Alison Bartsch

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Education

Carnegie Mellon University   *Pittsburgh, PA*
PhD Candidate in Mechanical Engineering | GPA: 3.92/4.0   Anticipated Grad. Aug. 2025
Thesis Title: "Learning-Based Methods for 3D Deformable Object Manipulation"
Relevant Coursework: Deep Learning for Engineers, Deep RL & Control, Computer Vision, Learning for Manipulation, Robot Cognition, Math Fundamentals for Robotics, Project Management

Stanford University   *Stanford, CA*
BS in Aeronautics and Astronautics | GPA: 3.78/4.0   Graduated June 2021
Relevant Coursework: Principles of Robot Autonomy I and II, Topics in Advanced Robotic Manipulation, Feedback Control Design, Space Flight, Space Mechanics, Spacecraft Design Laboratory

Research Experience

PhD Researcher | Carnegie Mellon University   *Pittsburgh, PA*
Mechanical and AI Lab   Sept. 2021 – Present

- **Reinforcement Learning:** Developed a novel experience replay sampling method for off-policy RL, leading to improved convergence speed (13% faster) in benchmarking tests. Designed a trajectory augmentation strategy utilizing a single human demonstration to seed the replay buffer, reducing sample complexity and improving learning efficiency.
- **Deformable Object Manipulation:** Designed a latent dynamics model to predict plasticine deformation, leveraging pre-trained PointBERT embeddings to minimize real-world data requirements and improve model generalization.
- **3D Vision:** Developed a multi-camera RGB-D system for real-time, high-accuracy 3D surface reconstruction, applied to deformable object manipulation tasks.
- **Sculpting Imitation Learning:** Created a novel 3D point cloud-based diffusion policy for imitation learning in robotic clay sculpting using a parallel gripper. Collected and released a real-world dataset of robotic demonstration trajectories to support reproducibility in deformable manipulation research.
- **LLMs for Sculpting Reasoning:** Built a system integrating large language models (LLMs) as high-level planners for the top-down sculpting task, exploring complex robot-object interactions.
- **Hierarchical Sculpting:** Developed a multi-level sculpting framework for text-to-3D shape creation combining LLM-driven task decomposition with supervised learning-based refinement strategies, improving robotic precision in elasto-plastic material shaping.
- **Diffusion for Neural Field Generation:** Designed a 3D sub-goal generation pipeline utilizing a diffusion model to generate intermediate 3D goals, enhancing accuracy and sample efficiency in robotic sculpting task planning.

Undergraduate Researcher | Stanford University   *Stanford, CA*
Autonomous Systems Lab   Jan. 2018 – June 2021

- **Gecko-Adhesive Grippers:** Developed a dynamic simulation model for gecko-adhesive gripper grasping scenarios to optimize robotic design and control strategies.

Technical Skills

Programming: Python, C/C++, Java, MATLAB
Machine Learning Techniques: CNNs, GNNs, Transformers, VAEs, Diffusion Models, Evolutionary Algorithms, Reinforcement Learning Algorithms (PPO, DDPG, SAC, TD3)
Frameworks & Libraries: PyTorch, TensorFlow, PyTorch3D, Open3D, OpenCV
Applications & Tools: ROS, SolidWorks, Git, Gym, ManiSkill2, PyBullet, MuJoCo, PlasticineLab
Robot Hardware: Franka arm/parallel gripper, LEAP hand, DeltaHand, Oculus-based Teleoperation

Select Publications

A Bartsch, AB Farimani. Planning and Reasoning with 3D Deformable Objects for Hierarchical Text-to-3D Robotic Shaping. Under review 2024.

A Bartsch, AB Farimani. LLM-Craft: Robotic Crafting of Elasto-Plastic Objects with Large Language Models. Under review 2024.

A Bartsch, A Car, C Avra, AB Farimani. SculptDiff: Learning Robotic Clay Sculpting from Humans with Goal Conditioned Diffusion Policy. IROS 2024.

A Bartsch, C Avra, AB Farimani. SculptBot: Pre-Trained Models for 3D Deformable Object Manipulation. ICRA 2024.

A Car, SS Yarlagadda, **A Bartsch**, A George, AB Farimani. PLATO: Planning with LLMs and Affordances for Tool Use. Under review 2024.

JH Park, GP Dalwankar, **A Bartsch**, A George, AB Farimani. Fluid Viscosity Prediction Leveraging Computer Vision and Robot Interaction. Engineering Applications of Artificial Intelligence 2024.

A George, **A Bartsch**, AB Farimani. OpenVR: Teleoperation for Manipulation. SoftwareX 2025.

A George, **A Bartsch**, AB Farimani. Minimizing Human Assistance: Augmenting a Single Demonstration for Deep Reinforcement Learning. ICRA 2023.

Conference Presentations

IROS 2024 Talk | SculptDiff | *Abu Dhabi, UAE*
ICRA 2024 Talk | SculptBot | *Yokohama, JPY*
ICRA 2023 Poster | Minimizing Human Assistance | *London, UK*

Awards

2024 CMU Mechanical Engineering Shaw Fellowship | Awarded for academic excellence
2023 CMU Engineering Dowd Research Fellowship | Recognized for cutting-edge research

Leadership Experience

Robotics Team Lead | Carnegie Mellon University · *Pittsburgh, PA*
Mechanical and AI Lab · Sept. 2022 – Present

- Lead a robotics research sub-group of 10 graduate students, overseeing experimental design, paper writing, and project direction.

Starting Central Defender · *St. Thomas, USVI*
US Virgin Islands National Women's Soccer Team · Sept. 2015 – Sept. 2021

- Starting central defender, representing USVI in Olympic and World Cup qualification tournaments.

Student Mentor | Stanford University · *Stanford, CA*
Women's Leadership Innovation Lab · Sept. 2018 – June 2020

- Led leadership workshops for high school girls, teaching interventions to address gender biases in STEM.

Teaching Experience

Teaching Assistant | Carnegie Mellon University · *Pittsburgh, PA*
Engineering Design II: Conceptualization & Realization · Aug. 2024 – Dec. 2024

- Provide feedback and critiques to assist teams in the design and prototyping of their projects.

Introduction to Deep Learning & Intermediate Deep Learning · Jan. 2024 – May 2024

- Taught core machine learning concepts in recitation and office hours and created homework.