

# 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.

## Education

**Doctor of Philosophy in Mechanical Engineering** Aug 2016 – April 2022

*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, TypeScript, SQL

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

**Mechanical Design** MCAD, Technical Drawing, RTV Molding, 3D Printing, Classical Machining

**Software Infrastructure** 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 × 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] **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: *Journal of Rehabilitation and Assistive Technologies Engineering* 8 (Apr. 19, 2021), pp. 1–26. ISSN: 2055-6683. DOI: [10/gjrpj8](https://doi.org/10/gjrpj8).
- [2] **Michael J Sobrepera**, Vera G Lee, Suveer Garg, Rochelle Mendonca, and Michelle J Johnson. "Perceived Usefulness of a Social Robot Augmented Telehealth Platform by Therapists in the United States". In: *IEEE Robotics and Automation Letters* 6.2 (2021), pp. 2946–2953. ISSN: 2377-3766. DOI: [10/gh6hkk](https://doi.org/10/gh6hkk).
- [3] 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).

**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.

### Pre-Prints Under Review

- [1] **Michael Sobrepera**, Vera Lee, and Michelle Johnson. "Therapists' Opinions on Telehealth, Robotics, and Socially Assistive Robot-Augmented Telepresence Systems for Rehabilitation". In: (Feb. 11, 2022). DOI: [10/gpfmwd](https://doi.org/10/gpfmwd).

### 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 – Feb 2021
<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
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### 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>Social Robotics in Rehabilitation</b>	Nov 2021
Course: Bioengineering 514: Rehab Engineering and Design	
<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>Lehigh University AIRLab General Meeting</b>	Feb 2022
Social Robot Augmented Telepresence For Remote Rehabilitation of Patients With Upper Extremity Impairment	
<b>GRASP SFI</b>	Feb 2021
Using Social Robots and Computer Vision to Augment Telerehabilitation <a href="https://youtu.be/2b8YyKZ1DsM">https://youtu.be/2b8YyKZ1DsM</a>	
<b>Global Perspectives on Medicine, Rehabilitation, and Robotics Webinar Series</b>	Nov 2020
Using Social Robots for Remote Assessment of Children With Disability <a href="https://youtu.be/FF0dKiB1qGM?t=2030">https://youtu.be/FF0dKiB1qGM?t=2030</a>	

**Penn MEAM Department Seminar**

Jul 2020

The Design of Lil'Flo, a Socially Assistive Robot for Upper Extremity Motor Assessment and Rehabilitation Via Telepresence

<https://youtu.be/DDZe1RhcpWY>**Service****Community Service**

UPenn Bioengineering BETA Day Volunteer	Mar 2021
UPenn Bioengineering BETA Day Volunteer	Jan 2020
Tech Girlz Circuit Workshop Volunteer	Jan 2020
Girls Advancing in STEM (GAINS) Lab Tour Lead	Nov 2019
Philadelphia Robotics Expo Volunteer	Oct 2019
Philadelphia Maker Faire Volunteer	Oct 2019
Upward Bound <i>Growing out of the Stereotypes</i> Workshop Lead	Dec 2018
EL Education Future of Work Conference Interviewee	Nov 2018
Participated in RET: Leveraging Our Collective Impact Conference	Oct 2018
Philadelphia Robotics Expo Presenter	Oct 2018
GRASP NSF Research Experience for Teachers Program	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.	
Be a Penovator Workshop Lead	Apr 2018
Penn Science Olympiad Volunteer	Feb 2017
Penn First Lego League Judge	Feb 2017
Penn-Alexander School Science Fair Judge	Dec 2016

**University Service**

Penn Doctoral Diversity and Inclusion Board Member	Jun 2020 – Present
GRASP Student Advisory Committee Member	Jan 2020 – Present
Mechanical Engineering Graduate Association Vice President	Sept 2017 – Sept 2018

**Reviewer**

Journal of Rehabilitation and Assistive Technologies Engineering (JRATE)	2020
International Conference on Robotics and Automation (ICRA)	2017, 2020, 2021
International Conference on Intelligent Robots and Systems (IROS)	2018, 2020, 2021
International Conference on Human-Robot Interaction (HRI)	2020–2021
International Symposium on Robot and Human Interactive Communication (RO-MAN)	2021
Disability and Rehabilitation: Assistive Technology	2022
International Conference on Rehabilitation Robotics (ICORR)	2022

**Conference Volunteer**

Northeast Robotics Colloquium	2019
Biomedical Engineering Society Conference	2019
Rehabilitation Engineering and Assistive Technology Society of North America Conference	2018

**Selected Press**

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

**Mentees**

<b>Ajay Anand</b> Penn Robotics Master's	May 2021 – Present
<b>Julie Elfishawy</b> Penn Cognitive Science and Healthcare Management Bachelor's	Jun 2021 – Present

<b>Jiayu Li</b> Penn Bioengineering Master's	Oct 2021 – Present
<b>Suveer Garg</b> Penn Systems Engineering Master's	Feb 2020 – May 2021
<b>Vera Lee</b> Penn BioE Undergrad, Robotics Master's	Sept 2019 – Apr 2021
<b>Ralph Tamakloe</b> Penn BioE Undergrad	Jun 2019 – Aug 2019
<b>Dhruv Karthik</b> Penn CIS Undergrad	Jan 2018 – May 2019
<b>Enri Kina</b> Penn MEAM Undergrad	May 2017 – May 2019
<b>Danielle Chen</b> Penn Integrated Product Design Master's	Jun 2018 – Sept 2018
<b>Andrew Levine</b> Penn MEAM Undergrad	Jun 2018 – Aug 2018
<b>Jagtar Singh</b> Penn MEAM Master's	May 2018 – Aug 2018
<b>Shyon Small</b> Penn BioE Undergrad	May 2018 – Jul 2018
<b>Weiyu Du</b> Penn CIS Undergrad	May 2018 – Jul 2018
<b>Sabrina Smith</b> Imperial College London Biomedical Engineering Undergrad	July 2017 – Sept 2017
<b>Tim Kulesza</b> BSE, Mechanical Engineering & Materials Science	Jun 2017 – Aug 2017
<b>Leora Korn</b> Penn MEAM Undergrad	May 2017 – July 2017