Marcus Dominguez-Kuhne

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Google Scholar

Curriculum Vitae

Education

2021 **California Institute of Technology**, *B.S. in Computer Science (Machine Learning Focus)*, GPA: 3.8/4.0
Teaching Assistant: CS 155 Machine Learning & Data Mining (2 Terms), CS 156a Learning Systems

Publications

M. Dominguez-Kuhne*, T. Chen*, A. Swann, X. Liu, M. Schwager. *Semantic-Metric Bayesian Risk Fields: Learning Robot Safety from Human Videos with a VLM Prior*. Submitted ICLR 2025.
G. Salhotra*, I.-C. A. Liu*, **M. Dominguez-Kuhne**, G. Sukhatme. *Learning Deformable Manipulation from Expert Demonstrations*. IROS 2022.
M. Dominguez-Kuhne*, H. Huang*, J. Ichnowski, V. Satish, M. Danielczuk, K. Sanders, A. Lee, A. Angelova, V. Vanhoucke, K. Goldberg. *Mechanical Search on Shelves using Lateral Access X-RAY*. IROS 2021.
A. Kurenkov*, J. Taglic*, R. Kulkarni, **M. Dominguez-Kuhne**, A. Garg, R. Martin-Martin, S. Savarese. *Visuomotor Mechanical Search: Learning to Retrieve Target Objects in Clutter* IROS 2020
* Denotes Equal Contribution

Research Experience

May 2025–Present **Researcher, Machine Learning & Robotics**, *Stanford Multi-Robot Systems Lab*, Advisor: Prof. Mac Schwager

- Risk Aware Robotic Control with Vision Language Embeddings from Safe Human Video Demonstrations
- Scalable pipeline converting human demonstrations to task-agnostic risk fields utilizing open vocab object embeddings from foundation models (e.g. CLIP, DINOv3)
- Transformer based model learned risk from safe-only demonstrations, modeling unsafe regions without unsafe examples
- Integrated lightweight controller utilizing Control Barrier Functions to adjust VLA Policy (e.g. Gr00t) for safe rollouts
- Co-authored submitted **ICLR 2025** paper

Aug 2021–Aug 2022 **Graduate Student Researcher**, *University of Southern California RESL (Robotic Embedded Systems Laboratory)*, Advisor: Prof. Gaurav Sukhatme

- Task driven Robotic Manipulation with a focus on Reinforcement and Imitation Learning from Demonstrations incorporating Computer Vision
- Co-authored **IROS 2022** paper on deformable object manipulation
- Trained network to learn rope and cloth manipulation from human demonstrations & finetune with reinforcement learning
- Developed simulation & real robot experiments for policy transfer

June–Nov 2020 **AI Researcher**, *UC Berkeley AUTOLab*, Advisor: Prof. Ken Goldberg

- **First Author IROS 2021** paper introducing **LAX-RAY** (Lateral Access Mechanical Search) to find hidden objects on shelves in home environments utilizing computer vision and manipulation
- CNN network using RGBD images to predict occluded items distributions on shelfs utilizing perspective transformations
- Developed two hidden-object mechanical search policies achieving 89% success in simulation and on Fetch robot

June–Nov 2020 **Machine Learning Researcher**, *Caltech CAST Lab*, Advisor: Prof. Yisong Yue

- Applied imitation learning of distance & steering functions for multi-robot planning using Rapidly-Exploring Random Trees for double and single integrator models

Apr–Oct 2019 **AI Researcher**, *Stanford Vision and Learning Lab*, Advisor: Prof. Silvio Savarese

- Co-authored **IROS 2020** paper on **Visuomotor Mechanical Search**
- Built reinforcement learning pipeline using OpenAIBaselines to search for a desired object in a pile, using end effector deltas as movement primitives in PyBullet
- Developed computer vision pipeline using PoseCNN on the YCB object dataset to identify and segment objects using RGBD in real and simulation
- Developed multi-stage architecture integrating teacher-guided exploration and mid-level representations

Sept 2018–Apr 2019 **Machine Learning Researcher**, *Caltech Vision Lab*, Advisor: Prof. Pietro Perona

- Trained CNNs to detect dementia on retinal images drawn from small datasets (200 patient images)

Work Experience

Oct 2024–Feb 2025 **Founding Engineer – First Employee**, *SynthAI (YC Combinator Funded Startup)*

- Joined first half of Fall YC Batch, integral to Pre-Seed funding (3.5 million dollars) from VC's (Caffeinated Capital, 47th Street Partners, Innovation Endeavors, Coughdrop Capital) & product showcase for YC demo-day attracting top investors
- Led engineering & applied research for increasing precision and minimizing false positives for multi-stage AI Agents
- Built pipeline to identify and cluster errors in multi-stage LLM AI Agents to correct with synthetic data generation and finetuning with prompt engineering using techniques from the ReAct, STaR, Reflexion research papers
- Architected Docker-based infrastructure, Supabase DB, Python SDK, and React frontend with testing in SWEBench and CraftAxLm agent reinforcement learning environments
- Led customer discussions driving product direction and integrations

Sept 2022–July 2024 **Data Scientist & Software Engineer**, *Amazon Fire TV*

- Statistical Analysis for Machine Learning models with the Fire TV Science team to train models for Time-of-Day aware recommendations incorporating content genres
- Trained and improved Random Forest model, clustering Movies and TV Shows using provider labeled metadata
- Created the Model Evaluation Dashboard with slice-based metrics, dataset distribution comparison, coverage analysis, and drift detection, enabling data-driven prioritization of labeling and retraining

June–Sept 2018 **AI Intern**, *Northrop Grumman*

- Demonstrated Deep Q Learning outperforms Evolutionary Algorithms for Autonomous Drones with Prioritized DDQN as highest impact improvement
- Increased deep learning pipeline and training speed by 200%

June–Sept 2017 **Software Intern**, *Northrop Grumman*

- Programmed an Atmel Microcontroller with C++ for high speed intra-satellite message passing

June 2015–August 2016 **Software Intern**, *Sandia National Laboratories*

- Created an Android and iOS Application to automatically manage WiFi and BlueTooth in designated areas

Skills

Languages Python, Java, SQL, TypeScript (React), C, C++, HTML

ML/DS PyTorch, RLlib, Keras, Scikit-Learn, DuckDB, SQLAlchemy, Apache Spark, Prefect, OpenAI Baselines, Jupyter

Platforms/Tools Docker, AWS, Git, Lambda Labs, Vercel, Supabase, Modal, Render, GitHub Actions, cProfiler, FastAPI, Zeppelin, AWS QuickSight, Make, Jira, Amazon Brazil

Robotics PyBullet, ROS, MuJoCo

Scripting Linux Shell, Bash, Slurm

Awards & Honors

2021 USC 4-Year Fellowship for Ph.D study

2019–2020 Caltech Summer Undergraduate Research Fellowships (SURF) supporting Machine Learning research at Stanford and UC Berkeley

2019 Perpall Caltech Speaking Competition Semi-Finalist (Visuomotor Mechanical Search)

2016–2021 Lockheed Martin Merit Scholarship (National Merit)

2016 MIT Summer Scholar (Robotics)

2015 New Mexico State Science Fair Second Place for Computer Science Category

2014 Los Alamos National Laboratories Supercomputing Challenge Finalist (Top 8/70 Teams)

2013 Los Alamos National Laboratories Supercomputing Challenge Finalist (Top 5/58 Teams)