Jaime Alon Berkovich

DoD NDSEG Fellow & PhD Candidate @ MIT DMSE & LAMM
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Education

Massachusetts Institute of Technology — Cambridge, MA
Department of Materials Science and Engineering (DMSE) — Expected Graduation: June 2028
Doctor of Philosophy, Materials Science and Engineering
Investigating utilizing cellular automata algorithms to architect lightweight, bioinspired hierarchical materials with minimal computational cost. Engineering transformer-architected neural networks and other machine learning models to predict the long-term behavior of chaotic systems.

Northwestern University — Evanston, IL
McCormick School of Engineering — Sept. 2019 - June 2023
Bachelor of Science, Materials Science and Engineering; GPA: 3.74; Minor in Critical Theory
Concentration in biomaterials with interested in eco/bioresorbable materials, self-assembly, computation *in materio*, biomimetic systems, and sustainable manufacturing technologies.

Honors, Awards, and Grants

- National Defense Science and Engineering Graduate (NDSEG) Fellowship Award — 2023
- Finalist – NASA's Breakthrough, Innovative, and Game-changing (BIG) Idea Challenge (2023 Lunar Forge Challenge) — 2023
- McCormick School of Engineering Honors Certificate (Dean's List), Four-Time Recipient — 2019 - 2022
- 1st Place – Querrey Simpson Institute for Bioelectronics Summer Symposium — 2021
- Northwestern University Summer Undergraduate Research Grant (SURG) — 2020

Work Experience

NU Tutors — Evanston, IL
Tutor — Oct. 2022 – June 2023
- Tutoring high school students part-time in both AP and non-AP classes, SAT, and ACT.

Wearifi, Inc. — Evanston, IL
Engineering Intern — June 2021 – Sept. 2022
- Developed and improved upon an existing wearable skin hydration sensor to improve device accuracy and user-friendliness.
- Independently designed, fabricated, and experimentally validated a compliant mounting mechanism to minimize the pressure applied to the skin during the application of the device to improve measurement precision and accuracy – results published in the journal Advanced Healthcare Materials.
- Mentored/ managed a team of 4 undergraduate/ high school interns over the summer of 2022.
- Fabricated devices from bare PCBs using various techniques including solder paste screen-printing, pick-and-place machine operation, laser cutting, CNC milling, silicone molding, sputter coating, SLA 3D printing, and micro-soldering.
- Independently designed, fabricated, and implemented new device encapsulation geometries to provide space for additional sensing components.
- Independently designed and fabricated a 3D-printable, protective charging case for the skin hydration sensor.
- Developed a scalable method of device encapsulation, using thermoplastic polyurethane to replace conventional silicone.

Exicure, Inc — Chicago, IL
Research and Development Intern — Sept. 2020 – Feb. 2021
- Aided in and independently performed novel research on the spherical nucleic acid (SNA) nanoparticle platform used for gene therapy delivery.

- Characterized nanoparticle composition using high-pressure liquid chromatography (HPLC).
- Created a mathematical model to estimate the size distribution of nanoparticles given the ratio of constituent elements and dynamic light scattering (DLS) data.
- Presented original research characterizing nanoparticle stability changes over time at extreme temperatures.

Northwestern University, Rogers Group/ Querrey Simpson Institute for Bioelectronics (QSIB) Evanston, IL
Contract Employee Sept. 2020 – June 2021

- Created a new method of encapsulating and stabilizing molybdenum-candelilla-wax solder connections with a mixture of beeswax and shellac to fabricate a portion of a robust, bioresorbable heart strain sensor.
- Structured samples of thin films using a laser ablation machine inside a class 100 cleanroom facility (NUFAB).
- Independently characterized the effect of differing laser ablation strategies on silicon and magnesium films using atomic force microscopy (AFM) and optical profilometry. Measured roughness, ablation depth, and ablation resolution. Results published in the journal Nature Communications.

Research Experience

Massachusetts Institute of Technology/ Laboratory for Atomistic and Molecular Mechanics (LAMM) Evanston, IL
Ph.D. Student Sept. 2023 – Present

- Researching cellular automata (CA) algorithms and their potential application to biomimetic engineering. Demonstrated the application of CA for design of hierarchical, architected, structural metamaterials.
- Construction machine learning (ML) model in PyTorch and Tensor flow to predict the long-range dynamics of chaotic CA systems, across a multitude of rulesets.
- Constructing custom hardware to observe the growth of fungus for use in programmable, self-organizing biological materials.
- Mentoring two high-school summer (2024) research interns (one who is in MIT's Research Science Institute) in the fields of cellular automata, vis-transformer models, and multimodal transformer models.

Northwestern University, Rogers Group/ QSIB Evanston, IL
Student Researcher Sept. 2022 – Dec. 2022

- Researching novel embodiments of an existing implantable vitals sensor for minimally invasive fetal surgery as part of my senior honors project in materials science and engineering.
- Optimizing the design of a circuit board to miniaturize the device.
- Implementing inductive charging to enable wireless, battery-free operation *in vivo*. Simulating inductive coupling on the scale of the device using Ansys Maxwell 3D.

Northwestern University, Gianneschi Group Evanston, IL
Student Researcher June 2022 – Aug. 2023

- Implementing a universal Turing machine in an additive and subtractive manufacturing scheme.
- Showed that such a machine could be used to perform computations in real-world tests.
- Independently validated the physical machine's calculations by simulating its printing, milling, and machine vision capabilities in Blender 3.0 using its Python API and TensorFlow.
- Independently created a program capable of generating thousands of realistically rendered 3D-printed objects to train an object recognition neural network without the need for real photographs.
- Manuscript in progress.
- Pursued an independent project where strong, lightweight structures were architected via cellular automata algorithms (Conway's Game of Life) and were shown empirically to outperform structures designed with Autodesk Fusion 360's generative design under a compressive load using a mechanical testing system.

Northwestern University, Rogers Group/ QSIB Evanston, IL
Student Researcher June 2020 – June 2021

- Independently designed, fabricated, and characterized induction coils for an implantable, bioresorbable heart strain sensor as a part of a Northwestern summer undergraduate research grant proposal.
- Used solvent lamination, heat pressing, and 3D printing to manufacture bioresorbable induction coils.
- Used a network analyzer to characterize the signal quality factor (Q factor) of the coils.

- Continued my research as part of a hired contract employee position for QSIB (see Work Experience).

Northwestern University, Chandrasekhar Group/ Mesoscopic Physics Group — Evanston, IL
Student Researcher — May 2018 – Sept. 2018

- Aided in research on the electronic properties of 2D hexagonal boron nitride.
- Fabricated samples of h-BN using tape and PDMS exfoliation techniques.
- Utilized spin coating and photolithography inside a class-100 clean room to fabricate masks on silicon wafers for vacuum deposition of gold to create a coordinate grid for locating small samples.
- Used optical microscopy to locate candidate 2D h-BN flakes for further analysis with AFM.

Extracurricular Activities & Volunteer Work

Northwestern NASA BIG Idea Challenge Team — Sept. 2022 – Nov. 2023

- Founded the team and acted as the team lead/ head captain for the duration of the project.
- My team was selected as one of only seven finalists on Mar. 2, 2023
    - Awarded $167,928.38 in total funding from NASA to pursue prototyping and validation of our concept lunar casting system over 7 months.
- My team was awarded the *Best Systems Engineering* award at NASA's Lunar Forge Conference in Nov., 2023.
- Solicited Northwestern faculty sponsorship (Prof. Ian McCue, Department of Materials Science and Engineering)
- Collaborated with Northwestern's Aerospace and Rocketry Club to recruit team members (NUSTARS)
    - Recruited 22 undergraduates and 2 graduate students
- Collaborated with the Society of Women Engineers to increase inclusivity during recruitment.
- Planned team meetings, lead research efforts, and managed the preparation of a proposal to NASA for our embodiment.
- Facilitated brainstorming and proposal design reviews - consulted with graduate student and faculty mentors to develop our proposal.
- The proposed system casts metallic landing pads within lunar regolith using energy harnessed from focused sunlight with a modular, parabolic mirror array, optical waveguide system, and a novel, yttria-stabilized-zirconia crucible.
- Led team meetings throughout the summer, designated tasks, and was the creative project/ engineering lead during the initial 3 months of physical prototyping and experimentation.
- Coordinated safety trainings, connected facilities managers with students, and communicated with Northwestern's Department of Materials Science and Engineering purchasing office to place orders on time and prevent bottlenecks.
- Facilitated team-wide social events and communicated with the NU Dean of Engineering's office to provide free lunches for team members during the entire summer to improve morale.
- Assisted with the development of a team logo.
- Coordinated team-wide transportation to NASA's Lunar Forge Conference in Cleveland, OH.
- Solicited free software from ANSYS for use in various optical, mechanical, thermal, particle (soil), and electromagnetic simulations.
- Solicited in-kind donations of lathed parabolic mirrors from Rexnord Aerospace.
- Solicited guidance on metallurgical experimentation from Questek, LLC.
- Solicited in-kind donations in the form of access to fabrication equipment from Wearifi, Inc.
- Supervised the construction of mechanical apparatuses, electrochemical experimentation, simulation work, fabrication of optical components, and more, by undergraduate students over the summer.

Delta Tau Delta Fraternity Beta-Pi Chapter — Jan. 2020 – June 2023

- Member of the executive board: Director of Communication (Sept. 2020 - Present)
- Merchandise Chair (2021 – Present)
    - Organized merchandise orders for intra-chapter and charity sales.
- Head of Fraternity Awards and Accreditation Report Committee (Sept. 2020 - Present)
- Dance Marathon Chair (2021)
    - Lead the chapter in raising funds for Northwestern University's 2021 Dance Marathon charity event.

- Assisted in hosting a charity Spikeball tournament (in partnership with JDRF)

Northwestern University Mat Sci Club Mar. 2021– June 2023

- Executive Board Member; Co-social chair (2021-2022)
    - Assisted with planning social events for Materials Science and Engineering undergraduates.

Illinois Holocaust Museum & Educational Center; Speaker: Sept. 2022

- Gave a speech introducing my grandfather, a Holocaust survivor, at the 81st annual commemoration of the mass shootings at Babiy Yar that took place in 1941.

Northwestern University Dance Marathon Oct. 2020 – Mar. 2021

- Development & Alumni Relations Committee
    - Communicated with alumni and solicited donations for Northwestern's largest annual charity event.

City of Evanston Zombie Scramble: Oct. 2019

- Volunteered to run around dressed as a zombie and tag runners for a city-wide Halloween event.

Peer-Reviewed Journal Articles

1) Luu, R. K.; Arevalo, S.; Lu, W.; Ni, B.; Yang, Z.; Shen, S. C.; **Berkovich, J.**; Hsu, Y.-C.; Zan, S.; Buehler, M. J. Learning from Nature to Achieve Material Sustainability: Generative AI for Rigorous Bio-Inspired Materials Design. An MIT Exploration of Generative AI, March 2024. DOI: 10.21428/e4baedd9.33bd7449.
2) Wu, Y.; Liu, C.; Lapiere, M.; Ciatti, J. L.; Yang, D. S.; **Berkovich, J.**; Model, J. B.; Banks, A.; Ghaffari, R.; Chang, J.; Nuzzo, R. G.; Rogers, J. A. Thermoplastic Elastomers for Wireless, Skin-Interfaced Electronic, and Microfluidic Devices. Advanced Materials Technologies 2023. DOI: 10.1002/admt.202300732.
3) Shin, J.; Wang, H.; Kwon, K.; Ostojich, D.; Christiansen, Z.; **Berkovich, J.**; Park, Y.; Li, Z.; Lee, G.; Nasif, R.; Chung, T. S.; Su, C. J.; Lim, J.; Kubota, H.; Ikoma, A.; Lu, Y. A.; Lin, D. H.; Xu, S.; Banks, A.; Rogers, J. A. Wireless, Soft Sensors of Skin Hydration with Designs Optimized for Rapid, Accurate Diagnostics of Dermatological Health. Advanced Healthcare Materials 2022, 2202021. DOI: 10.1002/adhm.202202021.
4) Yang, Q.; Hu, Z.; Seo, M.-H.; Xu, Y.; Yan, Y.; Hsu, Y.-H.; **Berkovich, J.**; Lee, K.; Liu, T.-L.; McDonald, S.; Nie, H.; Oh, H.; Wu, M.; Kim, J.-T.; Miller, S. A.; Jia, Y.; Butun, S.; Bai, W.; Guo, H.; Rogers, J. A. High-Speed, Scanned Laser Structuring of Multi-Layered ECO/Bioresorbable Materials for Advanced Electronic Systems. Nature Communications 2022, 13(1). DOI: 10.1038/s41467-022-34173-0.

Additional Skills/ Hobbies

• Videography/ Video Editing • Digital Music Production (Logic Pro X) • Digital 3D Animation (Blender) • Graphic Design (Adobe Illustrator) • Technical Drawing • Technical and Persuasive Writing • Public Speaking/ Policy Debate • Philosophy • CAD (AutoCAD, Fusion360, Inventor, SOLIDWORKS) • MATLAB • PyTorch • Tensorflow •