017

**Leora Korn**

Penn MEAM Undergrad

May 2017 – July 2017