# LILLIAN CHIN

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#### ACADEMIC POSITIONS

| University of Texas, Austin (UT Austin) Assistant Professor of Electrical and Computer Engineering  | 2024 - present<br>Austin, TX   |
|---|--|
| National Institutes of Health (NIH) Postdoctoral Fellow, Advisors: Leonardo Cohen, Tom Bulea  | <b>2023 - 2024</b><br>Bethesda, MD   |
| EDUCATION   |  |
| Massachusetts Institute of Technology (MIT)  PhD in Electrical Engineering and Computer Science, Advisor: Daniela Rus  Thesis: "Function Follows Form: An Exploration of Robotic Embodiment through Geometry"   | <b>2017 - 2023</b><br>Cambridge, MA<br>GPA: 4.8/5.0                                |
| Massachusetts Institute of Technology (MIT)  S.M. in Electrical Engineering and Computer Science, Advisor: Daniela Rus Thesis: "A High-Deformation Electric Soft Robotic Gripper via Handed Shearing Auxetics"  | <b>2017 - 2019</b> Cambridge, MA GPA: 4.8/5.0                                      |
| Massachusetts Institute of Technology (MIT)  B.S. in Electrical Engineering and Computer Science  Minors in Mechanical Engineering, Comparative Media Studies   | <b>2013 - 2017</b><br>Cambridge, MA<br>GPA: 4.9/5.0                                |
| Honors and Awards   |  |
| Research Awards Winner (\$5,000) (2 selected, institution) – Dimitris N. Chorafas Award Winning Team (\$100,000) – Norman B. Leventhal City Prize Nominated, Best Paper [J.5] – IEEE Robosoft Conference First Place (\$1,000) – MIT Research Slam Best Poster Award [C.3] – IEEE Robosoft Conference First Place, Student Paper Competition [W.3] – ACM Symposium on CS & Law Finalist (40 selected, nationally) – Intel Science Talent Search   | 2023<br>2022<br>2021<br>2020<br>2019<br>2019<br>2013                               |
| Fellowships Fellow (32 selected, internationally) – Schmidt Science Fellows Fellow (10 selected, nationally) – Hertz Foundation Graduate Fellowship Scholar (55 selected, institution) – MIT Social and Ethical Responsibilities of Computing (SERC) Scholar Fellow (2,000 selected, nationally) – National Science Foundation Graduate Research Fellowship Fellow (40 selected, nationally among first-gen immigrants) – Paul & Daisy Soros Fell. for New Americans Fellow (25 selected, institution) – MIT Energy Initiative Graduate Fellowship Fellow (75 selected, nationally) – Kleiner Perkins Caulfield Byers (KPCB) Engineering Fellow | $2023 \\ 2018 - 2023 \\ 2021 - 2023 \\ 2018 - 2021 \\ 2018 - 2020 \\ 2018 \\ 2014$ |
| Personal Awards  Participant (85 selected, internationally among EECS academics w. underrepresented genders) – EECS Ri Participant (70 selected, nationally among underrepresented engineering academics) – NextProf Nexus Participant (30 selected, internationally among robotics researchers) – Robotics, Science & Systems (RSS) First Place (\$10) – Topsfield County Fair, Crafts Department, Original Needlework Member (75 selected, institution) – Phi Beta Kappa Honors Society, Xi Chapter First Place (\$100,000) – Jeopardy College Championship Winner  | 2022   |

## Publications

## Peer-Reviewed Journal Articles

- \* indicates members who contributed equally to the manuscript.
- [J.13] Chen, V.\*, **Chin, L.\***, Choi, J.\*, & Rus, D. "End-to-End Online Packing of Groceries Enabled by Soft Fingers with Integrated Visual-Tactile Sensing." Manuscript in preparation.

- [J.12] Chin, L., Lipton J., Xie, G., & Rus, D. "AuxSwarm: A Compliant Cellular Material with Electroactive Voxel-Level Control through Modular Auxetic Robots." Manuscript in preparation.
- [J.11] Xie, G., Holladay, R.\*, **Chin, L.\***, & Rus, D. "In-Hand Manipulation with a Simple Belted Parallel-Jaw Gripper." Manuscript under review at *IEEE Robotics and Automation Letters* (2023).
- [J.10] Chin, L., Burns, M.\*, Xie, G.\*, & Rus, D. "Flipper-Style Locomotion through Strong Expanding Modular Robots." *IEEE Robotics and Automation Letters.* 8(2), 528-535. (2022) Presented at ICRA 2023.
- [J.9] Truby, R.\*, Chin, L.\*, Zhang, A., & Rus, D. "Fluidic Innervation Sensorizes Structures from a Single Build Material." Science Advances. 8(31). (2022)
- [J.8] Zhang, A., Truby, R., Chin, L., Li, S., & Rus, D. "Vision-Based Sensing for Electrically-Driven Soft Actuators." IEEE Robotics and Automation Letters. 7(4): 11509-11516. (2022) Presented at IROS 2022.
- [J.7] Araki, B., Choi, J., Chin, L., Li, X., & Rus, D. "Learning Policies by Learning Rules." IEEE Robotics and Automation Letters. 7(2): 1284-1291. (2021)
- [J.6] Chin, L. "How to Survive a Public Faming: Understanding 'The Spiciest Memelord' via the Temporal Dynamics of Involuntary Celebrification." First Monday. 26(4). (2021)
- [J.5] Spielberg, A.\*, Amini, A.\*, Chin, L., Matusik, W., & Rus, D. "Co-Learning of Task and Sensor Placement for Soft Robotics." *IEEE Robotics and Automation Letters*. 6(2): 1208-1215. (2021) Nominated, Best Paper Award at Robosoft 2021.
- [J.4] Truby, R.\*, **Chin, L.\***, & Rus, D. "A Recipe for Electrically-Driven Soft Robots via 3D Printed Handed Shearing Auxetics." *IEEE Robotics and Automation Letters.* 6(2): 795-802. (2021) Presented at Robosoft 2021.
- [J.3] Lipton, J., MacCurdy, R., Manchester, Z., Chin, L., Celluci, D., & Rus, D. "Handedness in Shearing Auxetics Creates Rigid and Compliant Structures." *Science*. 360(6389): 632-635. (2018)
- [J.2] Stevens, A., Oliver, R., Kirchmeyer, M., Wu, J., Chin, L., Polsen E., Archer, C., Boyle, C., Garber, J., & Hart, J. "Conformal robotic stereolithography." 3D Printing and Additive Manufacturing, 3(4): 226-235. (2016)
- [J.1] Harrow, C. & Chin, L. "Technology-Enhanced Discovery." Mathematics Teacher, 107: 660 665. (2014)

#### Peer-Reviewed Conference Papers

- [C.9] Xie, G., Chin, L., Kim, B., Holladay, R., & Rus, D. "Strong Compliant Grasps through a Cable-Driven Soft Robotic Gripper." Manuscript in preparation.
- [C.8] Zhang, A.\*, Wang, T.-H.\*, Truby, R., Chin, L., & Rus, D. "Machine Learning Best Practices for Soft Robot Proprioception." In *Intelligent Robots and Systems (IROS)*, 2023 IEEE International Conference on. IEEE. (2023). Manuscript in press.
- [C.7] Stölzle, M., Chin, L., Truby, R., Rus, D., & Della Santina, C. "Modelling Handed Shearing Auxetics: Selective Piecewise Constant Strain Kinematics and Dynamic Simulation." In Soft Robotics (Robosoft), 2023 IEEE International Conference on. IEEE. (2023).
- [C.6] Chin, L., Barscevicius, F., Lipton, J., & Rus, D. "Multiplexed Manipulation: Versatile Multimodal Grasping via a Hybrid Soft Gripper." In Robotics and Automation (ICRA), 2020 IEEE International Conference on. IEEE. (2020).
- [C.5] Lipton, J., Chin, L., Miske, J., & Rus, D. "Modular Volumetric Actuators Using Motorized Auxetics." In Intelligent Robots and Systems (IROS), 2019 IEEE International Conference on. IEEE. (2019).
- [C.4] Chin, L., Yuen, M.C., Lipton, J., Trueba, L.H., Kramer-Bottiglio, R., & Rus, D. "A Simple Electric Soft Robotic Gripper with High-Deformation Haptic Feedback." In Robotics and Automation (ICRA), 2019 IEEE International Conference on. IEEE. (2019).

- [C.3] Chin, L., Lipton, J., Yuen, M.C., Kramer-Bottiglio, R., & Rus, D. "Automated Recycling Separation Enabled by Soft Robotic Material Classification." In Soft Robotics (Robosoft), 2019 IEEE International Conference on. IEEE. (2019). Winner, Best Poster Award
- [C.2] Chin, L., Lipton, J., MacCurdy, R., Romanishin, J., Sharma, C., & Rus, D. "Compliant Electric Acutators Based on Handed Shearing Auxetics." In Soft Robotics (Robosoft), 2018 IEEE International Conference on. IEEE. (2018).
- [C.1] Beaudoin J., Chin L., Zlotnick H., Cervantes T., Lassey S., Robinson J., & Slocum A. "Obstetrical Forceps with Passive Rotation and Sensor Feedback." ASME. Frontiers in Biomedical Devices, 2018 Design of Medical Devices Conference. (2018).

#### **Patents**

- [P.2] Rus, D., Lipton, J., & Chin, L. "Vibration absorber for power tools", US11,583,972, issued on Feb. 21, 2023.
- [P.1] Lipton, J., MacCurdy, R., Chin, L., & Rus, D. "Non-planar shearing auxetic structures, devices, and methods", US10.850,406, issued on Dec. 1, 2020.

#### Workshop and Symposium Contributions

- [W.3] Chin, L. "Focusing the Legal Lens on Data: Examining Metaphors of Personal Data and their Legal Implications" Paper and poster in 2019 ACM Inaugural Symposium on Computer Science and Law First Prize, Student Paper Competition
- [W.2] Chin, L. "Design and fabrication of dual-flipping mechanisms." Abstract and poster in 2019 International Conference on Robotics and Automation workshop: Robot Design and Customization: Opportunities at the Intersection of Computation and Digital Fabrication
- [W.1] Chin, L., Lipton, J., MacCurdy, R., Romanishin, J., Sharma, C., & Rus, D. "Compliant Electric Acutators Based on Handed Shearing Auxetics." Poster in 2018 New England Manipulation Symposium

#### TEACHING EXPERIENCE – ACADEMIC

#### CMS.701 - Current Debates in Media

2020

Teaching Assistant

Cambridge, MA

- Led discussions on technology and society for a class of 15 senior undergraduate students.
- Managed transition from in-person to online teaching due to the COVID-19 pandemic.

#### MIT Mobile Autonomous Systems Laboratory

2018

Teaching Assistant

Cambridge, MA

- One of 7 undergraduate TAs who led this completely student-run course to design an autonomous robot with computer vision in a month.
- Staffed lab for 30 undergraduates, providing mechanical, electrical and programming guidance to 30 undergraduates in a time-constrained environment.

#### 6.002 - Circuits and Electronics

2015 - 2017

Head Lab Assistant

Cambridge, MA

- Staffed lab for 60-85 undergraduates, guiding students to a better understanding of circuits by helping them debug their lab circuits, from basic ADCs to audio amplifiers
- Organized and scheduled 8 different Lab Assistants, helping them with their duties by giving weekly lab overviews

#### 6.004 - Computation Structures

2016

Lab Assistant

Cambridge, MA

• Staffed lab for 300 undergraduates, guiding students to a better understanding of digital circuits from the transistor level to creating their own basic CPU in assembly language

#### MIT Kaufman Teaching Certificate Program

Participant Cambridge, MA

• Participated in semester-long teaching training program, learning evidence-based teaching techniques to create effective lessons and inclusive classrooms.

#### MIT EECS UROP Mentorship Initiative

2022

2022

Focus Group Member

Cambridge, MA

• Acted as semester-long beta tester for graduate student intiative to develop new guidelines for undergraduate research mentorship

| TEACHING | Experience – | OUTSIDE | OF | CLASSBOOM |
|----------|--------------|---------|----|-----------|
|          |              |         |    |           |

| Mentorship Mentor, Project SHORT Mentor, MIT EECS Graduate Application Assistance Program Mentor, Cientifico Latino Graduate Student Mentorship Initiative Mentor, MIT Society of Women Engineers Alumni Mentorship Program Mentor, MIT Office of Minority Education, Laureates and Leaders Program Mentor, MIT Women in Electrical Engineering and Computer Science Mentor, Girls Who Code Mentor, Society of Women Engineers | $2021-2023 \ 2020 \ 2018-2020 \ 2018-2020 \ 2018-2020 \ 2018-2020 \ 2015-2015 \ 2014$ |
|--|---|
| Extracurricular Tutor, ESL Program for MIT Facilities Department Employees Mentor and Library Machine Master, MIT MakerWorkshop Teacher, MIT Educational Studies Program Tutor, InstaEDU / Chegg Tutors  | $2019-2020,\ 2022-2023\ 2017-2020\ 2013-2019\ 2014-2017$                              |
| Professional Service   |   |
| Conference Service Program Committee Co-Chair, RSS Pioneers Local Arrangements Chair, ACM Symposium on Computational Fabrication   | 2023<br>2018  |
| External Paper Reviewer  IEEE Robotics and Automation Magazine (RA-M)  First Monday  IEEE Robotics and Automation Letters (RA-L)   | $\begin{matrix}2023\\2020-2021,2023\\2019-2023\end{matrix}$                           |
| IEEE International Conference on Robotics and Automation (ICRA) IEEE International Conference on Soft Robotics (Robosoft) IEEE International Conference on Intelligent Robots and Systems (IROS) IEEE International Conference on Automation Science and Engineering (CASE) International Journal of Robotics Research (IJRR)  | $2019-2020,\ 2022,\ 2023 \ 2018-2021,\ 2023 \ 2019,\ 2021,\ 2021 \ 2019$              |
| Invited Speaker  Talk: "Materials Make the Bot: Directly Embedding Actuation and Perception into Robotic Section Queen's University at Kingston, Centre for Neuroscience Studies Talk  UC Berkeley, Mechanical Engineering Seminar  UT Austin, Electrical and Computer Engineering Seminar  Oregon State, Mechanical Engineering Seminar  Carnegie Mellon, Softbotics Seminar  Georgia Tech, Mechanical Engineering Seminar    | Structures"  Jun. 2023  Mar. 2023  Mar. 2023  Feb. 2023  Nov. 2022  Oct. 2022         |

UMass Boston, Dept. of Psychology, Class on Research Methods – "Repeated Measures" Hertz Summer Workshop – "Sensorizing Architected Materials with Fluidic Networks"

CUNY Queens College, Media Studies Colloquium – "How To Survive a Public Faming"

Hertz Fall Retreat - Panel Leader, "Robotics"

June 2023

Jul. 2022

Nov. 2021

Sep. 2020

| University of Copenhagen SURF@DAWN – "Embodied Intelligence" | Jul. 2020 |
|--|-----------|
| Consumer Electronics Expo – Panelist, "Robots Save the Land" | Jan. 2020 |
| Hertz East Coast Retreat – Panelist, "Science and Media"     | Sep. 2018 |
| Designed Education – Speaker, "Introduction to Robotics"     | Jul. 2018 |
|  |           |

Professional Societies: IEEE, IEEE RAS

| Research | STUDENTS | Supervised |
|----------|----------|------------|
|          |          |            |

Magtana Studenta

| Masters Students  | 2022 2022  |
|---|--|
| Gregory Xie [J.10, J.11, J.12, C.9, thesis] – Design of tendon-driven gripper and belt-driven gripper | $egin{array}{c} 2022 - 2023 \ 2020 - 2022 \end{array}$ |
| Jeana Choi [J.7, J.13, thesis] – System integration of grocery packing robot                          | 2020 - 2022  |
| Undergraduate Students  |  |
| Juliana Covarrubias – Mechanical design of dual-flipping robots                                       | 2022 - 2023  |
| Shruti Garg – System integration of sensorized fingers and design of tactile sensors                  | 2022 - 2023  |
| Katherine Pan – Mathematical exploration of dual-flipping robots                                      | 2022 - 2023  |
| Grey Saramiento – Algorithmic lattice generation and routing of fluidic sensors                       | 2022 - 2023  |
| Daniel Tong – Exploration of resin chemistry and metamaterial design through nTopology                | 2022 - 2023  |
| Max Burns [J.10] – Application exploration of modular volumetric robots                               | $\boldsymbol{2022}$                                    |
| Nine Morch – Design testing rigs for metamaterials; mechanical design of dual-flipping robots         | $\boldsymbol{2022}$                                    |
| Ahmed Diongue – Mechanical characterization of metamaterials  | $\boldsymbol{2022}$                                    |
| Valerie Chen [J.13] – Computer vision algorithms for bin packing; tactile sensor design               | 2019 - 2022  |
| Gregory Xie [J.10, J.12] – System design of modular volumetric robots                                 | 2019 - 2021  |
| Joaquin Giraldo-Laguna – Fabrication and simulation of modular volumetric robots                      | 2020   |
| Sofia Leon – Mechanical design of dual-flipping robots  | 2019 - 2020  |
| Hannah Adams – Mechanical characterization of metamaterials   | 2019   |
| Felipe Barscevicius [C.6] – Mechanical design of multiplexed manipulator                              | 2019   |
| Andromeda Teevens – Exploration of machine learning segmentation algorithms                           | 2019   |
| Sabina Tontici – Mechanical design of soft robotic gripper  | 2019   |
| Chetan Sharma [C.2]— Mechanical design of soft robotic gripper covering                               | 2017 - 2019  |
| Shiloh Curtis – Exploration of computer vision segmentation algorithms                                | 2018 - 2019  |
| Jacob Miske [C.5] – System design of modular volumetric robots  | 2018 - 2019  |
| Jonathan Tagoe – Design testing rigs for metamaterial characterization                                | 2018 - 2019  |
| Antares McCoy-Villaneda – Design testing rigs for metamaterial characterization                       | 2018   |
| Luis Trueba [C.4] – Grasping tests and mechanical design of grocery packing testbed                   | 2018   |
|   |  |

#### OTHER EMPLOYMENT

Robotics Intern

#### Toyota Research Institute

June - Aug. 2017

Feb. 2014 – Jan. 2017

Cambridge, MA

• Designed automated mechanical testing rigs to evaluate performance of new soft tactile sensor against simulation

- Created new silicone-based tactile skin and performed experiments on mechanical adhesion and accuracy
- Explored current tactile sensing solutions contacting manufacturers and recreating academic prototypes

#### MIT Computer Science & Artifical Intelligence Lab., Distributed Robotics Group Sept. 2016 – June 2017 Undergraduate Researcher with Dr. Daniela Rus Cambridge, MA

• Designed electrically-powered soft robotic actuator based on handed shearing auxetic patterns.

Massachusetts Institute of Technology, Department of Mechanical Engineering

• Mechanically characterized force output and compliance of new actuator, creating soft robotic linear actuator.

#### Undergraduate Researcher with Dr. John Hart Cambridge, MA • Created machine vision algorithms in C++ for dynamic photolithography system, increasing speed of tracking,

- detection and encapsulation by 300% with multithreading, Kalman filters and bit plane splicing.
- Performed encapsulation experiments on liver hepatocytes in photopolymers for tissue engineering applications.
- Adapted photolithographic system to a robot arm, enabling accurate micropatterning on macro-scale objects. Improved scanning system's accuracy and designed mechanical enclosures for electronic / optical systems.

- Designed and printed NFC circuits to test capabilities of photolithography system for flexible circuits
- Analyzed performance of various particle detection and tracking algorithms in simulated and actual conditions.

Apple June – Aug. 2016

iPad Hardware Systems Integration, Electrical Engineering Intern

Cupertino, CA

- Designed schematic layout and PCB board in Cadence for internal project board involving high-speed signals.
- Wrote TCL scripts to validate basic functionality on primary SoCs. Deployed and supported this test suite at stations on SMT, FATP and REL lines in China.
- Performed and debugged power validation and signal integrity measurements on low and high speed signals, including SPI, I2C, and PCIe.
- Brought up and performed failure analysis on boards and full systems, working cross-functionally among product design and module teams
- Conducted thermal experiments on battery life and power output. Wrote Python scripts for data analysis and visualization, suggesting testing and board design changes based on results.
- Wrote scripts in Lua and C++ to take internal eye diagram measurements of high-speed signal lines.

Square
Electrical Engineering Intern

June – Aug. 2015

San Francisco, CA

- Wrote C code for NFC card proximity detection that interfaced with 2 microcontrollers, an FPGA, ADC/DACs, and a voltage regulator. Key part of firmware needed to pass contactless payment certification
- Tuned NFC antennas with VNA and SMT rework skills, enabling proposal of new antenna design directions
- Wrote Python script to send HCI commands to Bluetooth chip, validating results with spectrum analyzer
- Supported EVT build of 300 units in China with electrical engineeirng, embedded software and translation skills for SMT and FATP factory lines
- Provided foundation for algorithm to automatically design tamper mesh in Altium
- Created preliminary schematics and PCB layout for new NFC board in Altium

#### MIT Media Lab, Biomechatronics Group

Jan - May 2015

Cambridge, MA

Undergraduate Researcher with Dr. Hugh Herr

- Created thin-wire electrodes and Matlab script to stimulate rat sciatic nerve and measure response
- Wrote automated particle analysis in ImageJ to measure and differentiate neuron size, count and g-ratio to quantify nerve regrowth

MIT Computer Science and Artifical Intelligence Laboratory, Big Data Initiative

Sept. – Dec. 2014

Undergraduate Researcher with Dr. Sam Madden

Cambridge, MA

- Strengthened Django and Javascript frameworks of a system that allowed users to control data privacy and access
- Created REST API for the personal data storage system, enabling interfacing with iOS and Android sensors

Coursera
Software Engineering Intern

June – Aug. 2014

Mountain View, CA

- Wrote Javascript for on-demand certification, moving Coursera's major revenue generator to an updated platform.
- Restructured large portion of backend logic in PHP and Django for Coursera's shift to single certification and trials.
- Created internal analytics dashboard in AngularJS to monitor status of product and revenue generated.

# Georgia Institute of Technology, Department of Mechanical Engineering

May 2011 - Aug. 2013

Atlanta, GA

High School Researcher with Dr. Michael Leamy

- Constructed an agent-based model in NetLogo to study collective cell movement during wound healing.
- Innovatively applied engineering principles to create model based on biological time-lapse videos of wound healing.

#### Emory University, Department of Pharmacology

Aug. 2011 - May 2013

High School Researcher with Dr. Jennifer Hurst-Kennedy

Atlanta, GA

- Conducted cell invasion and cell-migration assays to study the role of a deubiquitnating enzyme in cancer metastasis.
- Established a method for quantitative analysis of cell invasion data taken from time-lapse confocal video microscopy.

Westminster Schools Jan. 2010 – May 2013

High School Researcher with Dr. Chris Harrow and Dr. Shaffiq Welji

Atlanta, GA

• Investigated locus of a conic section's foci using dynamic geometry and computer algebra software

Guitar-playing robot that uses solenoids to strum and a rack-and-pinion setup to fret. Won first place.

• Analyzed behavior found by applying projective and algebraic geometry to the problem.

#### SIDE PROJECTS

# 2.72 – Elements of Machine Design Desktop lathe that maintained 50 micron precision even after being dropped. Won first place for highest accuracy MIT Mobile Autonomous Systems Laboratory Cube-stacking autonomous robot. Won first place, best software, best wiki and "most likely to be staff" award MakeMIT 2014