Gabrielle Leah Hoyer

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EDUCATION

University of California, San Francisco & UC Berkeley | San Francisco, CA
Ph.D. Candidate, Bioengineering | 2021 – Present

University of Utah | Salt Lake City, UT
M.S./B.S., Biomedical Engineering (Neural Interfaces) | May 2020

RESEARCH EXPERIENCE

Graduate Researcher | Musculoskeletal Quantitative Imaging Research (MQIR) Group | 2022 – Present

JointAI: Scalable AI for Knee-Joint Health and Precision Orthopedics (Dissertation Research)
An integrated research initiative unifying dataset innovation, biomarker discovery, and advanced AI methods into a cohesive framework designed to improve musculoskeletal health management and clinical decision-making.

- **Scalable Dataset Innovation and Clinical Validation**
  - Developing thorough methods to evaluate clinical value, reliability, and practical impact of foundation AI models for musculoskeletal MRI.
  - Creating scalable, reproducible approaches to generate and curate diverse medical imaging datasets, ensuring consistent model generalizability, accuracy, and fairness.

- **Integrated MRI Biomarker Discovery and Statistical Validation**
  - Using cross-sectional analysis and hierarchical modeling to identify clinically meaningful MRI biomarkers predicting disease progression, osteoarthritis incidence, and knee replacement outcomes.
  - Establishing foundational datasets and analytical strategies that support advanced predictive modeling and clinical translation.

- **Digital Twin Development for Longitudinal Analysis and Predictive Medicine**
  - Extending identified MRI biomarkers into longitudinal assessments through causal inference, survival analyses, predictive analytics, and generative AI for scenario exploration. [slide deck]
  - Merging multi-modal data (imaging, clinical demographics, biomechanical signals, and 3D anatomical representations) into personalized digital twins, featuring interactive tools for real-time clinical decision support, prevention planning, and treatment optimization.

- **Bias Evaluation and Fairness through Self-Supervised Learning (Collaborative Project)**
  - Examining how self-supervised learning methods influence MRI segmentation and fairness across diverse populations in large-scale musculoskeletal imaging. [slide deck]
  - Validating SSL as a scalable way to achieve equitable performance without increasing demographic biases in clinical AI applications.

- **Human-in-the-Loop Pipeline Optimization for Medical Image Annotation (Collaborative Lab Initiative)**
  - Contributing to the design and optimization of workflows that pair automated annotation algorithms with clinician oversight, elevating both speed and quality in large-scale dataset creation.

Graduate Researcher | Computer Vision in Anesthesiology Lab | 2018 – 2021

- Designed software to create an augmented reality view of the endotracheal tube placement to improve clinician success rate of patient intubation.

- Utilized the deep learning architecture of YOLO for the development of clinically-applied real-time object detection.
- Awarded NSF I-Corps Seed Grant in an attempt to bring this device from bench to bedside.

Undergraduate Research Asst. | Mechanisms of Synaptic Functions Lab | 2016 – 2018

- Investigated the calcium control of vesicle fusion at neuromuscular junctions.
- Utilized TEM to image worm genotypes involving complexin and calcium-sensing synaptotagmin proteins to determine the accuracy of current synaptic neurotransmission models.
- Developed proficient skills with handling C. elegans, and Transmission Electron Microscopy (TEM) – Hitachi 7100 and JEOL JEM-1400. [poster]

Undergraduate Research Asst. | Neural Information Lab | 2014 – 2017

- Examined the relationship between behavioral movement and cortical oscillations associated with Parkinsonism.
- Gathered daily behavioral and electrophysiological recordings and wrote MATLAB script to analyze data.
- Discovered new motor patterns that differentiate rodent behavior across healthy and parkinsonian conditions.
- Developed proficient skills with rodent EEG electrode implantation surgery, Microinjections, Transcardial perfusions, and cryostat sectioning.

LEADERSHIP & SERVICE

Chief Development Officer | Project Embrace nonprofit | 2018 – 2022

- Generated an operational model that efficiently delivered medical devices to more than 1000 people in 9 countries.
- Managed Patient Impact and Patient Resources teams to create educational and impact-driven initiatives to ensure consistent and efficient throughput of medical resources to community partners.
- Developed customized inventory system for medical resources and community partners using Python, SQL, Django.
- Spearheaded successful acquisition of grants from prominent organizations including Intermountain Healthcare, Utah Division of Multicultural Affairs, SelectHealth, and more, bolstering the non-profit organization's funding initiatives. [slide deck]

Technical Lead, A.I. Healthcare Venture | NSF National I-Corps Program | 2021

- Conducted a market analysis on A.I. integration into the clinical workflow and the potential strategic and tactical uses of video airway data.
- Interviewed 100+ industry stakeholders – including hospital administration, insurance groups, I.T., supply chain, end-users, and competitors.
- Acquired hands-on experience with the chaos and uncertainty of commercializing innovations and creating ventures.

Director of Research + Project Development | Project Embrace nonprofit | 2016 – 2018

- Researched, organized, and executed medical resource campaigns to the Navajo Nation of Utah, Arizona, and New Mexico, as well as to Tijuana, Mexico, Seattle, Washington, redirecting 500+ medical devices to vulnerable communities.
- Established sustainable partnerships with clinics and community distribution centers in the Navajo Nation of Utah through the Navajo Health System Inc.

Volunteer Lab Technician | Shriners Hospital for Children | 2014 – 2016

- Engaged actively with various prosthetic and orthotic-based services inclusive of upper and lower extremity prosthetic care, scoliosis bracing and muscular dystrophy bracing.
- Utilized 3-D scanning technology incorporated computer-aided design (CAD) and computer-aided manufacturing (CAM) to assist the design and fabrication of devices.
- Aided clinical staff in their appointments with patients and fit orthotic and/or prosthetics to patients for measurements.

WORK EXPERIENCE

Software Development Intern | Compassion International | 2020

- Developed user interfaces and chat apps with React JS and RESTful APIs with AWS Lambda.
- Designed and coded application components in an Agile environment.

Data Science Impact Fellow | Sorenson Impact Center | 2018

- Provided customized data diagnostics for clients Using R and Python.
- Created data visualizations and dashboards.
- Developed code with best practices of data sharing and security in mind.
- Determined impact measurement for both public and private sector projects.

Product Development Engineering Intern | Ortho Development | 2017 – 2018

- Utilized SEM imaging to understand the morphological changes of Direct Metal Laser Sintering (DMLS) Printed Titanium to quantify different heat treatment effects.
- Defined, quantified, and differentiated between residual stress-induced cracking versus incomplete build defects of DMLS printed Titanium bone ingrowth porous super structure using SEM imaging.
- Utilized Image Analysis software to characterize SEM and photographic images of 3D-printed titanium and histological cross-sections of bone implants.
- Maintained FDA-compliant writing protocols, as well as engineering drawings via Creo Parametric CAD software.

PUBLICATIONS AND PRESENTATIONS

1. **Hoyer, G.**, Tong, M.W., Bhattacharjee, R. et al. Scalable Evaluation Framework for Foundation Models in Musculoskeletal MRI Bridging Computational Innovation with Clinical Utility. *arXiv* (2025). https://arxiv.org/abs/2501.13376. (under review at *Nat. Commun.*). [code | supplement | poster]
2. **Hoyer, G.**, Gao, K.T., Gassert, F.G. et al. Foundations of a knee joint digital twin from qMRI biomarkers for osteoarthritis and knee replacement. *npj Digit. Med.* 8, 118 (2025). https://doi.org/10.1038/s41746-025-01507-3. [code | code | supplement]
3. Huang, H., **Hoyer, G.**, Hess, M. et al. Does Demographic Bias Always Affect Model Fairness? An Evaluation with Musculoskeletal Imaging. (2025). (under review at *Conference on Health, Inference, and Learning* (CHIL)). [preprint | code]
4. Liu, F., **Hoyer, G.**, Ziegeler K. et al. Validation of a Fully Automized Volumetric Thigh Muscle Segmentation Pipeline Using Segment Anything. In *Proceedings of the OARSI World Congress*, Incheon, South Korea, (2025).
5. **Hoyer, G.** & Tong, M.W. et al. Towards a Generalizable Foundation Model for Multi-Tissue Musculoskeletal MRI Segmentation. In *Proceedings of the 32nd Annual Meeting of ISMRM*, Session: The Future of AI in MRI: Emerging Technologies & Directions, Singapore, (2024), 8045. (Awarded Magna Cum Laude). [abstract]

6. **Hoyer, G.**, Gao, K.T., et al. Quantitative MRI Interpretable 100D Feature Space of Knee Osteoarthritis. In *Proceedings of the 31st Annual Meeting of ISMRM*, Session: ML/AI New Ideas, Toronto, Ontario, Canada, (2023), 993. [slide deck]

7. **Hoyer, G.**, Runnels, S. et al. Comparison of Procedural Distancing of Primary and Advanced Intubation Techniques. In *Proceedings of the Difficult Airway Society Annual Meeting*, UK (2020).

8. **Hoyer, G.**, Runnels, S., Kuck, K. et al. Automatic Video Laryngoscope Archiving System, First Pass Rates in Archived Intubations. In *Proceedings of the Society for Technology in Anesthesia Annual Meeting*, Austin, TX (2020). [demo]

9. Dorval, A., Polar, C. & **Hoyer, G**. Cortico-Subthalamic Beta-Coherence Suppression During High-Intensity, Self-Directed Motion in a Parkinsonian Rat Model. In *Proceedings of the 9th International IEEE/EMBS Conference on Neural Engineering (NER)*, IEEE Engineering in Medicine and Biology Society, San Francisco, CA, (2019), 491. [poster]

10. Sudabattula, M. & **Hoyer, G**. Towards the Provision of Sustainable Medical Materials to Low and Middle-Income Countries: A Non-Profit Case Study. In *Proceedings of the 2017 International Health Conference*, Session: Health Inequalities and Big Data, St. Hugh's College, Oxford, UK, (2017), 178.

HONORS AND AWARDS

UCSF Discovery Fellowship | 2023 – Present
Awarded for leadership potential, research excellence, community engagement, and communication skills. Fellows advocate for UCSF's foundational biomedical sciences and healthcare research initiatives.

NIH T32 Bioengineering Training Grant | 2021 – 2022
Competitive NIH-funded training grant supporting interdisciplinary biomedical engineering research.

NSF National I-Corps Program Grant | 2021
Experiential entrepreneurship training from the National Science Foundation's Innovation Corps (I-Corps™), fostering skills to accelerate technology commercialization from research laboratories to industry.

NASA Space Grant Fellowship | 2019 – 2021
Nationally competitive fellowship supporting research aligned with NASA's aeronautics and space exploration missions, aimed at advancing scientific understanding and public engagement in aerospace.

Chevron Scholarship for Women in STEM | 2018 – 2019
Award recognizing academic excellence among self-identified women pursuing STEM disciplines, created to support and encourage women's careers in science, technology, engineering, and mathematics.

Bioscience Undergraduate Research Scholar | University of Utah | 2015 – 2017
Recognition and funding from the Department of Biology awarded to exceptional undergraduate students conducting advanced bioscience research.

NSF Research Experiences for Undergraduates (REU) Grant | 2015 – 2016
National Science Foundation-funded program supporting undergraduate research participation in neural engineering and computational neuroscience, under Dr. Chuck Alan Dorval in the Neural Information Lab.

ACCESS Program for Women in STEM Scholar | University of Utah | 2014 – 2015
Selective scholarship and mentorship program dedicated to first-year women demonstrating exceptional potential and interest in science, technology, engineering, and mathematics.