ALVIN ZHANG

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RESEARCH INTERESTS

My goal is to **build robust, intelligent autonomous systems**.

- **Model verification and continual learning** by using **test-time feedback from self-supervision**.
- **Ground visual representation in touch** as the ultimate modality for robotic interaction.
- **Learn actionable representations** of an agent's external environment.
- Augment volumetric rendering systems with **expressive priors for faster and more stable inference**.
- Demonstrate effectiveness of algorithms on **real-world robots**.

EDUCATION

University of California, Berkeley 2016 - 2020
B.Sc., Electrical Engineering and Computer Science Major GPA: 3.875
Selected Coursework:
Computer Vision (A+), Robotic Manipulation and Interaction (A+), Machine Learning (A+), Artificial Intelligence (A+), Computer Graphics (A+), Statistical Learning Theory (A), Feedback Control Systems (A)

EMPLOYMENT

Research Engineer May 2021 - present
Matician (Autonomous Household Robotics Startup) *Mountain View, CA*

- Develop, integrate, and deploy a real-time *cm*-resolution 3-D mapping algorithm on a real-world robot.
  - Trusted interface for autonomous behavior; central to the user experience.
  - Fuse multi-modal inputs in a principled Bayesian manner by introducing a novel probabilistic interpretation of the signed distance function.
  - Inaugural member of the Mapping team; coordinate with other sub-teams; lead and mentor future members.
- Identify unexpected anomalies during operation; incorporate this into internal state and use it to adapt behavior.
- Integrate IMU measurements into a Visual-SLAM system. Analyze sensor noise, determine its sources, and develop mitigation strategies to run on-bot.

Perception Software Engineer Jan 2021 - Apr 2021
Nuro (Autonomous Delivery Vehicle Startup) *Mountain View, CA*

- Review state-of-the-art literature on optical flow; train and evaluate industrial-sized models for optical flow.

Perception Engineer May 2020 - Jan 2021
Ike Robotics (Autonomous Trucking Startup), acquired by Nuro in Jan 2021 *San Francisco, CA*

- Research, develop, and evaluate neural approaches for 3-D bounding box segmentation from LiDAR point clouds.
- Co-authored, with Lance Martin, a blog post on "Perception for Automated Trucking".

RESEARCH EXPERIENCE

Research Intern May 2022 - Jan 2022
Redwood Center for Theoretical Neuroscience, UC Berkeley *Berkeley, CA*

- Empirically demonstrate that a hierarchical generative model performs "explaining away" of nuisance factors; show that this process follows the theoretical neural dynamics of predictive coding and Bayesian inference.
- Extend NeRF by learning 3-D structural priors in a multi-scale volumetric rendering system, with the goal of improving reconstruction quality in sparse-view scenarios.

PUBLICATIONS

Generalized Skill Learning, Safety, and Exploration with Flow-Based Models [link] May 2019
Workshop, Task-Agnostic Reinforcement Learning, ICLR *New Orleans, LA*

- Single-author paper. Demonstrate an Ant learning to perform jumps and flips through unsupervised exploration. Perform actionable self-supervision by using the time between states as the cost function.

PROJECTS

A Geometric Introduction to Lie Theory [link] Nov 2022
Tutorial (WIP)

- Provide an intuitive, visual introduction to Lie theory though the motivating example of rigid-body motion.
- Introduce a novel formula for computing the logarithm of SE(3) that is faster and more numerically stable than existing methods.

Named Tensors [link] Nov 2021
PyTorch Library

- Support named dimensions for tensors. Reduce code ambiguity; enable better debugging and run-time checks. At the original time of its development, this provided more functionality than PyTorch's native implementation.

Type-Safe Coordinate Transforms [link] Oct 2022
Rust Library

- Implement type-safety for transforms between coordinate systems: projecting a point in coordinate frame A into camera B raises a compile-time error; composing $G_a^b(t=1)$ with $G_b^c(t=2)$ raises a run-time error.