MARCUS DOMINGUEZ-KUHNE

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Education:

PhD Computer Science: Machine Learning & Robotics — **Advisor: Dr. Gaurav Sukhatme**
University of Southern California — *August 2021 – June 2026*

B.S. Computer Science — **GPA 3.82/4.0; In Major: 3.94**
California Institute of Technology — *September 2016 – June 2021*

- *Graduate Level Coursework*: Vision: Computational Theory to Neuronal Mechanisms, Markov Chains, Computer Vision, Bayesian Statistics, Machine Learning (3 course track), Linear Algebra, Probability, Reinforcement Learning
- *Other Coursework*: Algorithms, Computing Systems, Networks, Databases, Discrete Math, Differential Equations
- *Teacher's Assistant*: CS 155, Machine Learning and Data Mining (Yisong Yue, 2019 & 2020); CS 156a, Learning Systems (Yaser Abu-Mostafa 2018)

Publications:

* equal contribution

Decentralized Data-Driven Heuristics for Fast Multi-Robot Motion Planning — Preprint
Fengze Xie, **Marcus Dominguez-Kuhne**, Benjamin Riviere, Wolfgang Hoenig, Jialin Song, Soon-Jo Chung, Yisong Yue

Mechanical Search on Shelves using Lateral Access X-RAY — IROS 2021
Huang Huang*, **Marcus Dominguez-Kuhne***, Jeffrey Ichnowski, Vishal Satish, Michael Danielczuk, Kate Sanders, Andrew Lee, Anelia Angelova, Vincent Vanhoucke, Ken Goldberg

Visuomotor Mechanical Search: Learning to Retrieve Target Objects in Clutter — IROS 2020
Andrey Kurenkov*, Joseph Taglic*, Rohun Kulkarni, **Marcus Dominguez-Kuhne**, Animesh Garg, Roberto Martin-Martin, Silvio Savarese

Honors and Awards:

Samuel P. & Frances Krown SURF Fellowship ($3,000 Awarded) — June 2020 – September 2020
Doris S. Perpall SURF Speaking Competition Semi-Finalist — November 2019
Rose Hills Foundation SURF Fellowship ($3,000 Awarded) — June 2019 – September 2019
MIT MOSTEC Summer Program Scholarship — July 2015 – January 2016
National Hispanic Scholar — January 2016

Research Experience:

Caltech CAST Lab, *Undergraduate Researcher* — Pasadena, CA
Advisor: Professor Yisong Yue — *March 2020-Present*

- Used Imitation Learning for distance and steer functions to speed up finding initial solutions for RRT (Rapidly-exploring Random Tree) for multi-robot planning for Double & Single Integrator Models
- Extracted training data from trajectory data and trained network (PyTorch)
- Second author of paper submitted to ICAPS 2021 Conference

UC Berkeley AUTOLab, *Visiting Researcher* — Berkeley, CA
Advisor: Professor Ken Goldberg — *June 2020 – November 2020*

- Trained geometric reasoning network in little studied shelf environment for target object occupancy distribution
- Used Fetch robot arm pushes to reveal target object, with least number of pushes
- Developed two *new* algorithms for hidden object search, *DAR (Distribution Area Reduction)* & *DER (Distribution Entropy Reduction)*, achieving 89% success rate with 6 occluding objects using *DER*
- Constructed pipeline used to generate data to train occupancy distribution and run simulation experiments
- Co-first author of paper submitted to ICRA 2021 Conference
- Successfully combined semantic and geometric reasoning to generate distributions of unseen object locations in collaboration with the Hierarchical Mechanical Search Project at *Stanford Vision and Learning Lab*

Stanford Vision and Learning Lab, *Visiting Researcher* Stanford, CA
Advisor: Professor Silvio Savarese *April 2019 – October 2019*

- Intelligent continuous push retrieval of partially occluded object in pile of distractor objects
- Used reinforcement learning with privileged critic on a Sawyer robot arm with an Xbox Kinect visual sensor
- Constructed data and training pipeline
- Finetuned classical and machine learning image segmentation algorithms for Xbox Kinect visual sensor
- Investigated mid-level representations as input to RL algorithms to greatly improve training speed
- Paper Published in IROS 2020 Conference

Caltech Vision Lab, *Undergraduate Researcher* Pasadena, CA
Advisor: Professor Pietro Perona *September 2018- April 2019*

- Trained and investigated convolutional neural network structures to determine if dementia is present
- Investigated challenges of using a small dataset, including data augmentation, and using classical CV methods to preprocess images before training

Industry Experience:

Northrop Grumman Corporation, Data Science Intern Redondo Beach, CA
Distributed Autonomy / Remote Control Research Group *June 2018 – September 2018*

- Used RL Deep Q Learning to train autonomous drones to avoid detection from other drones
- Investigated Genetic and Evolutionary algorithm solutions for this problem
- Implemented several optimizations to the Deep Q Learning algorithm speeding training by 200%

Northrop Grumman Corporation, Software Intern Redondo Beach, CA
Microcontroller Attached as Redundant Check for an Unstable Spacecraft *June 2017 – September 2017*

- Programmed Atmel Microcontroller in C++ to communicate between spacecraft components
- Constructed framework for sending and verifying signals along with performing regression testing, used on satellite

Sandia National Laboratories, Software Intern Albuquerque, NM
Personal Electronic Device Alert *June 2015 – August 2016*

- Programmed Android application to use GPS to turn off Wi-Fi and Bluetooth on cellular devices
- Developed and Beta Tested application to be used internally at Sandia, presented work to employees

Network Traffic Soup

- Developed Markov Chain Model in Python to generate webpages for cyber-attack testing

Projects:

Using Semantic Segmentation ML Methods for Better Content Retention in Seam Carving (CS 101C) *May 2020*

- Used pretrained semantic segmentation network & edge detection to generate energies in seam carving algorithm
- Significantly improved content retention of objects in cartoon images, with low density of edges within objects
- Performed ablation studies with different methods including entropy and image subtraction

Active Learning for Multi-class Image Classification (CS 186) *March 2020*

- Compared several active learning uncertainty metrics to train a CNN classifier for the MNIST and Fruits360 datasets with single and multi-class classification problems
- Compared Largest Margin, Smallest Margin, Least Confidence, and Entropy Reduction uncertainty metrics

Netflix Competition for Learning Systems (CS 156b) *April 2018 – May 2018*

- Blended several trained algorithms including Time SVD++, RBMS, and PMF to predict users' ratings for movies
- Worked in team of 4, finished 5th in class out of 19 teams

Languages: Python, PyTorch, RLlib, OpenAIBaselines, Scikit Learn, PyBullet, ROS, Keras, Pandas, Bash, Java, C, C++